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Tuberculosis and Society in Tromsø 1878-1920

An Epidemiological Study of Tuberculosis Mortality Within Societal Differences

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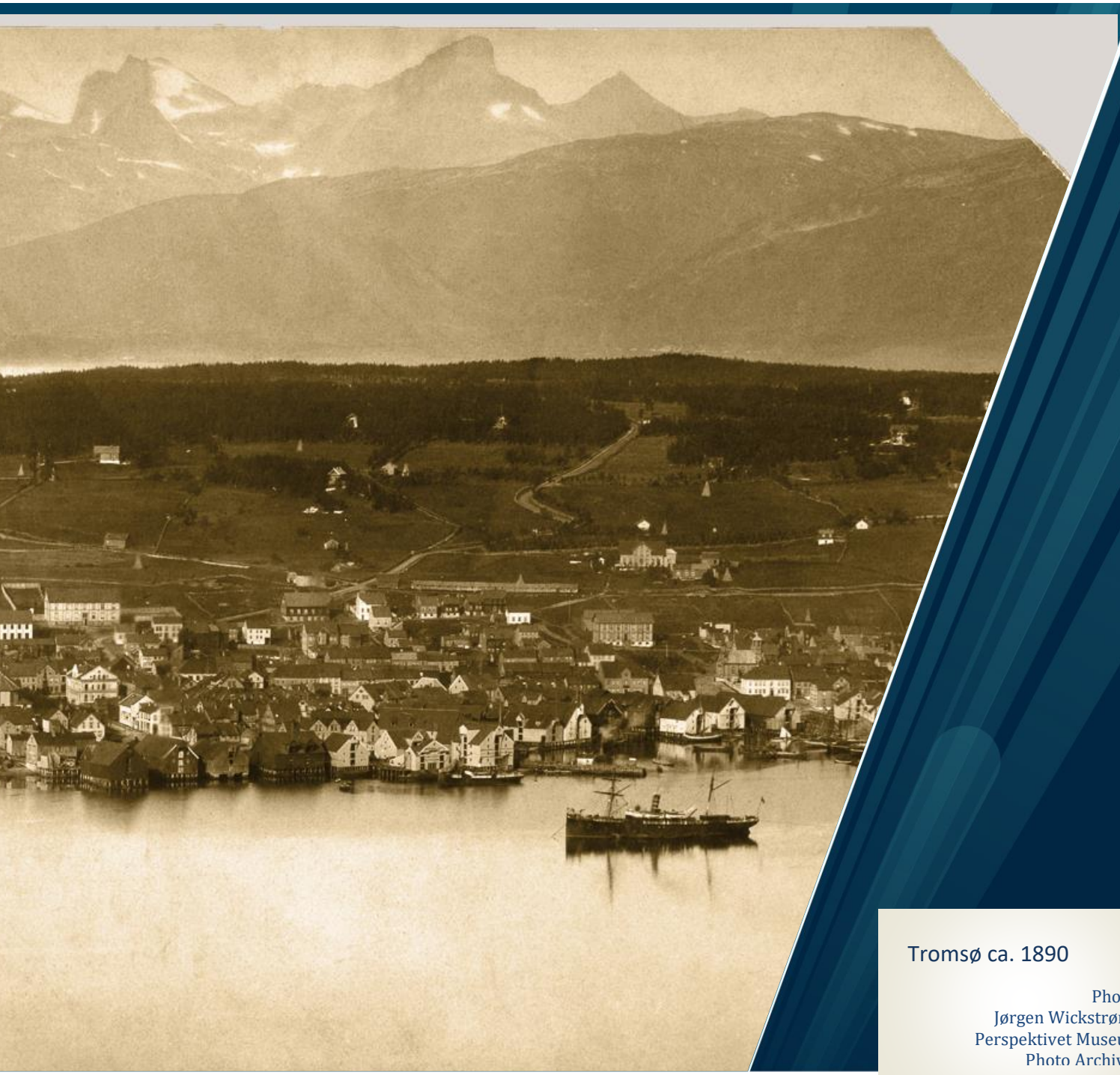

Tromsø ca. 1890

Photo:
Jørgen Wickstrøm/
Perspektivet Museum
Photo Archives

Preface

I would like to thank Hilde Sommerseth for all the decisive supervision for this project. Had it not been for Hilde's charismatic lectures about historical demography, I likely never would have chosen to dedicate myself to this field of study. Her enthusiasm and unending dedication made this one of the most educational and rewarding experiences of my life, I could not have hoped for a better supervisor.

She was however, not the only one to pour hours on this project with me. I would like to thank Arne Solli for sharing his invaluable expertise on ArcMap and all the spatial designs surrounding it, and to apologize for cutting into his lunch hours when our sessions went overboard. I would also like to thank Trygve Andersen for all the assistance and patience it took for me to learn and adapt information through Access tables and queries. An especially big thanks to the Målselv crew at NHDC, who did all the transcribing for me, without either of you this would have taken me a decade.

I also want to thank Narve Fulsås, Ian Grohse and Francisco Tapia for great seminars and pointers to both writing and methodology, their willingness to share knowledge and experience have inspired me to seek greater things from this project and myself.

The reading hall at Breiviklia has been a crucial social environment that I would recommend any young historian to seek out. A thanks to all my fellow students there for their friendship, support and for bestowing upon me the trust of overseeing our shared responsibilities. Thank you Haakon Sørlie for all the thorough reads and administrative work, and for the astonishing ability to not complain. Finally, thank you Anya for putting up with my incessant rambling about tuberculosis and volleyball. Your support in my days of disparity was decisive for a semblance of emotional stability.

Хвала мојим драгим родитељима, што су ме наговорили да студирам и упутили ме на моју највећу страст.

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Chapter 1. Introduction

1.1 Opening statements

This master thesis explores the infectious disease commonly known as tuberculosis. It is in effect, a local history study of a Northern Norwegian town and its relationship with the disease. It most of all tries to explore the effects of societal and economic differences on tuberculosis mortality within the population of this town.

Tuberculosis is without a doubt one of the most menacing and adaptive diseases in human history. From ancient times until modern day world, it has afflicted most densely populated civilizations. It can survive major changes and developments in human societies, as if it was made for a parasitic symbiosis with humans. There are in fact certain strains of *Mycobacterium Tuberculosis* that are resistant to all kinds of antibiotics that have formerly been proven efficient.[1] The World Health Organization considers it one of the deadliest epidemics in developing countries today. The main impression is therefore that projects about this disease will remain important and relevant for many disciplines in the near future.

Historically, tuberculosis dramatically affected local societies, both demographically, with severe consequences for the composition of the population, but also the sorrow and losses that few numbers will ever reveal. Cities and towns, with their densely packed populace and continuous flow of people became hotbeds for disease. In addition, port cities were extraordinarily exposed as the hubs of exchange and transportation to both naval shipping and the surrounding countryside. Western countries today have in many ways adapted through an extensive and advanced medical health care system, whose priority for obvious reasons always has been to handle modern society's ever-increasing plethora of challenges. Perhaps most of us take it for granted, that our well-being is protected and ensured by the ever-vigilant welfare state.

Since the 1960s there have been almost no fatalities caused by tuberculosis in Norway.[2] Vaccination, antibiotics and general cleanliness combined have almost eradicated most familiar infectious diseases. Some of the purpose of this project will because of that be to examine, through a thorough study, a local population in a time where tuberculosis was a

[1] WHO 2018
[2] Pedersen 2004: 31

considerable threat for human lives, with both social and economic consequences for individuals, families and the society they lived in.

With a mere 5,443 inhabitants in 1875,[3] in contrast to the 77,295 inhabitants in 2020,[4] the coastal town of Tromsø has without a doubt changed in the past 140 years. Local history has been written thoroughly, where diseases are mentioned and considered, but there are no detailed epidemiological studies specifically considering Tromsø. Bigger Norwegian cities in the south have gotten most of the attention in this particular field.[5] Tromsø was economically and politically not as influential as Kristiania, Bergen, Stavanger or Trondheim during the 19th century. Despite that, it became a pivotal hub and trade centre for Northern Norway that without a doubt deserves to have its epidemiological story told.

Karlsen and Skogheim claim that "Tuberculosis was increasingly widespread the further north one went."[6] They are not the only ones, a closer quantitative angle of Tromsø might be a useful addition to the work Teemu Ryymin has done, on the fight against tuberculosis in Northern Norway.[7] The severe arctic climate cannot be ignored as an effect in this project, but its consequences are hard to trace. The effects of cold weather and dark winters surely impacted people somehow, but they are in-depth, long-term and very hard to isolate. As such these factors will be considered, but not focused. The decline in tuberculosis mortality, which was gradual until 1960, is another considerable aspect in the project's period, this topic is however so broad, complex and well covered in other projects, and will therefore not be focused or thoroughly discussed here.[8]

This master thesis is structured into six sections, where the first introduces and elaborates on previous research and justifies the thesis question. The second inspects the background history and gives an overview of both the town, the disease and the surrounding medical factors. The third discusses the theory and methods applied, their uses, strengths and shortcomings. The fourth presents the results of these applied methods, tuberculosis mortality is here directly assessed and discussed especially in regard to differences in age and gender. The fifth considers the effects of socioeconomic differences in regard to both living standards,

[3] Andresen 1994: 315
[4] SSB 2020 – Kommunefakta Tromsø
[5] Schiøtz 2003: 25
[6] Karlsen and Skogheim 1990: 121 – «Jo lenger nord ein kom, jo meir utbreidd vart tuberkulosen»
[7] Rymin 2007
[8] Karlsen and Skogheim 1990, Gaard 2016, Otterholt 2015

professions, income and spatial aspects. While the sixth section summarises and concludes the results of these findings.

Previous research in many ways helps justify the path of one's own study. It was through consideration of all these great works that a thesis question was initially formed. Their importance to this project can therefore not be overstated.

1.2 Previous Research

Britt-Inger Puranen's dissertation is one of the most comprehensive studies about tuberculosis. She investigates tuberculosis in Sweden from 1750 to 1980, and uses parish registers, population censuses and medical reports from the periods these sources became available. No one could hope to analyse all of Sweden's parishes over a 230-year period, but Puranen uses the aggregate death and burial numbers for the whole country and then considers in detail seven representative parishes from various different environments and climates, to check the validity of the general statistics. She also considers many factors that influence tuberculosis mortality, most noteworthy being the differences in living standards, age and gender, but also the immunological changes and competition from other diseases. One interesting choice is prioritizing the comparison of the lowest and the highest of living standards within Stockholm between 1749 and 1866, where the royal court, a prison and a poor house are considered in detail. The hypothesis of living standards and nutrition were well tested here, and she concludes that the devastating 50 per cent dead from tuberculosis or other deprivation sicknesses was amplified in accordance with the hypothesis stating "that the variations in the tuberculosis mortality rate are an expression of changes in the standard of living"[9]. The royal court, however, was despite the best and most spacious dwellings and the most nutritional food available, not spared. Tuberculosis remained a common cause of death amongst royals as well.[10]

The long 230-year period allows for a long-term overview of the rises and falls of tuberculosis in Sweden, and certainly gives a good perspective of the infamous effects of the industrialisation process. A comparison of urban and rural areas gives an impression of both spatial and living conditions.[11] In most cases the two are quite entwined, as denser spatial distribution was, at least in urban environments quite directly a result of poverty and poor living conditions. The claim is at least that before the modern treatment of the disease, starting

[9] Puranen 1984: 351
[10] Puranen 1984: 352, 362
[11] Puranen 1984

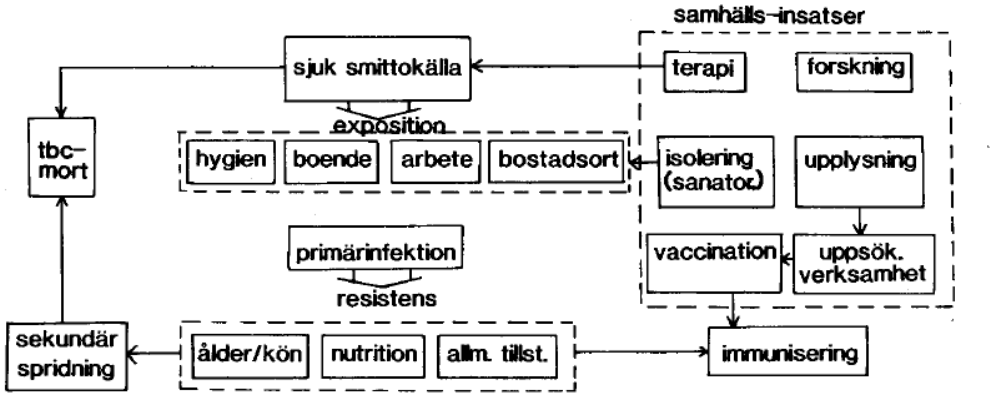
at about 1900, the fluctuations in tuberculosis mortality was deeply connected with increases or decreases in living conditions of a population.[12]

Puranen concludes that bigger and more heavily industrialized urban environments definitely had higher exposure risks, especially those in rapid growth due to urbanisation from an already tuberculosis-affected countryside. Rapid urbanisation also causes extraordinary poverty situations for the new arrivals, often having to cope with the least favourable dwellings and worst jobs. Some industries like mining, metallurgy and textiles were notoriously ridden with tuberculosis victims. Cramped, dusty and damp environments allowed ideal conditions for the bacteria to transmit. Puranen uses Eskilstuna as an example where all of these harmful factors aligned to devastate the population.[13]

With the following Figure, Puranen illustrates the intricate web of causes that could increase or decrease the occurrence of tuberculosis within a population.

Figure 1: Puranen's 33rd Figure, "Illustration of the cause factors' connection by occurrences of tuberculosis within a population" (provides own translation)

Figur 33. *Illustration av orsaksfaktorernas sammanhang vid förekomst av tuberkulos hos en befolkning*



Source: Puranen 1984: 346

[12] Puranen 1984: 352
[13] Puranen 1984: 342

As her 33rd Figure shows, the living standards factors are what allow exposure and spreading, while the nutrition, gender, age and general healthiness of a person will determine their resistance and potential immunisation. Before about 1900, few of the societal efforts that reduced exposure and increased resistance were available, which is why Puranen concludes that the last three decades of the 1800s were the most devastating tuberculosis periods in Sweden, like they were in most of north-western Europe.[14]

Neil Munro McFarlane's dissertation on *Tuberculosis in Scotland 1870-1960*, is the other comprehensive and greatly inspiring work. Much like Puranen he considers a plethora of factors like nutrition, standards of living, immunology and gender. He also harshly criticises any research that attributes tuberculous mortality to any monocausal explanation. He uses a wide array of both quantitative and qualitative sources, but underlines the complexity of investigating tuberculosis even with an abundance of sources.

His primary perspective is on Glasgow and its unusual tuberculous mortality growths and retreats, comparing it to the rest of Scotland and to other British cities of the time. The main conclusion focuses on the increase of real wages as a pivotal factor until 1920, which he argues greatly decreased the mortality in spite of the worst overcrowding happening during this time. Standards of living and nutrition were despite that not sufficient in the long run, as the continued overcrowding kept reinfection levels too high, which gave the abrupt surge of mortality during world war 2. When the absence of increased real wages, continued overcrowding and longer work hours contributed to an unusually high mortality.

Aside from this, milk and bovine tuberculosis is also considered in relation to pasteurization. Where sources clearly show that the lack of country-wide pasteurization laws in Britain allowed for the bovine strain to heavily afflict Scottish rural communities. McFarlane also dismisses the importance of sanatoriums and other tuberculous institutions, dubbing them "an expensive failure"[15]. Stating that even if they had achieved their unrealistic goals it would have still been extremely doubtful that sanatoria could have solved the problem of tuberculosis.[16]

[14] Puranen 1984: 353, 363
[15] McFarlane 1990: 96, 102-105
[16] McFarlane 1990: 345

His conjectures on natural immunisation make an interesting point in regard to urbanisation. Some rural communities who might never have been exposed to tuberculosis bacilli seem to have far higher infection and mortality rates than those that had.[17]

Teemu Ryymin has written several inspirational articles about tuberculosis in Northern Norway, especially the northernmost county of Finnmark, which also has the largest percentage of indigenous people. This being some of the focus of his work, whether or not the lack of "civilization" or the old cultural perceptions really did cause the high mortality of tuberculosis in the north. He firmly states that the north was more afflicted by tuberculosis, that it peaked there several decades later, and that percentagewise it was much more devastating.[18]

His numbers and conclusions pose interesting question when it comes to spatial and climactic factors. Since Finnmark always has been the least populated county in Norway, but at the same time had numerous densely populated fishing villages, does tuberculosis require population density to thrive, like many other diseases do? Since the climate and lack of arable land in Finnmark caused quite troublesome living conditions, did these shortages in nutrition and abundance of harsh weather intensify mortality of tuberculosis? Tromsø town shared the same climactic challenges but with a denser population.

Thomas Dormandy's comprehensive tome *The White Death*, is a wide reaching and detailed overview of the history of tuberculosis. The information and compiled findings here are regularly used and referred to in nearly every part of this project, and have given invaluable clues for where to look. He too emphasizes the importance of socioeconomic differences, living standards, nourishment and explains in detail the effects of the developing medical community of the late 19th century.

Hanne Sandvik Lundekvam's master thesis on *Epidemic Mortality in Change*, analyses epidemiology in Bergen in the last half of the 18th century. Her methods are in many ways aligned with my own, along with the scope of a trading port and its population affected by epidemic diseases. Lundekvam considers the more rampant epidemic diseases such as small-pox, typhus and pneumonia. She considers inoculation and child mortality from these diseases, but there is no gendered or in-dept socioeconomic perspective. Nevertheless, the

[17] McFarlane 1990: 187, 188, 189
[18] Ryymin 2005, 2006, 2007

methodology and systematic structure provides useful examples and approaches applicable in my own work.[19]

Björn Fredriksson's micro study of the treatment of patients at Lugnet sanatorium in Växjö, Sweden in between 1920 and 1926 does indeed focus on gender and class differences. He concludes that the doctors at the sanitorium, for the most part, were objectively consistent in their treatment of men and women, but that the women spent on average twice the time in the sanitorium. But also, that more women than men died in the sanitorium. Doctors were aware of the class differences and noted them accordingly along with details of how spacious dwellings the patients came from. But no conclusion as to class differences playing a role in deaths or afflictions could be drawn due to the background of the patients largely being similar working-class backgrounds.[20]

Georg Moseng's historiography about contagious diseases and the public work against them is an important aspect in this subdiscipline, but it is his most recent article in *Heimen* (2019) *Tuberkulose: Kampen mot bekjempelsen,* about the resistance to changing medical perspectives that gives us a crucial insight into the period. It explains some of the tense debate that lay the groundwork for the changes made in the medical reports of this time.

1.3 Thesis question

> What characterised tuberculous mortality in relation to age, gender, socioeconomic class and space in Tromsø town's population between 1878 and 1920?

Like many Norwegian cities, Tromsø saw a major population boom in the late 1800s. Immigration, growth and trade naturally cause ideal circumstances for the spread of diseases and epidemics. Many deadly diseases had fairly frequent outbreaks in Europe at this time, and tuberculosis is considered to be one of those that caused most concern. Aina Schiøtz calls tuberculosis "the premier institution builder"[21], due to the massive resources mobilized in preventative efforts. Ytreberg mentions in his book, that the decades before the great war saw a revolutionizing progress in especially the health care and social sector of Tromsø. After a serious increase in tuberculosis during the 1890s and the tuberculosis law, *Tuberkuloseloven*

[19] Lundekvam 2010
[20] Fredriksson 2012
[21] Schiøtz 2003: 25 – «den fremste institusjonsbygger»

in 1900, the medical community imposed a series of strict regulations on the population.[22] These were primarily concerning public hygiene and living conditions, and since there was no effective cure, preventative efforts against contagion became the imperative strategy.

One hypothesis is that the working class was more exposed than the bourgeoisie, both because of malnutrition from poverty and the working and living conditions they had to endure. Dyer writes: "During the years of Industrial Revolution in Europe, TB relentlessly savaged the emerging working class. The heavy burdens of industrialization – poverty, malnutrition, and overcrowded, putrid living conditions – created the perfect environment for TB to kill en masse."[23] That being said, Dyer also emphasizes the fact that no one was really spared from this disease, and that it affected the wealthier strata of the population as well. This is however something that could have been exaggerated by popularization from influential authors and musicians of the time, whose lives and experiences have received much more attention from contemporary perspectives. As for the Norwegian perspective; Karlsen and Skogheim firmly state: “One cannot say that tuberculosis struck with equal measure against poor and rich. The White Plague was first and foremost a disease of the poor.”[24]

The gender roles of the time, along with the big socioeconomic differences makes this an interesting prospect to explore, were the genders affected equally by the disease? A gender perspective will also make it more useful to estimate some of the effects on working environments, and potentially say something about which common hubs for men or women, might have caused the intensified spread within urban environments. This is especially interesting in this period because the gender roles were so much more rigidly enforced than what they are in contemporary Tromsø. Björn Fredriksson concluded, in his study of tuberculosis in a sanitorium in Växjö, that women spent on average twice the time being treated in the sanitorium as men did, and that the lethality was relatively higher among them. Karlson and Skogheim claim that women were age-wise earlier infected, more commonly infected and more often died of tuberculosis, at least until about 1925. With the main argument being the role they played in both private homes and institutions as caretakers of the diseased.[25] This argument can explain infection, but not necessarily lethality, meaning the percentage of dead among the infected of a specific disease. This would require insight into

[22] Ytreberg 1962: 371-386
[23] Dyer 2010: 36
[24] Karlsen and Skogheim 1990: 121 –"Men ein kan ikkje seie at tuberkulosen slo til like hardt mot fattig og rik. Den kvite pesten var framfor noko anna dei fattiges sjukdom."
[25] Karlsen and Skogheim 1990: 122-123

variables like knowledge about the disease, nutrition and treatment. As most sources agree that awareness of early symptoms, proper nutrition and proper treatment all saved many lives.[26]

1.3.1 Subtopics

The following four subtopics should be useful in highlighting the direction I intend for this project:

1. Which forms of tuberculosis affected which age groups? Finding the risk group.
2. Which sex died most of tuberculosis? Was there a gendered difference in tuberculosis mortality?
3. Did socioeconomic class, profession and living standards affect tuberculosis mortality?
4. Did population density, overcrowding and wealth affect tuberculosis mortality in a spatial district, street and dwelling perspective?

[26] Pedersen 2004: 31

Chapter 2. Overview and Background

This background chapter will portray an overview of the disease, the town, its people and speculate on their nourishment. This is in order to explain the foundation of the project's thesis question and to elaborate on the complex settings and factors this kind of historically set epidemiological research involves.

Introducing the disease of tuberculosis itself, some of its history, bacteriology, and epidemiology is considered necessary in order to clarify how the still active bacteria and disease itself functions in the eyes of contemporary medicine. The understanding of the disease dramatically changed from 1878 to 1920, but also in the hundred years following. The estimation of how advanced this understanding of the disease was during this period is a comprehensive discussion and is critically considered.

The port town of Tromsø also sees comprehensive changes in these years, both geographically, demographically and structurally. Introducing the object of epidemiological investigation is as such considered instrumental in order to answer the different aspects of the thesis question. How did the various people of the town live within this period, and could this have affected their susceptibility to the disease? The spatial and socioeconomic aspects are at the same time considered to be greatly entwined, as people of the same socioeconomic class tended to live in proximity to each other, either in the same dwellings or streets. Establishing a rough overview of the fluctuating class divides within the town is therefore considered necessary for a more complete picture.

To an extent the nourishment of the populace seems to be a recurring topic when considering their well-being. Most demographers and economists see the local nutrition as pivotal to the developments of the community. Therefore, these difficult decades around the turn of the century likely have their own story to be told, purely in regard to the access of food.

2.1 Mycobacterium Tuberculosis – Bacteriology, Epidemiology and the Historical Struggle

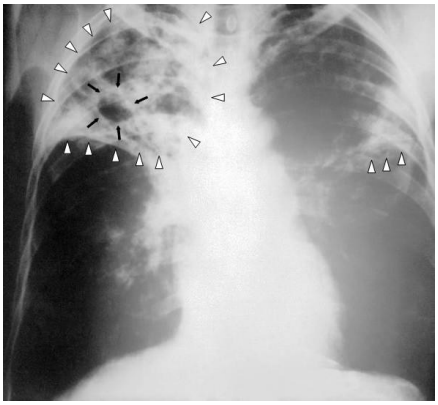
Robert Koch named the bacteria *Mycobacterium Tuberculosis* when he discovered it in 1882. He was not the first to consider it however, Greek and Roman physicians from antiquity have accurately described patients with the disease. The educated term before Koch was most

commonly *phthisis*, literally meaning "wasting" in Greek.[27] The layman term in both English and Norwegian, *consumption* and *tæring* respectively, practically mean the same thing. They all refer to the individual's weight loss and self-imposed malnutrition or the way it tore away the individual's lungs.[28] Dag Skogheim experienced pulmonary tuberculosis personally, and writes that during his feverish and weakened state the very thought of food made him retch.[29]

Tuberculosis literally means "lump disease" in Latin, called so because of the lumps it forms in the lungs of those affected by pulmonary tuberculosis. These lumps are actually formed by the immune system's macrophages, a type of white blood cells that surrounds and tries to dissolve the detected bacteria. It is important to note that even within patients that have a fully functioning immune system this eventually turns into a struggle for resources. Since the tubercle bacilli have a durable and acid-resistant coating, the macrophages are unable to dissolve them and instead try to isolate their spread, trying to choke off their access to oxygen[30]. To some extent the bacteria can still multiply, albeit slowly, as they oxidize other compounds that the surrounding macrophages are made off. How strong these isolations or blockades are depends almost entirely upon how effective the patient's immune system is, and if the bacteria do break out of the macrophages, it forces the body's immune system to allocate even more energy and macrophages to stop the infection. In some cases, the isolations work, and the patient gets "latent tuberculosis", but even this can lead to reactivation at a later point. The bodily struggle becomes apparent if one looks at the size of these lumps, which usually grow so big that they are easy to recognize on chest x-rays.[31]

[27] Dormandy 1999: 2
[28] Nielsen 2008: 164
[29] Skogheim 2001: 20
[30] Grosset, Truffot-Pernot & Cambau 2000: 144
[31] Daniel, Ellner & Boom 2000: 176

Figure 2: X-ray chest scan of advanced tuberculosis infection



Source: Center for Disease Control and Prevention's Public Health Library: 2543

As Figure 2 shows, the white arrows indicate the extensive *tubercles* or *tuberculomas*, while the black arrows indicate a ruptured cavity in the lung tissue.

If the patient has a reduced immune system an initial infection can spread to a devastating effect, killing within weeks or months, as the bacteria are aerobe they thrive in the oxygen-rich environment of the lungs. Their slow replication rate of 13-20 hours still means this takes more time than most other bacterial infections.[32] These infections can gradually spread throughout the lungs, eventually tearing through the tissue and causing the infamous blood cough, potentially spreading throughout the body, causing other forms of tuberculous infections.

The other consequence of the slow replication rate, is the superb potential to spread to other people.[33] This process is what made it such an effective killer in the 19th century, as the early stages of development are so asymptomatic, that the diseased usually did not notice they had the disease before it was too late. Not only devastating for the sake of the victim, but also for any people they might have interacted with over the past few weeks. As this pulmonary variant of the disease is spread through water droplets from exhalation, most commonly by coughing, sneezing or spitting. The bacteria within these droplets can be left to float in the air or land on surfaces and survive for weeks, depending on how moist the environment is, and only around ten bacteria are required to infect a person.[34] A French pathologists rigorously tested the bacteria's resilience already in 1885 and concluded: "…bacilli in sputa could be ground under foot, dried, moistened, dried again and remoistened eight times and could still

[32] Grosset, Truffot-Pernot & Cambau 2000: 145
[33] Schlossberg 2011
[34] WHO 2018

kill a guinea-pig."[35] As a result the French government became the first to introduce a ban on spitting in public the very next year.[36]

These very slow and resilient characteristics are also what make this disease challenging to investigate epidemiologically, and more specifically, its lethality. With a two to twelve-week incubation time, and already a marginal risk of spreading during the undetectable first phase, it becomes exceedingly difficult to track the numbers of the diseased. Skogheim elaborates on the great shame and stigma that befell any family with a tuberculosis infected member, often leading to secrecy and lies. Even after the law enforced reporting, which anyone was obligated to, we get a statistical challenge; the infection can last for many years before it kills an individual, leading to certain overlaps and numbers that are hard to track when it comes to movement and development of these patients. Some experience recurrences after they were seemingly cured, Skogheim being one of these, who struggled with it for eleven years.[37] It is the aforementioned reactivation of the latent cases that to a great extent complicates this, as contemporary numbers estimate that a third of the world's population has latent tuberculosis, while only approximately ten per cent of these risk developing active tuberculosis during their lives.[38] It is fortunately only the active form of the disease that is contagious.

There are many factors that increase the risk of both infection and death, however. According to recent WHO numbers, alcohol use disorder increases the risk of active tuberculosis by a factor of 3.3, smoking by a factor of 1.6, and undernourishment by a factor of 3.[39] In addition, silicosis, through inhalation of various microparticles, increased the risk three- to fivefold.[40] In the late 1800s active tuberculosis in most cases meant death, as there were no antibiotics available back then, and if the initial infection was not supressed by the immune system to what is called a latent case, then the odds of supressing it in its later stages became increasingly lowered. Which is why alcohol, smoking and undernourishment were even more dangerous back then, as they all lowered the immune systems capacity either entirely, or locally in the lungs.[41] This kind of knowledge, however, is all discovered through extensive modern research and methods.

[35] Dormandy 2000: 137
[36] Dormandy 2000:137
[37] Skogheim 2001
[38] WHO 2018
[39] WHO 2019
[40] Hoffman & Churchyard 2009: 333 – Silicosis is commonly a result of working in dusty environments or with physical labour that involves the spread of microparticles in the air.
[41] Hoffman & Churchyard 2009: 333, 334

These modern discoveries aside, there were few and conflicting measures physicians of the time could take in the late 1800s. Before Koch's discovery, tuberculosis was considered a chronic disease, most likely hereditary or spontaneously occurring. Its slow and subtle mechanisms make this an understandable contemporary label, as other diseases that were considered epidemic, like cholera or smallpox cut swiftly through populations and spread far more visibly and easily. The dominating theories before bacteriology blamed filth and unsanitary conditions of the poor for the spontaneous occurrences of diseases. As such, even before its causes were known, tuberculosis was considered a poor man's illness. Those affected were often skinny and poorly dressed. Contemporary physicians argued that there was little they could do for them, as they went around coughing blood and eventually died in the squalor and filth that caused their demise.[42]

2.1.1 The Developing Medical Community

The 19th century is quite notorious for its epidemics, where the dramatic growth of towns and cities created excellent squalid conditions for the spread of both virus and bacteria. Both central and local governments increasingly started leading battles against them even before they knew exactly how they were spread, contagion was hard to deny, especially considering how effectively quarantines worked to halt it, which were commonly implemented since 1710.[43] In Norway, 1803 represents the start of medical reports, but these were not systematically organised or very consistent before the 1850s.[44] The government gradually felt increasingly forced to take more direct, active and systematic responsibility, and after several devastating outbreaks of cholera a significant law to prevent epidemic diseases was enforced, "Sundhedsloven" of 1860.[45] The law primarily brought forth the first country-wide medical reports and enabled quantitative data for comparison, evaluation and prioritization, considering the fact that public health care was in its infancy and that communication and infrastructure in medicine was far from clearly established. The government wanted and needed information and evidence before it could act and invest responsibly, especially information about which cases were urgent and devastating for the health of the population. In order to do this more effectively, the law also required municipalities to have so-called local

[42] Schiøtz 2003: 67
[43] Schiøtz 2003: 63 and Nielsen 2008: 18, 19
[44] Schiøtz 2003: 35
[45] Schiøtz 2003: 35 – Literally "the health law"

"health commissions" to prioritize preventative and curative measures against any disease.[46] In this regard Tuberculosis was treated uniquely, because it was never considered an epidemic, but a constantly present endemic diseases that had trending increases and decreases.[47] Even considered hereditary by large parts of the medical community. The information from these medical reports of the late 19th century also made two things clear; tuberculosis was steadily increasing everywhere in Norway, and compared to many other diseases, it had a remarkably high lethality rate.[48]

At the same time, the last decades of the century saw significant medical progress, especially with Robert Koch's discovery of the *Mycobacterium tuberculosis*, which, *eventually*, resulted in a more united front within the educated medical personnel, as well as an agreement on how to disrupt the further spread of the bacteria. Before Koch's discovery and the breakthrough of bacteriology, there were two dominating theories within epidemiology: miasmatism and contagionism, where the miasmatists became dominating in Norway from 1830 to 1880.[49] In many ways these rivalling theories both perceived some things right and some things wrong.[50]

Miasma theory according to Nielsen and Schiøtz, was the belief that disease and illness came from the conditions which often occur in squalor; filth and bad air. The natural human repulsive reaction to any kind of foul odours, rotting or moulding being the instinctive logical explanation for this. The adherents to this theory did accept that there was some sort of substance in which disease spread through, but that it was not necessarily contagious, it could also spontaneously occur if the conditions were squalid enough. Which made them put less faith in quarantines and more faith in sewage and clean-up projects.[51]

Contagionism adherents, however, were convinced that this substance in which the disease spread through had to come from the outside and spread by touch or contact between individuals. Specifically how or what made people contract this substance was unclear, but the contagionists were willing to agree that hygiene was important, at least once the epidemic was a fact, and that contraction was more likely if people had the right constitution for it. This of course made the contagionists put more faith in quarantines than the miasmatists. Several

[46] Michael Journal 2005: 5
[47] NOS medical reports consistently kept tuberculosis separate from the epidemic disease throughout the whole period.
[48] Karlsen Skogheim 1990: 121, 122
[49] Nielsen 2008: 113
[50] Schiøtz 2003: 30
[51] Nielsen 2008: 111, 112, 113, 114 and Schiøtz 2003: 30, 31

cholera epidemics did however convince many to believe more strongly in contagionism, as it was empirically proven to spread so quickly and could be stopped with quarantine.[52]

To an extent they were both right; squalor, filth and rot does help diseases spread, as a wide plethora of bacteria thrive under these conditions. Since it contaminates the air people breathe, the water people drink and infests the food people eat. At the same time most of this spread does come from outside factors and are hardly spontaneous. Trade, movement of people and domesticated animals being decisive factors that indeed bring dangerous *substances* that cause epidemics in these susceptible areas. What was identified as bodily "constitution" for contracting a disease, we would likely define as immune system or lack thereof, something that indeed is heavily affected by living conditions and nutrition.

The ways these theories were inaccurate or insufficient was rather in the details. Neither of them included any microorganisms in the spreading substance, or any specific ways to fight any specific disease, a side from hygiene and quarantine. The more long-term diseases that did not cause epidemics, like tuberculosis were labelled as chronic or hereditary, because they often logically spread within families. This becomes noticeably clear when one analyses the development of the medical reports in Norway and the ways the district doctors describe them. After the bacteriological breakthrough and Koch's discoveries, many other discoveries followed, like lepra. The medical reports in Norway for a long time keep reporting the same diseases this way, but rename it "various diseases" in 1891, and remove it entirely in 1896. These kind of changes in the reports can tell us that the developing medical perceptions of epidemiology was quite frequent in this period.[53]

The medical historian Ole Georg Moseng elaborates on the great struggle that ensued amongst scholars after 1882. "The fight against victory"[54] as he calls it, became a heated debate among adherents to the traditional school of miasma and those convinced by Koch's bacteriological breakthrough. The leading traditionalists argued that a hundred years of medical science could not simply be thrown out the window. Despite their arguments the empirical evidence was undeniable in the long run. As a result, an awareness poster was unanimously approved and published in 1889, the so-called "tuberculosis plaque" became the first step. Though many idealists argued it was hardly enough and struggled for a decade to implement a law that

[52] Schiøtz 2003: 30
[53] NOS I C.No. 185. 1891, I C No. 274. 1894 – "forskjellige sygdomme" (provides own translation)
[54] Moseng 2019: 39 – Literally "Kampen mot bekjempelsen" (provides own translation)

would enable the real work to begin.[55]

As such the tuberculosis law of 1900 in Norway is perhaps the most important milestone that divides this period. It forced doctors to treat it as an epidemic and it forced everyone in society to report the sick and to change their behaviours. Its wide-reaching consequences explains a part of the struggle against it, as it allowed for the inspection of private dwellings, separation of families and married couples (if they consented), all for the sake of isolating the infected. Doctors were also expected to inspect the hygienic conditions of dwellings, and if infection was detected within a dwelling it would have to be sterilised before it was reused.[56] This was understandably met with resistance, especially since a lot of the poor hardly had alternatives and were often met with destitution.

One of the grand issues remained the lack of expertise and ways to diagnose the infection. The most widespread early method was listening to the lungs with a stethoscope, where differences in breathing with infections were distinguishable to the educated and experienced ear alike. Röntgen invented his x-ray already in 1895, but its usefulness versus stethoscopes was long debated and did not see widespread use before the first world war.[57] By the time a patient developed visible or audible enough tubercles the infection was already at a dangerous stage. Clemens von Pirquet announced a safe way to detect early infection in 1907 by injecting the patient with traces of dead bacilli in the surface skin, and observing if the immune system reacted to them. The method was not considered reliable or widespread before the 1930s.[58] However, district doctor in Tromsø mentions that they requested tuberculin testing of the cattle already in 1907.[59] In a later report from 1914, it is confirmed that this has been done on the cows delivering milk to the local dairy, but there is no mentioned use on suspected tuberculous people.[60] As such we can assume that there were gradually developing methods to identify a tuberculous infection, but the issue was rather that its symptoms stayed so concealed and generic in its crucial early stages.

By the time the fevers and blood coughs started, it was often too late for most people, especially since most people could not afford the expensive and intensive care of the sanatoriums. In the case of Tromsø, there were no tuberculosis specialized institutions before

[55] Moseng 2019: 48, 49, 52
[56] Øverland 1926: 5-8
[57] Dormandy 2000: 203-205
[58] Dormandy 2000: 206-208
[59] NOS V. 98. 1907: 242
[60] NOS VI. 94. 1914 Medical report: 240

Tromsø Tuberkulosehjem opened in 1913. Ytreberg mentions that before it was opened, the hospitals and doctors had traditionally refused to take in the tuberculous patients, stating that they had no remedies, no capacity and far from the resources needed to help them recover. They were instead instructed to go to the town's retirement home. [61] §11 of the tuberculosis law allowed the King's delegates to requisition certain public and private buildings for use in the struggle, but such measures are almost unheard of, as few officials wanted to expose even more buildings to the disease.[62]

The brunt of the work against the disease was in fact conducted by voluntary organisations, such as *Norske Kvinners Sanitetsforening* (NKS), *Nasjonalforening mot tuberkulosen* and the Red Cross. The NKS gathered donations and eventually managed to open up *Hvilhaug* in 1913, as the town's first building to specialise in fighting tuberculosis. This would be followed by *Kysthospitalet* in 1924, which specialised in *Scrofulosis,* tuberculosis in the lymphatic system. Compared to the rest of the country this is neither late nor early, but signifies the gradual shift in the decades after the law and makes it clear that the struggle against this disease took time and resources unlike any other.[63]

In its own way there is a parallel to the way the Norwegian society reacted to tuberculosis. The few engaged and willing individuals struggled for resources to isolate the infection in their society. Much like the body's own macrophages intensely struggled for resources with which to isolate the durable bacterial infection. The efficiency of the immune system is deeply dependant on an individual's level of nourishment, as such the malnourished and poverty-ridden environments of any society can prove a fatal weak link in its well-being. With that in mind, it is important to establish an overview of what kind of environments and societal conditions existed in the port town of Tromsø at this time.

2.2 Tromsø's Background and Characteristics

The foundation for this local historical knowledge is primarily based on Astri Andresen, Pål Christensen and their predecessor Nils A. Ytreberg's works about Tromsø's history, which is told in detail through many different themes.

Tromsø received its township privileges in 1796, shortly after the dual monopoly of Bergen and Trondheim was revoked in 1789. The population in the Tromsø district was quite

[61] Ytreberg 1962: 388
[62] Øverland 1926: 7
[63] Ytreberg 1971: 47, 389 and Schiøtz 2003: 25

dispersed and primarily based its economy on fishery from coastal villages in various straits and fjords. Despite that, an increasingly important and illegal seasonal trade with Russian grain exporters eventually convinced the government in Copenhagen that a softened mercantile policy was required. Unlike many of its competitors in Northern Norway, Tromsø was practically non-existent as a town when it gained its privilege, in fact, even 20 years after the privilege was granted in 1815 it still had only 75 residents. By 1855 that number had dramatically increased to 2,958.[64] This is more than anything due to the general population boom in Norway, which caused the first wave of intense urbanisation and migration northwards.

Tromsø's attractiveness increased after independence from Denmark in 1814, when it was made the regional seat for "Finmarkens amt" and granted the regional bishopric in 1834. In 1844 the town was also granted the "Stiftamt" seat, meaning the town became the regional centre for most of Northern Norway, in contrast to being controlled from Trondheim as it was until then. In fifty years Tromsø went from being an insignificant trade post with a church to becoming the most important town in Northern Norway. It is hard to imagine that any of this would have been the case if it were not for the local merchants who wanted an officially legalized trading port in their sound. Capital attraction was made possible with governmental incentives and an ever-increasing demand for fishing and whaling, thus enabling this prosperous trading centre.[65]

Throughout the period under scrutiny, the growth of the town slowed down to some extent. Technological changes and increasingly global mercantile networks led to fluctuating economic troubles for the population in the last half of the 19th century. Steam ship fishing and faster freight from the south and abroad led to greater competition and reduced profits from the Russian grain trade and trade in general. Table 1 shows where the residents of the town were born, taken from the population censuses of those years.

[64] Andresen 1994: 80-81
[65] Andresen 1994: 120

Table 1: Birthplaces of Tromsø town residents according to the population censuses of 1875, 1885, 1900, 1910 and 1920

Birthplace in population census	1875 Total	%	1885 Total	%	1900 Total	%	1910 Total	%	1920 Total	%
Tromsø town	2,348	42.6	2,836	47.7	3,810	49.4	4,139	51.9	5,062	48.2
Rest of the county	1,186	21.3	1,493	25.1	2,179	28.2	2,310	29.0	3,210	30.5
Rest of the north	595	10.8	511	8.6	663	8.6	714	9.0	1,126	10.7
Rest of Norway	1177	21.4	967	16.7	932	12.1	678	8.5	915	8.7
Abroad	214	3.9	144	2.4	132	1.7	129	1.6	196	1.9
Unknown	0	0	124	2.0	3	0.0	47	0.6	30	0.3
Sum	5,509	100	5,931	100	7,716	100	7,970	100	10,509	100

Source: Population censuses 1875, 1885, 1900, 1910, 1920 NHDC, UiT

As Table 1 shows, the native-born population is generally outnumbered by the migrating population. This is more and more due to urbanisation from the rural countryside and the rest of northern Norway, than due to southern migration, which was more common during the middle of the 19th century. Andresen explains that net migration for the first time since 1815 became negative between 1875 and 1891. Tromsø was thereby no exception when it came to the great transatlantic migration to the United States, the Statistics Norway's tables for migration of the population will confirm this.[66] Especially between 1875 and 1884 district doctors keep reporting meagre harvests and bad fishing seasons for many years in a row, which could explain the stagnation.[67] The historian Jostein Nerbøvik explains that this was the case for most of coastal Norway, where the spring herring fishing brought enormous profits in the 1860s, but then suddenly disappeared in the 70s and 80s. The salted and dried cod being one of the most lucrative Norwegian exports up until 1880, saw a problematic downturn as European markets were seemingly oversupplied.[68] Tromsø was thereby not alone in its economic struggle during the late 19th century.

Even if the population more than doubled in fifty years, 7,719 people by 1900 is a modest town compared to the bustling boom of the southern Norwegian cities of the time. Despite that, the exchange of population and settlement of travellers shows that Tromsø was, to varying degrees, an attractive town well connected to the outside world. The inconvenient aspect of this is that it was not spared from any of the diseases and epidemics that afflicted Western Europe at the time.

[66] NOS: VII. 25. Utvandringsstatistikk 1921
[67] NOS: I C.No.4 1877, 1878, 1879, 1880, 1881, 1882, 1883 and 1884
[68] Nerbøvik 1999: 72, 73

Figure 3: Map of Tromsø 1903

Source: Edelsteen 1903

As Figure 3 shows, the entirety of the town's municipality was on the island of Tromsøy, with no bridge connection to the mainland until 1960. The municipality boundary was gradually expanded five times between 1842 and 1964, as national laws allowed local governments to agree on these boundaries through bilateral agreements and purchases amongst themselves. As a township municipality, Tromsø traditionally encapsulated the urban area, which was in between 1872 and 1915 approximately 72 hectares, or 0,72 square kilometres, but far from the entire area was developed. It meant a population density of 10,720 people per square kilometre in 1900, according to that year's population census.[69] This made it a comparatively dense urban environment where diseases could easily be transmitted among an impoverished population.[70] For modern comparison; New York City as of 2018 has a population density of 10,715 per square kilometre.[71] It is thereby safe to say that this small area was somewhat overpopulated.

This fits with both Astri Andresen's descriptions, and is regularly confirmed in several medical reports between 1872 and 1900. The 1872 report states that the town of Tromsø is

[69] Population Census 1900 NHDC, UiT
[70] Calculation based on measurements from 1903 maps of the municipality
[71] NYC Government 2018 – Population estimates of the city planning department

still overpopulated, that the workers lack proper dwellings and wages.[72] District Doctor Danchertsen elaborates, in an appendix to the 1877 medical report, that the dwellings remain small due to the high lumber prices.[73] The 1880 report states that the living conditions of the commoners is deteriorating year by year, due to unemployment and failed fishing seasons. Andresen points out that there were 491 dwellings that needed to house more than 4,000 people in 1865 and that this disproportion only increased after 1875, forcing a density of nearly ten people per dwelling on average. [74] Not everyone was forced to live this densely however, there are apparent socioeconomic differences that are portrayed quite clearly in most sources. Especially in Sveinulf Hegstad's thesis on social divides and dwelling conditions, which in detail elaborates on the differences in Tromsø between 1900 and 1920. These are juxtaposed in detail during the spatial analysis of chapter 6.[75]

2.2.1 Socioeconomic class

The class divide seems to run as deep as one would expect from this time in Western Europe. The merchants, entrepreneurs and government officials built their spacious dockside houses and their luxurious villas along the hillside. The craftsmen, artisans and skilled labourers primarily inhabited the mid-town along Grønnegaten and Vestregaten. While the lowest strata of working-class labourers are said to have dwelled along the coastline in narrower and more squalor-exposed streets like Verftsgaten, Fiskergaten and Nerstranden. District Doctor Danchertsen makes further notes in the 1877 report, that the conditions in these places are as one can expect, a severe lack of cleanliness, often due to muddy streets or filth and stench produced by gutting of decaying fish.[76]

These are some of the commonly perceived and mentioned socioeconomic division within the town, but they are full of exceptions and nuances. Some merchants built street houses near the docks where their warehouses were located, and most of them hired servants from the lower strata that sometimes resided with them. Though it seems it was even more common for the upper class to rent out to other upper-class members.[77] Craftsmen were a very diverse group and in reality, widely dispersed all over town, both depending on where their customers and resource inlets were. Hegstad describes that commonly most merchant and craftsmen

[72] NOS: I C.No.4 1872: 134
[73] NOS I C.No.4 1877: 192
[74] Andresen 1994: 320
[75] Hegstad 1993
[76] NOS I C.No.4 1877: 192
[77] Hegstad 1993: 82, 83

dwellings doubled down as business locales and sometimes therefore limited their renting capabilities.[78]

After the guilds were abolished in 1839 in Norway, craftsmen became more numerous and diverse, and though few of the ones in Tromsø were as wealthy as most of the merchants, they had citizen or *burgher* privileges. This was an advantage to setting up shop in Tromsø as oppose to other older cities of the south, because here the need to attract investment and capital was much higher. Due to this town citizen privileges were granted to anyone that could pay 2 riksdaler.[79] This combined with the fact that municipality cheaply auctioned off property in its initial phases and forbade any establishment of guilds, made it far easier for both upstart merchants and craftsmen to establish new enterprises.

Despite that, Andresen points out that the craftsmen were highly dependent on the economic outreach of the town, and that most of them in reality had more in common with the workers than with the merchants.[80] As was common in Europe at this time, the craftsmen became more and more replaced as industry and resource prices of the early 1900s put many of them out of business. Hegstad explains that some of them adapted and implemented more large-scale production workshops, even including the first steam engines as early as 1875.[81] Despite this he emphasizes how deeply entrenched traditional societal values were, as even by the turn of the century he characterises Tromsø more as an estate society than a modern class society. Pointing out the undeniable patriarchal leading role the merchants had in a very trade- and fishery dependant town.[82]

The butt end of this traditional hierarchy was the lower strata of all kinds of servants and physical labourers. Their living standards and salaries are of special interest in this project due to a vast array of the available literature almost unanimously agrees that the poor were more affected by disease.[83] Finding out if this was the case for Tromsø, and in that case, which conditions were most important will therefore remain a focal point throughout.

2.2.1 Gender

As well as class, gender and gender roles during this period were much more decisive for an individual's outcome than they are in present day Tromsø. Though women in Norway gained

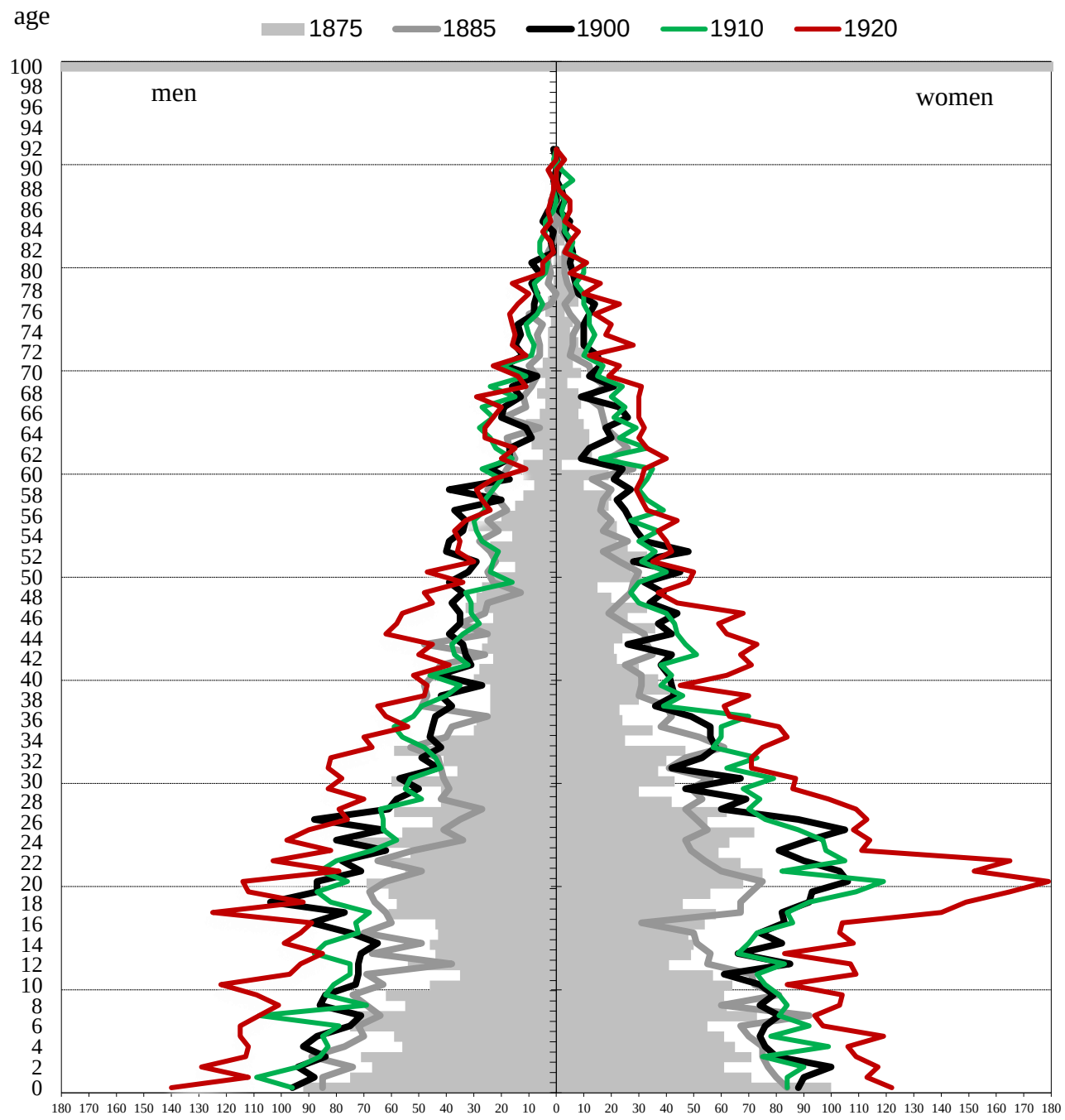
[78] Hegstad 1993: 81
[79] Hegstad 1993: 42
[80] Andresen 1994: 320
[81] Hegstad 1993: 49
[82] Hegstad 1993: 48
[83] Dormandy 2000, Karlsen&Skogheim 1990, McFarlane 1990, Puranen 1984

the right to vote fairly early in 1913, their political power was highly limited for the entire period here analysed. They were in most practical matters hierarchically subordinated and economically dependent on the men in their lives, commonly their fathers or their husbands. Andresen also writes a great deal about the servant girls and that this was the most common line of work for a young woman, and how it stimulated an urbanisation to the town, as most of these young women came from the neighbouring countryside, in search for work and marriage. These of course had to adapt to the household hierarchy, but became an important link between the upper and lower strata, as they were professionally tied to the upper strata and socially belonged to the lower strata.[84]

Which is also why the population pyramid often skews to the female side in most of the population censuses:

[84] Andresen 1994: 320

Figure 4: Population pyramid of Tromsø town for population censuses 1875, 1885, 1900, 1910 and 1920



Source: Censuses 1875, 1885, 1900, 1910, 1920 NHDC, UiT

As Figure 4 shows, the population of the town was relatively young, where the 16-20 and 21-25 age groups are almost anomalously high, especially on the female side. Andresen indeed also observes that a majority of those who migrated to the town from the surrounding

countryside were women, and that this was a trend since the mid-1800s.[85] This can be confirmed by comparing the population pyramids from the different censuses, as in four out of five these particular age groups from 16 to 25 are dominating.[86] Whereas if it were not the case, the 26 to 35 group would likely inherit the bulk, or be the ones emigrating from the town in turn. This way we can assume that especially women between 16 to 25 continuously kept migrating to the town. The exception is the 1885 census[87], which is a stark contrast to the other four, almost solely due to the great emigration wave of 1880-1883, where a total of 507 individuals migrated to *countries outside Europe*. This peaked in 1881 when 188 people, or 3% of the town's population left in just one year. [88] As was explained in chapter 2, this was primarily due to economic hardships and difficulties all over the country, but also in Tromsø town specifically. We can assume that those who stayed did not have a prosperous life the last two decades of the 19th century. Which coincidentally, as will be shown in chapter 4, is also where reports of the highest tuberculous morality rates of women are to be found.

Little of the literature about life in Tromsø is dedicated to how life was for each gender, but Hegstad makes a point out of underlining how long the traditional societal values were kept in place before widespread industrialisation took place. In that regard both men's and women's roles and standards of living were highly dependent on their place in the socioeconomic hierarchy. It is however undeniable that the working-class men were likely those most exposed to the harsh climactic conditions of arctic coast. Fishing, shipping and polar expeditions remained the main business cores that all other business seemed to revolve around. Men were by far more exposed to the risks that all the jobs around these endeavours entailed. Cod fishing adventures to Lofoten could either result in massive enrichment or a quick death in the cold autumn waters. Though just as this was a huge risk for the men, their wives and children were often left in destitution if such tragic fates were to occur. Randi Balsvik makes a point out of this by elaborating on the harsh conditions fishing towns in northern Norway existed in, exemplifying Vardø as one of the most difficult environments humans have dared attach themselves to.[89] She highlights the individual struggles of the people within the fishing communities.

[85] Andresen 1994: 300, 319, 322, 323 – This trend saw a dip in the 1880s through economic difficulties for the town.
[86] See appendix 3 for projection a pyramid projection of all four censuses.
[87] See appendix 3 for population pyramid from 1885 census.
[88] II C. No. 1 1880 V, II C. No. 1 1881 I, 1882 II, III 12 1883 III, III 30 1884 IV Vital Statistics and Migration Statistics
[89] Balsvik 2001: 1

2.3 Nourishment and Susceptibility to Tuberculosis in Tromsø

Ytreberg points out two dangerous developments in people's eating patterns in regard to tuberculosis during the turn of the century: Through separation of milk fat, people stopped drinking whole milk, and started eating whiter bread mixes instead of whole wheat bread. He argues that this reduced quality of nourishment was one of the pivotal causes of increased tuberculosis infection in the town.[90] This was likely the result of an attempt to make larger quantities of food cheaper to produce and accessible to more people. After all, they produced butter and cheese from this separated fat, but it is less likely that these refined products reached as many of the poorer dwellings. In support of this view, Puranen and Sagstad underline how decisive the lack of animalistic protein was for the malnourished victims of tuberculosis.[91]

This fits with the contemporarily perceived health benefits of milk, as most sanatoriums prescribed large quantities of whole milk to their patients. The 1914 district doctor reports, that of the 5,000 kroner budget the tuberculosis station in Tromsø had, 1,600 kroner of this was reserved for milk to the victims.[92] This is perhaps something we take for granted in modern western society, where greasy food is abundant and easy to come by, but the accessibility of these forms of nutrition 120 years ago was quite limited to most people. Therefore, milk played an important nutritional supplement if available. As it is one of the cheapest accesses to animalistic food, the cow being an invaluable grass converter that could support many family members throughout the winter. Andresen mentions that, due to the usefulness of cows, many of the wealthier people in town owned much of the surrounding countryside with a sizeable livestock, since both meat and dairy prices increased annually with the long winters.[93] This again only underlines the socioeconomic differences, and might explain why the potato rapidly replaced much of the grain harvest throughout the late 19th century. It was more durable and successful in the harsh climate, where the grain harvests often failed. Along with the reduced grain harvest a lot of the hay required for the livestock was also reduced, leading inevitably to less milk.[94] In the end Ytreberg's concerns for changing diets seem to be justified.

To elaborate on this, the medical report from 1895 describes the state of health in the district:

[90] Ytreberg 1962: 385
[91] Puranen 1984: 352
[92] NOS VI. 94. 1914 : 237
[93] Andresen 1994: 264, 265, 269
[94] Andresen 1994: 269

"Not many families have meat to eat. The diet contains porridge, herring, potatoes and occasionally salted fish, along with coffee, which is often inappropriately consumed. Milk is in most places almost not consumed throughout the whole winter because of poor animal husbandry."[95] The district doctor seems very concerned with the lack of meat and dairy products, this could be due to the "starvation-fed" livestock that Andresen describes. In contrast to southern farming, the countryside around Tromsø is topographically challenging and spread over long distances, which often lead to agricultural shortages of all kinds, where the most impoverished parts of society are the ones that suffer the consequences.

In one regard, being spared the consumption of milk might have saved the lives of some. As there has undoubtably been a potential for tuberculous infection through unpasteurised milk. Which Dormandy argues could have caused over half the tuberculous meningitis cases in children. [96] Puranen confirms this concern in her own study of tuberculosis in Sweden. As the bovine strain of the bacteria has the potential to survive in cow's meat and milk as long as it remains uncooked.[97] Which can tragically enough allow the very highly praised contemporary treatment to become one of the contributing factors that killed some of those who already suffered from the pulmonary form of the disease. How widespread the bovine type of the bacteria was in Tromsø is hard to estimate, as there is no research or reference to it. The numbers of meningitis cases can despite that likely give us an indication worth looking into, which will be done in chapter 4.

Cattle and livestock aside, more people likely survived off herring and potato. These are commonly perceived as staple foods for the poor during this period, one side note from an 1899 journal even reports that the local farmers commonly fed herring to their pigs, giving the meat an unpleasant hint of fish oil.[98] As mentioned, the demand for potato and the benefits of it, led to a gradual increase in its production throughout the 19th century. Though both Ytreberg and the district doctor's concerns about the local nourishment hold some merit, a contemporary dietician and historical demographer will often agree in praising the herring and potato combination as a quite healthy diet, if it is consumed in sufficient amounts.

Herring and other fish might in fact have been pivotal to healthy survival in Northern

[95] NOS III 295 - 1895: "Ikke mange Familier har Kjød at spise. Kosten bestaar i Grød, Sild, Poteter og en sjelden Gang saltet Fisk, samt Kaffe, som ofte misbruges. Melk haves paa de fleste Steder næsten ikke hele Vinteren paa Grund af daarligt Kreaturstel." – own translation.
[96] Dormandy 2000: 330
[97] Puranen 1984: 141
[98] Folkevennen 1899: s. 343

Norway, as contemporary studies confirm the necessity of vitamin D for strong immune systems.[99] Long and dark winters in Tromsø dramatically reduce the population's exposure to sunlight, meaning that consuming fish is the only easily obtainable alternate source to vitamin D. Along with cod liver oil and dried fish, herring was one of Tromsø's most profitable exports. The herring thereby brought both good diets and produced great wealth for Tromsø, but like the agriculture, it also had a fluctuating tendency, much more than any other fish, as a growing reliance on it in good years could lead to devastating effects in bad years. Ytreberg makes a point of this and mentions how combinations of harsh winters and bad fishing seasons likely caused many of the diseases to spread throughout the town.[100]

The British university medical doctor Andrew Morland looked into the potential effects climate itself may have on tuberculous mortality, but found it to be negligible in comparison to immunity and social conditions. He did despite that find some indication that warm and damp climates were associated with higher risks.[101] Tromsø hardly sees any warm days throughout the year and the bacteria is unlikely to thrive in these conditions, despite that, both Ryymin, Karlsen and Skogheim argue that the northern-most parts of the country were most severely affected by tuberculosis.[102] Based on Morland's work, this thesis argues that although it is unlikely that the harsh climate and weather itself are to be blamed, at least not as a direct cause. It is, however, likely that the climate indirectly affected the region long-term with unfavourable agriculture and riskier economic foundations which may have contributed to tuberculosis mortality in bad years.

Another problem is that those infected with tuberculosis likely did not struggle to obtain food. Appetite-loss seems to be one of the most pivotal symptoms of tuberculosis patients as it deprives them of nourishment, the very thing that could help them survive the infection. Only as recently as 2013 has there been focused research on the link between tuberculous infections and the loss of appetite. Chang et al. concluded the following:

"[…] our data show that patients with pulmonary TB display clear alterations in energy regulatory hormones in comparison to healthy controls, and these alterations coincide with changes in appetite and nutritional status. As altered hormone levels normalized during

[99] Aranow 2011
[100] Ytrberg 1962: 385
[101] Morland 1936: 151
[102] Ryymin 2007 and Karlsen & Skogheim 1990

treatment, appetite and nutritional status also improved."[103]

More recent studies about the connection between tuberculosis and nutritional status present a decisive bilateral correlation. Sylvi Ann Sagstad has looked at the specific nutritional functions of vitamin A, vitamin D, zinc and essential proteins in the immune system's response to tuberculous infections.[104] Through contribution of several relevant experiments and observations on both people, pigs and mice, Sagstad concludes that tuberculosis can likely lead to secondary malnutrition, while primary malnutrition to a large extent predisposes the development of a tuberculosis infection, and increases the chances of mortality.[105]

With this in mind, it is important to remember the difficulty of obtaining accurate information on this topic. Few sources can provide us precise accounts of what the local populace in Tromsø ate, let alone how much. The medical reports provide us some brief perspectives of the district doctors, but that is but one rare perspective glimpse. Contemporary newspapers might include their own take on it occasionally, but this hardly paints a complete picture. Therefore, one of the most important aspects of tuberculous mortality will remain one of uncertainty, where other sources like income and socioeconomic status can give indications.

[103] Chang et al. 2013: 5
[104] Sagstad 2002: 3
[105] Sagstad 2002: 25

Chapter 3. Methods and Sources

This chapter will introduce the methods and sources used to tackle the thesis question. Most of them are quantitative in nature, with the parish registers being the crucial core supplying the actual tuberculosis mortalities. While the population censuses grant the demographic overview and the medical reports give an alternative and supporting insight.

The details of the quantitative methods often entail rigorous processing of the transcribed and digitalised data, which for several reasons will not be shown or described here, but rather included with illustrations in brief excerpts. The chapter will rather include the scope, possibilities and limitations of these methods and their sources, in order to reveal how they have provided the empirical foundation for the following analysis.

3.0.1 The quantitative methods

The quantitative data gathered from parish registers, population censuses and medical reports allow analyses into the detailed characteristics of a local populace. The population censuses and parish registers used are digitalised sources from the Norwegian Historical Data Centre (NHDC) at the Arctic University of Norway and the National Archives of Norway. They are compiled and made accessible through Microsoft Access and consistently organized into graphs and tables through Microsoft Excel. The yearly printed medical reports are transcribed and fully key-word searchable from the Statistics Norway, the medical statistics relevant from these reports have been compiled and organised in their own Excel sheets.

Working with digital tools entails asking queries about the numbers that are necessary for looking into tuberculosis mortality. This involves tasks like cleaning up the tuberculosis denominations within the parish registers, or calculating the ages of individuals in order to organise them into risk groups. These steps are done to allow for the most solid empirical evidence, but it quickly becomes evident that all three of the data-providing sources have their weaknesses and shifting consistencies, just like they all have their advantages and supplements. To put it simply, none of them were exactly produced to chart differences in tuberculosis mortality of any one town, but in unison they can form a more complete overview for this purpose. Their respective uses and contents will be thoroughly considered in this chapter.

3.1 Burial Registers from Tromsø Stiftprosti

The parish registers from this period include the registration of an individual's birth, baptism, confirmation, marriage, death and burial. For this project, the ministry's registration of an individual's cause of death has been the sole focus. When a person died, the local priests were obligated to fill in the registry, which included writing down the cause of death along with some details about the deceased. Which commonly included; death date, name, gender, date or year of birth, place of birth, the address of residence and societal position. The parish registers were developed by the state clergy to keep track of people's social and legal status. Even if tuberculosis statistics were not the priest's priorities these numbers and the information included around them can all be used to identify the characteristics of tuberculous mortality in the town.[106]

Thorvaldsen questions how complete the burial registers were, and concludes that there was under registration, but that this was more common in the earlier periods among poor, infants and those lost at sea. This improved drastically in 1800 and especially after 1866, when the ministers were obligated to send in fully named lists of all the deceased.[107] Though some of the arguments that remain for under registration are more common in peripheral rural parishes, the individuals lost at sea were still a relevant category for a coastal town like Tromsø. This should at any rate not be too big of an obstacle when estimating the tuberculosis mortality numbers of the town.

For that estimation the cause of death is the most crucial detail as it allows for separation of tuberculosis mortalities from other mortalities. With the digitalised information from seven different burial registers spanning over six decades, these details inevitably changed. In tail with changes in the medical community, but also with trends in policies and with personal preferences of each minister. After 1820 they were obligated to specify causes of death of all external causes and infectious diseases, while after 1877 they were obligated to specify the rest as well, which mostly meant the non-infectious diseases and the ill-defined causes of death..[108] This could potentially explain why the period under scrutiny starts from 1878, as the registers before it had quite empty cause of death columns. But even after this change there is significant differences and irregularities. Some priests preferred to write the cause of

[106] Thorvaldsen 1996: 86, 90
[107] Thorvaldsen 1996: 86, 87, 88, 89, 90
[108] Thorvaldsen 1996: 97 and Sommerseth & Walhout 2019: 192-197

death in full, while others preferred shortened abbreviations, and this goes for nearly every denomination, of which there are quite a few:

Figure 5: The frequency of the various transcribed denominations of tuberculosis mortality from the burial registers

dødsårsak	CountOfdød
Tæring	300
Lungetæring	69
Tuberc. pulm.	56
Phthisis	39
Phthisis pulm.	33
Tubercul. pulm.	31
Tuberkulose	27
Tuberculose	22
Meningitis tuberc.	19
Phtisis	15
Phthisis pulmonum	13
Strubetæring	10
Lungetuberkulose	9
Meningitis tubercul.	9
Tuberculosis pulm.	9
Rygmarvstæring	7
Tub. pulm.	7
Meningitis tuberculosa	5
Tubercul. pulmon.	4
Tubercul.	4
Tbc. pulm.	4
Meningit. tubercul.	3
Lungetuberculose	3
Scrophulose	3
Meningitis tub.	3
Tuberkuløs Hjernebetændelse	3
Mening. Tuberc.	3
Meningitis tuberculose	2
Meningit tuberc.	2
Meningit. tuberc.	2

Record: 1 of 212 | No Filter | Search

Source: 1878-1925 Burial Registers NHDC, UiT

As Figure 5 shows, a total of 212 unique ways of denominating tuberculosis were isolated. Early on there was a preference for the Norwegian colloquial term of "tæring" or consumption, while others preferred to write the more international tuberculosis, but at that with various spellings. While some ministers even prefer to use the old Greek term; phthisis. One of the biggest issues with this, was the level of chosen detail, "tæring" for instance was predominantly used earlier, and can mean any form of tuberculosis, but was most likely a pulmonary case if not specified.[109] However, in the early phase there is no mention of meningeal tuberculosis until 1896, these were more likely simply denominated as tæring or as

[109] Burial registers 1872-1925 NHDC, UiT

meningitis, but there is no way of telling the non-tuberculous meningitis cases apart from the tuberculous meningitis cases. Therefore the total number of meningeal cases are a low estimate, as they are only counted when a tuberculosis identifying denomination is used with it in the registry. Since it was *never* used before 1896 is it safer to assume that there were unspecified cases before then, than that there were no cases before 1896.

The nosology has changed considerably it can be assumed that at least around a few more dozen deaths would have been found in the generic meningitis cases. This uncertainty is also mentioned in the district doctors report from 1907; where the doctor's description of a cerebrospinal meningitis case portrays the uncertainty of these diagnoses, as he claims his colleague's judgement to be doubtful, saying the case was much more likely a tuberculous meningitis. [110] If the doctors with their expertise were uncertain, the ministers filling in the reports were likely even less reliable in borderline cases.

Though less likely, pneumonia and bronchitis cases are also excluded denominations of uncertainty, as pulmonary tuberculosis is in practice a form of lung infection. The same report in fact mentions that chronic bronchitis among the elderly could be of "tuberculous nature." The telling difference is usually the time span and symptoms, but in patients with weak immune systems this can easily be accelerated and is misdiagnosed even in modern medical practice.[111] With the written concerns from district doctors and the way the concern for tuberculosis awareness spread after 1900, it seems likely that the data before tuberculin-test availability, around 1907, provide less certain numbers.

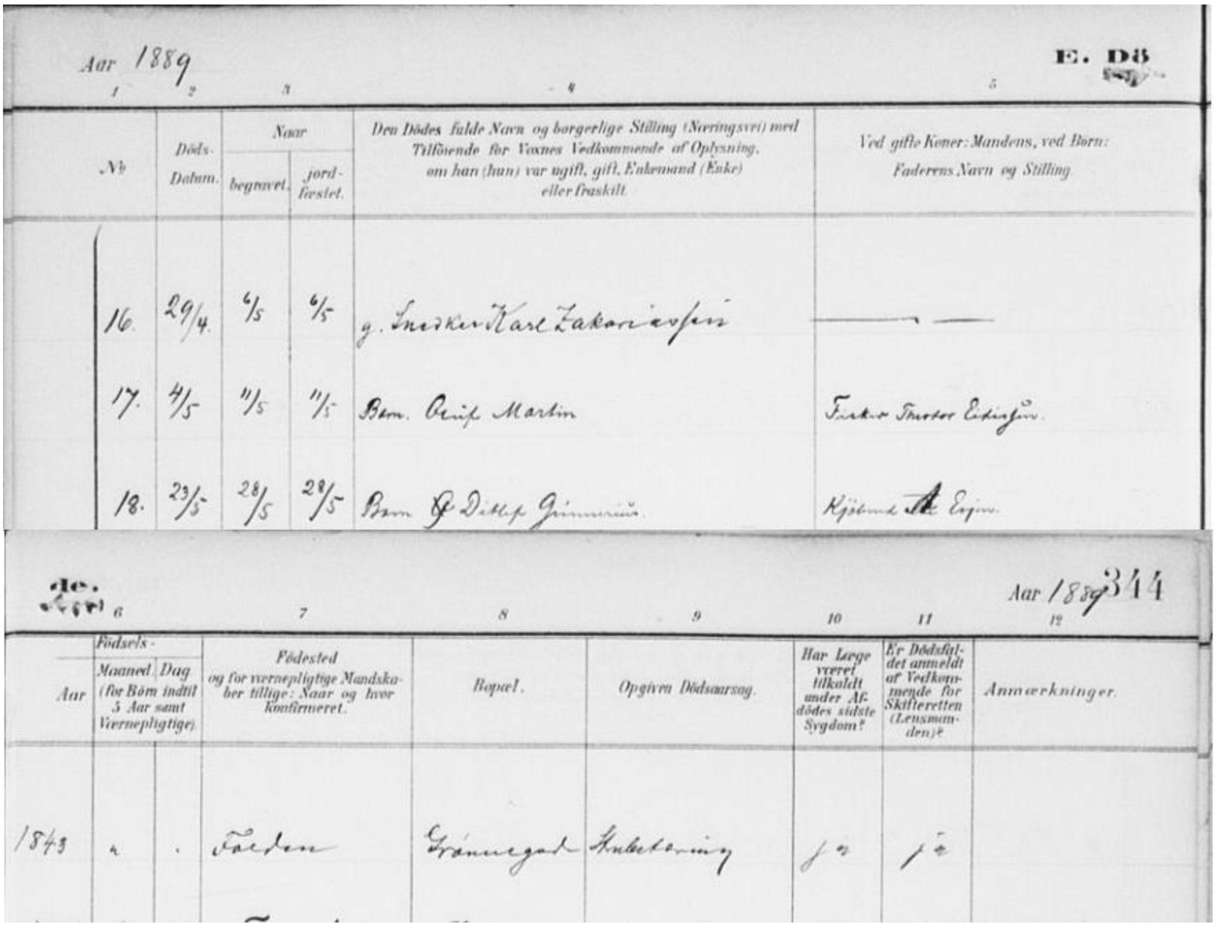
Puranen expresses concerns that many of the sources in Sweden showed certain under-registration and has in many cases added deaths that were likely from tuberculosis.[112] But she underlines the validity of those actually reported, as the "disease is relatively easy to diagnose in its lethal stages"[113] which may seem somewhat conflicting. Considering the lack of knowledge about diseases in much of the period she is analysing, it would make sense that there were falsely diagnosed deaths, both from secrecy and mistakes.

Using a historical variant of the international standardization system of ICD10,[114] the 212 different denominations have been narrowed down to fit into ten different forms of

[110] NOS V. 98. 1907 Medical report: 240 – He claims that one of the three cerebrospinalmeningitis cases was misdiagnosed, and was likely rather a tuberculous meningitis case.
[111] Liang, Shen, Zhang & Zhong 2016: 114
[112] Puranen 1984: 357
[113] Puranen 1984: 351
[114] WHO 2019: ICD10 2019 - https://icd.who.int/browse10/2019/en

tuberculosis, pulmonary by far being the dominant one, and is used for all those denominations that are unspecified tuberculosis. There are numbers in the medical reports that can give us an indication that is possible to link, but the added up annual numbers in both sources are small and yet vary greatly. The totals and comparisons from both sources will be presented in the next chapter.

Figure 6: Excerpt from burial register number 15, from 1889 in Tromsø Parish



Source: SATØ, Tromsø Stiftprosti, Ministerialbok nr. 15, 1889-1899: 344

As Figure 6 shows, this is an excerpt from burial register number 15, with 12 column headers. The printed columns covers two pages (shown separately in Figure 6), where each double page are horizontally divided between registration of male and female deceased, respectively. A person’s sex is used to look into gender differences in tuberculous mortality. Likewise, the date or year of birth is used to determine the age of the deceased, which is very accurate for children under the age of six, but as Figure 6 elaborates; after the individual reached the age of six, the date is not specified (unless they are conscripted), the year seeming sufficient. The age of the oldest individuals is considered the least certain, where highly unlikely and often rounded years are noted down. The place of birth is used to determine where the individual

came from, whether it was a local or a migrant to the town. While the address of residence and societal position or profession, are of varying detail and precision, they are very useful in order to establish a socioeconomic trait. It also makes it possible to spatially analyse the town, at least after 1903 when street numbers are introduced. By linking the address and the profession to the population censuses and cadastral registers it is possible, to some extent, to determine how wealthy or poor the individual was, and even how expensive the dwelling was. This will be covered in chapter 5.

Table 2: Percentagewise coverage of column information for individuals within the 1878 to 1920 burial registers for Tromsø town.

Column	Percentage of coverage
Sex	100.0
First name	94.1
Last name	96.6
Death date	99.9
Birth year	99.6
Birth date	42.7
Birthplace	97.2
Place of residence	98.4
Cause of death	85.0
Social position or role	97.6
Occupation	24.5

Source: Burial registers 1878 to 1920 NHDC, UiT

As Table 2 shows, the coverage of column information for all 5,741 deceased individuals within the period is here portrayed in percentages. Most of the crucial information is well within the 90th percentile, and even those that are not, like cause of death, are still considerably high. Occupation is low because it is only specified for those men that actually did the work, and not their family members, but these can be tied back through linking with population censuses, as shall be explained later. The birth date remains low because it is predominantly specified for children of up to five years of age, despite that, an individual's approximate age can be calculated based on their birth year. All this information combined gives an impression of who the individuals that died of tuberculosis were. Seeing it in comparison with those who died of other causes can give an overview of how devastating it was for the town compared to violent deaths or other diseases. At any rate, the burial registers

in the form of these compiled access tables provide the total death toll and, in many ways, form the foundation of the project. They should be seen in relation to the total populace however, for which the population censuses are instrumental to achieve.

3.2 The Population Censuses of 1875, 1885, 1900, 1910 and 1920

Population censuses of this period grant a full overview of the population of Norway at the exact date when they are done, though it varies, in this period it usually meant December decennially. The selected censuses for this project are nominative, which meant full informative lists of every single individual registered by the census takers, and are generally done quite thoroughly and consistently. However, like all demographic sources, there are gaps, errors and changes that will need to be critically examined, but of the material available, they are by far the most reliable and consistent sources to measure the population at risk of dying when register data are missing. The authorities did not start monitoring the populations movements continuously until 1964, when the modern population register was established. Thorvaldsen indeed confirms that they are of very good quality compared to many other sources, and they are also crucial in a confirmative way, as this project's long period requires consistent checkpoints.[115] Most importantly they grant concrete and detailed statistical data of Tromsø's population. Including name, gender, marital status, age, profession, address, birthplace, faith, ethnicity and languages spoken.[116] Through individual links across burial registers and population censuses, which is provided by the Norwegian historical population register, it is possible to categorise the dead by several relatable categories and to estimate the amounts and percentages that can give insightful information. The manual processing this project required also contributed to increasing the possibilities of these linking methods, that were otherwise overlooked by the automated systems at the NHDC.

Just the fact that the population of the town almost doubled from 5,509 in 1875 to 10,566 in 1920 gives room for many questions and assumptions.[117] How much of it was due to migration, urbanisation and birth rate? How did the populace and town infrastructure adapt to this growth? Did the town's increasing population density lead to increased mortality of tuberculosis? Did the migrants bring more tuberculosis, or cause the infection and death of more people? Did the demographic composition skew the numbers of the deaths in the burial registers in any way?

[115] Thorvaldsen 1996: 69, 70
[116] Population censuses 1875, 1885, 1900, 1910, 1920 – NHDC, UiT
[117] Population censuses 1875, 1885, 1900, 1910, 1920 – NHDC, UiT

Answering such questions gives useful and relevant information to support the main thesis question, but each of them requires thorough analysis of the vast numbers within each census. As doing so grants a total underlying population under threat from tuberculosis. Simply having the numbers of the dead tells very little comparatively, but comparing them to the total population gives proportions and in turn strengthens the usefulness of both sources for this project.

Having the totals each decade grants the possibility to calculate the mortality rates for each year during the period of study. For this purpose, the geometric mean method has been applied to estimate the population in the intercensal years. This method calculates a mean distribution for the intercensal years based on a theoretical assumption of a stable population growth rate between t_1 (e.g. census 1875) and t_2 (e.g. census 1885).[118] Evidently, the geometric mean has some constraints as it does not capture yearly fluctuations caused by for example epidemics and migration peaks. These constraints are further increased when the method is applied on age distribution for intercensal years. Applied on age distribution, the method assumes that the number of 30 years old at t_1 resemble the number of 30 years old at t_2. Ideally, a demographic balance equation should be applied, where the end population = starting population ± natural increase ± net migration, where natural increase = births – deaths, and net migration = immigrants – emigrants. These figures are not available. To evaluate the possible errors when applying the geometric mean method by age groups, we have reconstructed the intercensal population size by cohorts for the age group 15-49, which according to the time trends in the population pyramids shown in Figure 4. differed relatively more than other age groups. A cohort reconstruction starts with census t_1 and work by cohort: subtract the number of deaths, which gives the remaining size of the cohort 10 years later. The difference between the cohort size at t_1 and t_2 is the net migration for the cohort. The net migration is divided equality over the intercensal years. Our results show that the mortality rates only differ slightly for age group 15-49 when the two different methods are compared. This indicates that the geometric mean method can be applied. That said, we should always be careful in interpreting rates calculated from interpolated population data.

The discrepancies with the transcribed population censuses are similar to the ones in the burial registry. The level of detail varies greatly from one to the next, and amongst the individuals described. In the last three censuses, namely 1900, 1910 and 1920, there are more

[118] Dyrvik 1983: 54

details than in the first two of 1875 and 1885. Most noticeably in the spatial divisions, as the first two only have building numbers noted for the individuals residing in them, but in the last three there is also an area and apartment number, allowing for much clearer dwelling boundaries. This made it abundantly easier to assign women and children a socioeconomic division to the profession of the man in the household, as women and children were predominantly recognized as unemployed and are commonly specified as “wife” or “trueborn child”. While most of the men were assigned professions or positions, this was also more consistent in the latter censuses, but to some extent depended on which individual it was. The influential merchant with a reputable name often got extensive details to not just profession, but also place and time of birth. While an unemployed young migrant or visitor could have several of these details vaguely or barely noted.

The thing to keep in mind with these discrepancies throughout the whole project then, is that the early period is less accurate, and that the details about the poor and old are generally less accurate. In order to obtain fuller numbers within the discrepancies, some assumptions were made. For instance, assuming the most likely birth year in case of an impossible wrong number, where for instance 1976 was noted as a birth year in the 1910 census, it was edited to 1876. The argument for this is that improving the total likely amount of how many 24-year-olds there were in 1910 is more important than leaving an unknown blank in the statistic. This is notable since most of the data is not used to evaluate any one given individual, but rather interpret the whole composition those individuals make up in the population.

It might seem like extensive uncertainties are covered up like this, but on average more than 90% of the data within even the 1875 census seems quite reliable, and that minor uncertainties will not have any significant effect on the main results in the analysis.

3.3 Annual Medical Reports

Annual Medical Reports were since 1860 a more streamlined mandatory production, which compiled the statistics from each medical district, on illnesses and diseases and assessed the general state of health within the nation. Unlike a majority of parish ministers, the doctors who wrote and registered the numbers in these reports are assumed to have a high degree of education within medicine. This expertise should give a very credible and confirmative alternate source to the numbers in the burial registers. There is however no data on sole individuals here, there are aggregates on how many were afflicted and how many died of which disease in each district. In addition to a brief overview of medical personnel, facility capacities and an estimate of improvement or deterioration from previous years. There is a

varied consistency in these reports as well: district boundaries, disease denomination and categorisation.

As previously mentioned, there were changing theories and approaches to many medical issues, especially before Koch's discovery in 1882 and impasse of bacteriology. In the medical reports before 1886, tuberculosis is categorised as a chronic disease, in 1901 it gets its own category and is in 1911 officially considered an infectious one. Even though the main pulmonary form of the disease was officially called "svindsot", and it dominated all the statistics, there were others. Most noticeably, tuberculous meningitis, which was even before Koch's discovery denominated as "tuberkuløs meningitis" which means the tuberculosis term was used before, though less commonly, and for other forms than the pulmonary infections.

A long with the detailed attention to tuberculosis after the Tuberculosis Act the 8th of May 1900, the medical reports after this include more information about reported cases and specific parameters that are required by the act, such as how many cases came in throughout the year and even in which ways the cases were discovered and reported.

These table's provide excellent lethality statistics, but are unfortunately not available on town level, but are here instead shown for Tromsø Amt, the county as a whole. The best tables with the largest numbers are of course the country-wide tables. These remain useful for comparative measures, as it can tell us if the numbers from Tromsø are high or low in several ways compared to the rest of the country.

After the tuberculosis act came into force the 1st of January 1901, the local medical personnel were obligated to closely report the confirmed cases, deaths and movements of afflicted people, with any kind of tuberculosis to the local "sundhetskommisjon", or health commission. According to the regional archive in Tromsø, these separate local tuberculosis reports were only produced annually after 1913. Before this the archive only has a separate folder simply named "tuberkuløse", which mostly contains correspondence about individual patients, and no concrete statistical data. The so called "Tuberkuloseprotokoller" or tuberculosis reports are not specifically mentioned in the law but extracts from them are included in the medical reports even before 1913.[119] In the medical reports they work as a useful addition by compiling the reported cases of tuberculosis, which gives us a unique source to study this.

[119] Øverland 1926

The issue with the annual reports is that they have nation-wide numbers to express, and therefore often display the most detailed aggregates on regional levels. Some of the largest cities like Oslo and Bergen are necessarily treated with their own tables, but Tromsø town at this stage was not yet significant enough for this. As a consequence, there are many detailed tables for Tromsø Amt, and to a lesser extent, Tromsø medical district , which included the neighbouring rural municipality of Tromsøysund, but very few for the very municipal boundaries of Tromsø town that are the object of study in this project. In fact, the only relevant ones that remain consistent throughout the whole period for Tromsø town are mortality rates of pulmonary tuberculosis.[120]

The medical reports do also include a qualitative aspect which must not be underestimated. In each regional chapter there are written descriptions from the district doctor about the conditions in the Amt. These often include details about the towns as the towns are the densest concentrations of people and are frequently exposed to contagious diseases first. At the same time, the towns are where the poverty factor is most visible, a point of relevance the doctors seem to take an interest in. How they subdivide these reports can also tell us which external factors the contemporary medical community believed affected the health and well-being of the population.

The reports do as mentioned, change throughout the period, but the priority in these descriptive reports are placed on contagious diseases in the region. Beyond that a lot of emphasis is also placed on the weather and harvests throughout the year, and towards the end the *living ways and hygienic conditions*. These not only give us insight into how one year in Tromsø might compare to the next, but also how the doctors perceived the population's conditions, habits and understanding of the disease. Therefor these qualitative reports will be frequently referred to throughout the whole project, as the most primary source available to understanding the local mindset at the time.[121]

Statistics according to biological sex are unfortunately not available throughout the whole period. The detailed follow-ups in the medical reports treated it very differently after 1882, and again after 1900. These divides are however just two of several that affect the reports

[120] NOS I. C. 3a. 1875 to VII. 36. 1920 Medical Reports
[121] NOS I. C. 3a. 1877, 1892, 1907, 1914 Medical reports

throughout the period, as both medical and legislative measures change interpretations and priorities. [122]

The biggest concern with the numbers in the reports, is Julie Backer's claim of how incomplete they were. She specifically mentions that in 1860 only 40 per cent of all deaths were collected in the annual reports compared to all the numbers from the burial registers. This improved to 81 per cent around the turn of the century and to 90 per cent by 1920.[123] Backer also mentions that this varied greatly from district to district, and that it was more accurate earlier in urban municipalities than in rural ones.[124] To check this accuracy, the different numbers will be compared in chapter 4 .

3.4 Cadastral register and Residential Outlay

In order to display tuberculosis mortality spatially, more than individual data is required. The sources mentioned until now are well covering on that aspect, but for a clearer impression of the town's residential outlay and population density a map, population census and a cadastral register is needed. As mentioned, these in combination with any of the relevant individual's address of residence creates a fuller picture of the situation in the town.

A cadastral register is simply a list of property ownership within the municipality, primarily reserved for actual structures, but there are building lots for future development included as well. The 1904 cadastral register retrieved for this project includes owner names, tax valuation and fire insurance valuation. It was originally made to create an overview of the new address system implemented by the municipality. For the first time the properties received street addresses, whereas they earlier had independent lot addresses. This was a timely response to the town's growth and ever-increasing complexity, due to this both old and new numbers are included in this register. With this change, the minister's burial registers also started specifying residency addresses for the deceased. From this point it is therefore possible to place the deceased individuals within the town's boundaries, if their address is specified. There are also several handwritten editions to the document, where the valuation, property or ownership has changed since. These editions were done at some point before 1918, as the next official register was made then. Since their time of edition is difficult to

[122] See appendix 1 for collected data from medical reports and changing categorisation
[123] Backer 1961: 38
[124] Backer 1961: 37, 38

estimate, the original 1904 numbers and ownerships are retained for the sake of consistency and reliability.

Portraying all this data spatially is complicated, but with the use of Esri's ArcMap program it is possible, and it will allow for a geospatial analysis with a map of the town. There are several available, one from 1875, one from 1903 and one from 1918. The 1903 map was found to be most suitable for these purposes. Within ArcMap, the actual linking of all the information in the 1904 cadastral register to the burial registers reported deaths can be done, portraying which parts of the town were affected by tuberculosis. It is also possible to link the tax value of each building in the cadastre to the residents, even if the owners are commonly middle- or upper-class citizens, the censuses of 1900 or 1910 can be used to link these. The cadastre only contains taxed value and owner names, but the census also includes the actual residents and profession, thereby giving us the opportunity to ascertain a socioeconomic portrayal of the population within a limited timeframe. With ArcMap this can be visually displayed in a fully interactive digital map to identify possible affected parts of the city and population. Aside from this kind of land value and spatial wealth portrayal, it is also possible to display population density by applying the population of the 1910 census to the 1903 map.

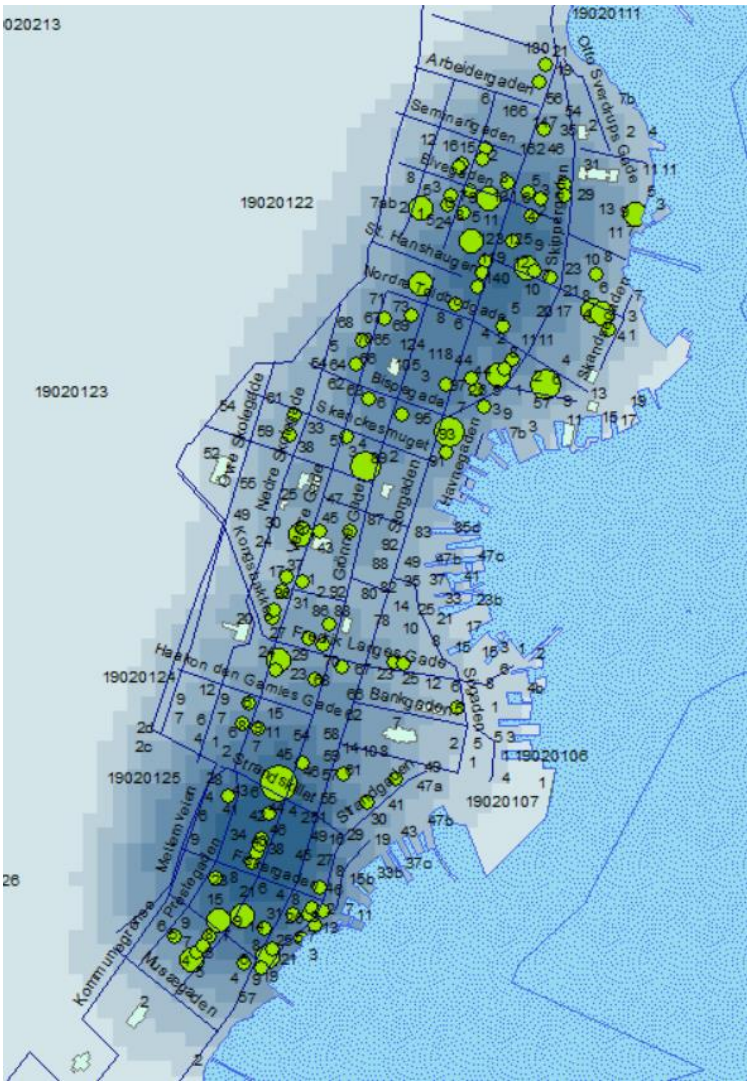
One of the major obstacles with this method, is that it relies on specific street addresses to work properly. Tromsø did not implement street addresses before the cadastral register change in 1904, they used property numbers before this.[125] This could have been used, but the burial registers are not compatible with them, as the burial registers refer to streets without any addresses. As such the entirety of the spatial analysis within this project will focus on the period from 1904 to 1920 where the linking of map, cadastral register and burial registers is possible.

This method will be the main approach to chapter five's spatial aspect. Where the important measure is to see if the different parts of town were differently affected by tuberculosis. Was a worker's choice to settle in the already cramped, but affordable, street more likely to seal his and his family's fate as a victim of the disease? For many this was perhaps the only choice in times of hardships.

To illustrate the linking of sources in a digital map program, an example has here been extracted to ease the explaining the methodology:

[125] Tromsø cadastral register of March 1904 – Old numbers referring to "gårdsnummer".

Figure 7: 1910 Population density with tuberculous deaths from burial register for 1907-1917



Source: Cadastral register 1904, population census 1910 and burial registers 1907-1917 NHDC, UiT

As Figure 7 shows, this is an excerpt from the digital map made through Esri's ArcMap program. It includes the 1903 map boundaries, streets, coastline and public buildings. There is a blue colour layering for the population density in the town, done by assigning the census residence addresses to object locations on the map. The darker this blue colour is, the higher the population density. The green dots represent reported deaths of tuberculosis tied to their address of residence, where the bigger dots represent more than one death at one address. This map includes a total of 169 out of 247 ministry reported tuberculous deaths within this one burial register from 1907 to 1917. Of the remaining deceased; 39 have an address outside of town, 21 have only specified the street or just the town, 9 have an unknown location potentially within the town, only specified by a colloquial place name no longer in use, and 8 have no location of residence specified at all. Excluding the 39 that are outside of town, this

leaves us with a 169 out of 208, which is arguably a rough representative amount of 81 per cent. The thing to keep in mind is that those without a specific address in town are rarely the wealthiest citizens. As mentioned about the variation of detail in the burial registers, the oldest, the youngest and the poor were often those with least detail and are likely to less often have a specific address included.

The highest concentration of tuberculous deaths is by the institutions that often ended up with the tuberculous cases, like the retirement home. Such institutions must be excluded from any spatial analysis, as their placements within any street or neighbourhood would unjustifiably distort their numbers to much higher ones. However, these institutions make up a considerable amount of those 169 placed tuberculous deaths, excluding them from the spatial analysis would also reduce the representative amount of the portrayal itself.

Keeping these discrepancies in mind will be crucial to understanding how much such a spatial analysis can explain or elaborate. It has its weakness and limitation like any other historical sources. That being said, tuberculosis was an immensely complicated societal phenomenon that entrenched itself within a very diverse population in this town. Any tools or measures implemented to trying to understand it would in the long run lack fullness or certainty, but trying to gauge it from several angles and directions like these combined sources and methods allow, covers more complexity and gaps than most projects at this detailed level could hope for. The results of these efforts shall be portrayed in the two following chapters.

Chapter 4. Tuberculosis Mortality in Tromsø

This chapter will present the results of the various compiled data from the quantitative sources described and scrutinised in chapter 3. The purpose is to investigate what characterised tuberculous mortality in Tromsø town between 1878 and 1920. Which means that this chapter will portray to what extent people died of the disease, which part of the period saw most of these deaths, which age group died most, and which gender died most.

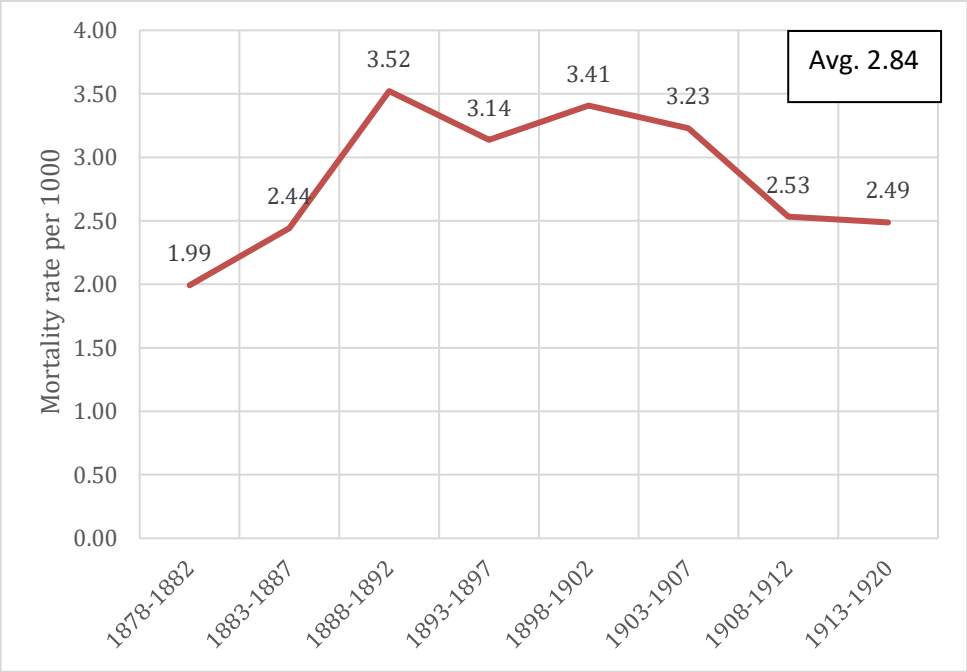
4.1 Initial Results and Mortality Rates

During the period between 1878 and 1920, burial registers for Tromsø town municipality counts 5,741 individual deaths. Of these 5,741 there are 809 with no mentioned cause of death. A majority of these unspecified deaths are infants, 490 of the 809 being babies under two years of age, that according to Backer, are commonly unspecified because the majority of them die of either, what was then considered common, or high-risk circumstances for their age group.[126]

Of the 5,741 of deaths, 914 of them have been identified as tuberculous of some form, which amounts to 15.9 per cent.[127] As mentioned earlier, the town population during this period increased from 5,673 to 10,566, and despite it being the most common cause of death in Tromsø town, the yearly tuberculous mortalities were not many, in fact they varied from 9 to 35, averaging at 21. [128] The most meaningful way of portraying them is in mortality rates per thousand within yearly intervals.

[126] J. Backer 1961: 76, 77, 78 and 1872-1925 burial registers NHDC, UiT
[127] 1872-1925 burial registers NHDC, UiT
[128] NOS 1878 to 1920 Medical reports – In most of the annual reports tuberculosis is mentioned as the deadliest disease in a majority of them, with pneumonia and old age frequently listed as the second deadliest diseases.

Figure 8a: Tromsø town's tuberculosis mortality rates from 1878 to 1920

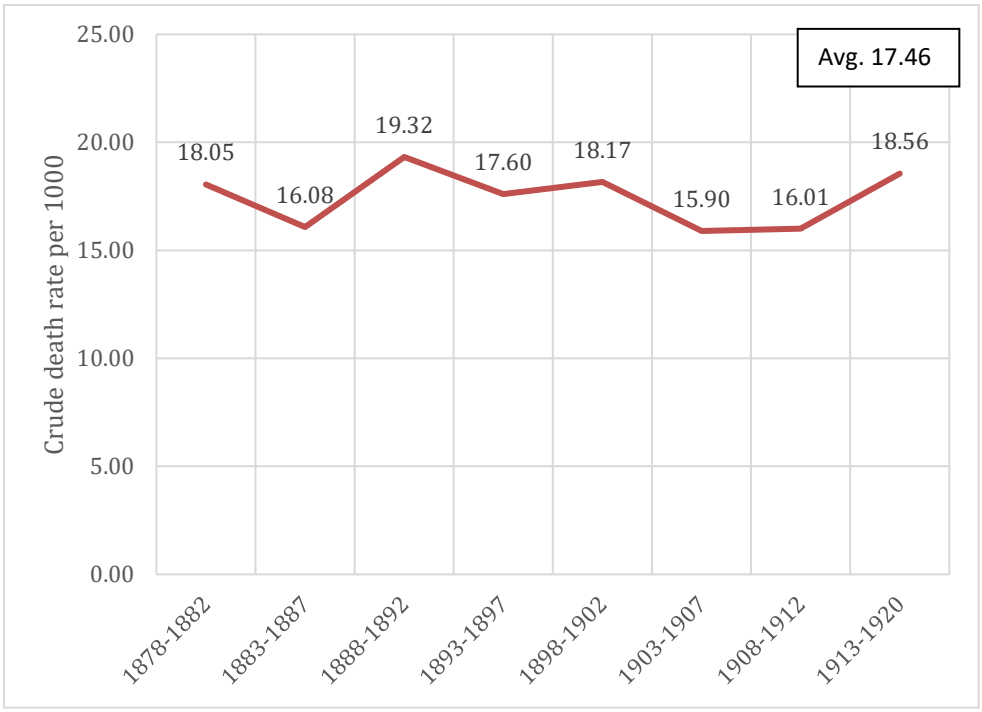


Source: Censuses 1875, 1885, 1900, 1910, 1920 and burial registers 1872-1925 NHDC, UiT

As Figure 8a shows, the tuberculosis mortality that goes from 1.99 deaths per thousand in 1878 to 2.49 in 1920, peaking twice at 3.52 and 3.41. From 1907 there is an indicated decline, where the rate goes below the average and does not seem to rise again. The reasons for this decline are as mentioned complex and have been debated, but this project will rather focus on the mortality by sex differentials, socioeconomic and spatial factors. There is also a plateau from around 1888 to 1907, where the mortality rate stays consistently above the average of 2.84. This shows that tuberculosis in Tromsø was at its worst during this plateau, which fits with the earlier research done on this. Ryymin, Karlsen and Skogheim write that tuberculosis peaked at around the turn of the century, but also that Northern Norway peaked later and was more devastated than the rest of the country.[129] This early peak is an indication that Tromsø as a regional trade and administration centre in some ways had more in common with other trade-based towns than the region which surrounded it. Andresen mentions the 1880s as being a decade of economic breakdown for the town, where fishing failed and more people left than came.[130] Seeing as tuberculosis is consistently tied to living standards and poverty, it would make sense if prolonged economic difficulties caused an increase in tuberculosis mortality. Does this mortality rate correspond to the total mortality rate though?

[129] Ryymin 2008: 1, Ryymin 2008: 2865 and Karlsen & Skogheim 1990: 121, 128 - Also see Figure 10 for comparison.
[130] Andresen 1994: 300

Figure 8b: Crude death rate in Tromsø town 1878-1920



Source: NOS 1878 to 1920 medical reports for Tromsø town

As Figure 8b shows, this is the crude death rate in the town, according to the medical reports. These had lower numbers than the burial registers, as discussed in chapter 3.3, but seem to be fairly accurate with a total of 5,302 deaths compared to the burial registers 5,741. During the period of study, the crude death rate shows no remarkable rise or decline.[131] It gives a contextual reference, where we see that the tuberculosis mortality in Tromsø town follows a more or less similar trend, with the exception of the first and last intervals. The last interval likely being a peak due to the Spanish Flu.

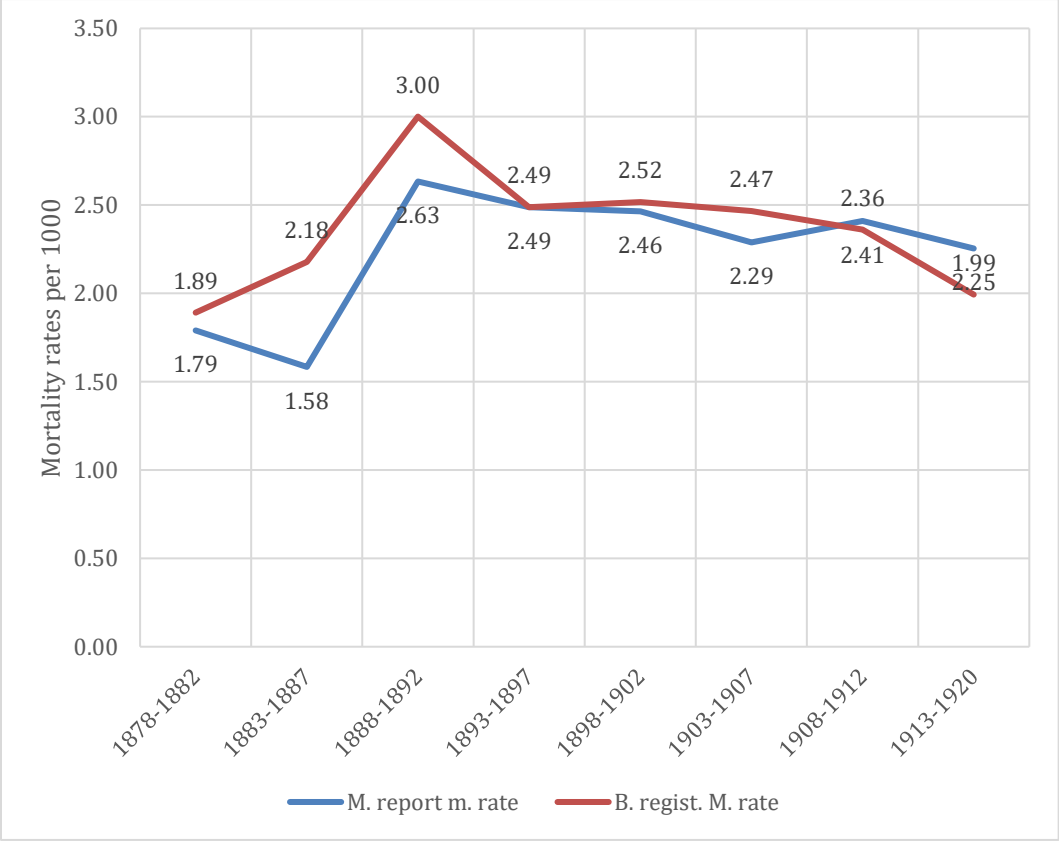
4.1.1 Pulmonary Tuberculosis and the Medical Reports

The medical reports provide excellent supplementary data to this discussion, which is why comparing the data from the reports to the data in the burial registers is fundamental. But as mentioned in chapter 3, there are no consistent statistics for total tuberculous deaths each year in the medical reports, but there are consistent tables for *pulmonary* tuberculosis deaths. Before Koch discovered the bacillus, pulmonary tuberculosis was in many ways considered its own disease, this becomes apparent if one examines the ways it is noted in the medical reports in contrast to the other forms of the disease. Through all the 43 annual reports the only tables that remain virtually unchanged are the ones for the deaths of pulmonary tuberculosis

[131] Crude death rate does not control for age variance

specifically.[132] For the whole period from 1878 to 1920 the medical reports for Tromsø town total at 730 deaths of pulmonary tuberculosis. Comparing these to the total of 5,302 registered deaths in the reports amounts to an average of 13.8 per cent of pulmonary tuberculosis. In the burial registers, however, 752 of the aforementioned 914 were pulmonary or pulmonary in addition to some other form of tuberculosis.[133] Comparing this to the total of 5,741 reported deaths in the registers, which had 439 more reported total deaths, amounts to an average of 13.1 per cent of pulmonary tuberculosis. If we compare their spread over the period, we get a graph like this:

Figure 9: Tromsø town's pulmonary tuberculosis mortality rates according to medical reports and burial registers



Source: Censuses 1875, 1885, 1900, 1910, 1920, burial registers 1872-1925 NHDC, UiT and NOS 1878 to 1920 medical reports

As Figure 9 shows, these are mortality rates for pulmonary tuberculosis from the medical reports and burial registers of the same period in Tromsø town. There is a noticeable discrepancy between the two sources, most considerably in the early period of 1878 to 1897.

[132] NOS 1878-1920 medical reports – The denomination in the reports change, but they all mean pulmonary tuberculosis.

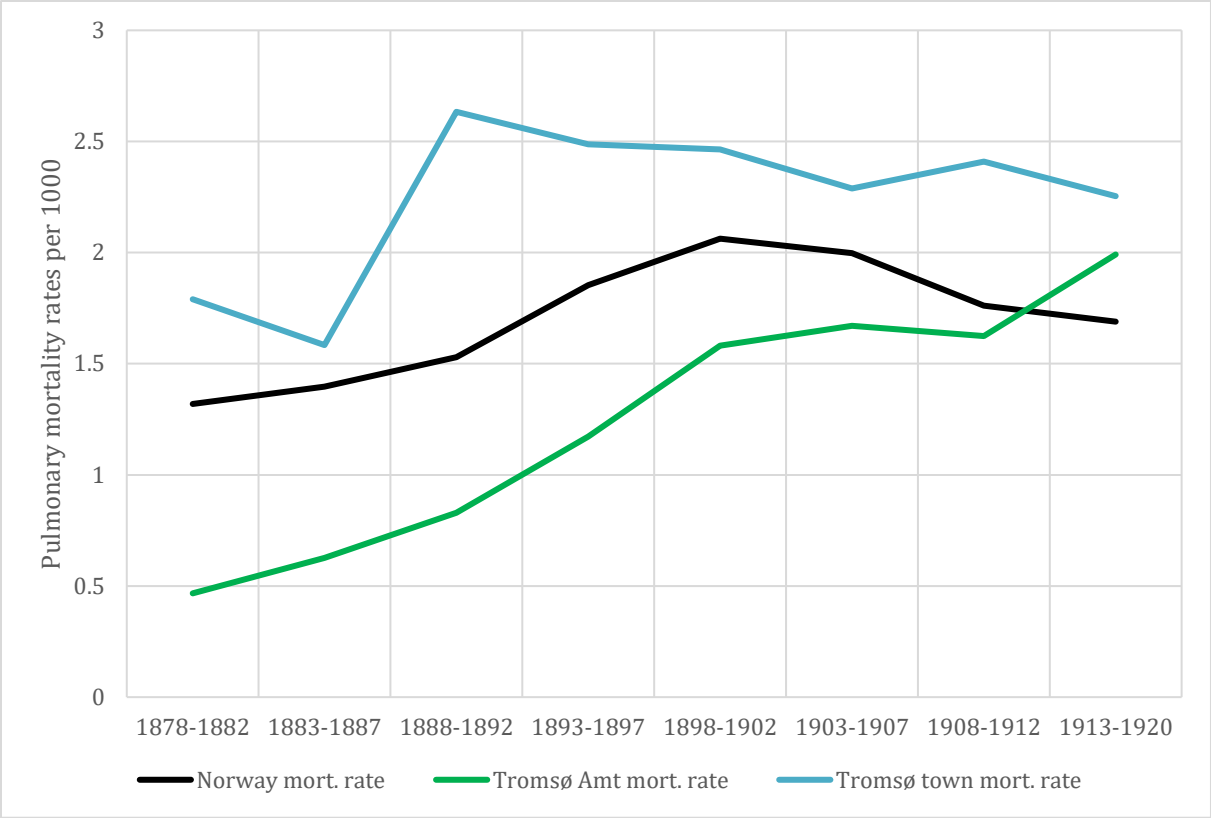
[133]1872-1925 Burial Registers NHDC, UiT – The vast variety of denominations makes it hard to be entirely consistent in categorizing and standardizing these, but as a rule those who had pulmonary and another form died due to the pulmonary.

As the reliability of both sources were mentioned in chapter 3, this difference is to be expected. Especially the lower numbers from the medical reports, which are far from as low as Backer claims, indicating that Tromsø as an urban environment might have had sufficiently accurate medical reports in this timeframe, at least for pulmonary tuberculosis.[134] Discrepancy aside, both lines show a similar development as the total numbers from Figure 8a. The concerning economic crisis seems to be evident in these numbers too, as the peak is clearly during 1888-1892. With the slow nature of this disease, the crisis likely started early in the 1880s like Andresen mentions, only resulting in increased mortality after a period of prolonged poverty.[135]

Looking at these changing mortality rates in Tromsø gives us a periodic overview of this small town, but without comparison it is difficult to say what significance these rates had. Fortunately, the medical reports cover several different geographic divisions within Norway, it is therefore possible to compare consistent numbers from the country-wide table and the regional table from Tromsø Amt:

[134] Backer 1961: 38 – Backer mentions that the medical reports severely under-registered deaths in the early period. 40 per cent in 1860, 81 per cent in 1900 and 90 per cent in 1920.
[135] Andresen 1994: 300, McFarlane 1990 and Dormandy 2000: 225 – Also mentions the delayed effects of the first world war on tuberculosis mortality.

Figure 10: Pulmonary tuberculosis mortality rates from Norway, Tromsø Amt and Tromsø Town according to medical reports



Source: NOS 1878 to 1920 medical reports

As Figure 10 shows, the mortality rates for both the region and the country are noticeably lower than they are in Tromsø town throughout the whole period. There is also an increase in all three lines up until 1898-1902 before they flatten out. The country rates in many ways represents the average of both rural and urban Norway, and portray the peak at the turn of the century, which is consistently mentioned in a plethora of Norwegian literature about tuberculosis.[136] The Tromsø Amt rates shows a consistent increase in mortality, which was to some extent expected from a region so far north in the country.[137] The town in comparison to these, shows greater fluctuations throughout the period, which is also due to its much smaller sample. That said, what remains clear is that Tromsø town experienced a consistently higher mortality compared to the country and Tromsø province (excluding the town) throughout the period. It can also be expected that Tromsø town's dependence on fishing and trade made its population more vulnerable to the effects of good and bad years, thereby showing that these effects were likely due to local circumstances and its characteristics as a densely populated urban environment. Age groups, which shall be discussed later, also play a decisive role here,

[136] Ryymin 2008, Karlsen & Skogheim 1990, Schiøtz 2003
[137] Ryymin 2008: 2864

as most towns did have a larger proportion of the very age group that is typically exposed to pulmonary tuberculosis mortality.[138] It would in the interest of comparison also be useful to compare Tromsø town's rates to other Norwegian towns of the same size and economic dependencies, but the focus of this project is not a comparative one. I will instead recommend future research to compare pulmonary tuberculosis mortality in coastal Norwegian towns.

4.1.2 Other Forms, Meningitis and the Bovine Strain

Pulmonary tuberculosis was however not the only form found in the burial registers; of the remaining 161 (17.6 per cent) tuberculous deaths, 81 (8.9 per cent) of them are meningeal, which is likely why tuberculous meningitis is the second most consistent cause of death that shows up in the medical reports. The other 81 non-pulmonary forms of tuberculosis excellently portray just how widely the disease can spread in the body:

Table 3: Anatomically categorized forms of tuberculous mortality in Tromsø according to interpreted burial registers

Number of deaths	Standardized term
752	Pulmonary Tuberculosis
81	Tuberculous Meningitis
18	Tuberculous Spondylitis (Pott's Disease)
13	Laryngeal Tuberculosis
10	Scrofulosis
9	Miliary Tuberculosis
7	Acute Tuberculosis
6	Tuberculous Enteritis
3	Tuberculous Peritonitis
2	Pelvic Tuberculosis
2	Abdominal Tuberculosis
2	Renal Tuberculosis
2	Tuberculous Coxitis
2	Tuberculous Gastroenteritis
2	Tuberculous Salpingitis
1	Urogenital Tuberculosis
1	Oral Tuberculosis
1	Tuberculosis in the Heart

Source: 1872-1925 Burial Registers NHDC, UiT

As Table 3 shows, these are the anatomically categorized findings from the burial registers with total mortalities throughout the whole period. There are few parts of the body that are excluded. The pulmonary one is simply most common because the bacillus is aerobe and

[138] J. Backer 1961: 117-154
See also population pyramid in chapter 2.

thrives in oxygen-rich environments, and because it spreads this way. That being said, a majority of these extrapulmonary forms usually occur when the bacteria get disseminated through the bloodstream after an already serious lung infection.[139] Which is the other reason there are so few of these, since the lungs have the highest concentration of oxygen, and if a tear in the lung tissue has already occurred it is more likely that the respiratory system fails, or causes a deadly fever and malnourishment that escalates the process.[140] Despite that, miliary and acute tuberculosis cases do occur and are both indications of several infections throughout the whole body, the difference is that acute tuberculosis has usually killed the patient within a much shorter time frame than expected. As mentioned in chapter 2, this is usually due to a severely weakened immune system. There are in addition 14 of the deaths on that list that can be placed somewhere within the digestive system. Much like the meningeal cases, they *can* also be a result of drinking contaminated milk, which is why extrapulmonary cases in many ways *were* a different disease.

Meningeal tuberculosis was a concerning contender, because this is one of the common forms that could spread through other means than the respiratory system.[141] In the medical reports it was initially in its own category, but later got categorised with other less common forms and labelled as "tuberculøse betændelser". In the early reports from 1878 to 1896 we have clear numbers of infected as well as deaths, most of whom are children that experienced a remarkably high lethality from it.

Table 4a: example cut from 1881 medical report

220 Tromsø Amt.

Liste over f

	Ialt opgivne.		Børn.		Voxne.	
	Tilfælde.	Dødsfald.	Md.	Kv.	Md.	Kv.
Chronisk Rheumatisme	242	-	-	2	155	84
Fnat	31	-	3	5	8	10
Skurv	6	-	2	-	2	2
Kjertelsyge	115	-	49	54	8	4
Rachit	17	1	10	7	-	-
Simpel Meningit	3	3	1	-	1	1
Tuberkuløs Meningit	6	6	3	3	-	-
Svindsot	82	19	3	2	37	34
Kræft	22	15	-	-	12	8
Vatersot og Morbus Brightii	40	[1]) 8	1	-	20	18

Source: NOS C No. 4 1881: 220 – Under the list of "common chronic diseases"

Table 4b: example cut from 1891 medical report

246 Tromsø Amt. 1891.

Liste over de

	Ialt opgivne		Børn.		Voxne.	
	Tilfælde.	Dødsfald.	Md.	Kv.	Md.	Kv.
Chronisk Rheumatisme	277	-	1	1	171	104
Fnat	244	-	59	71	65	49
Skurv	8	-	4	2	1	1
Kjertelsyge	184	-	72	81	12	19
Rachit	54	5	27	26	-	1
Tuberkuløse Betændelser og Miliærtuberkulose	39	27	14	13	8	4
Lungetuberkulose	180	63	4	7	64	105
Kræft	44	23	-	-	25	19
Morbus Brightii	33	6	1	2	20	10

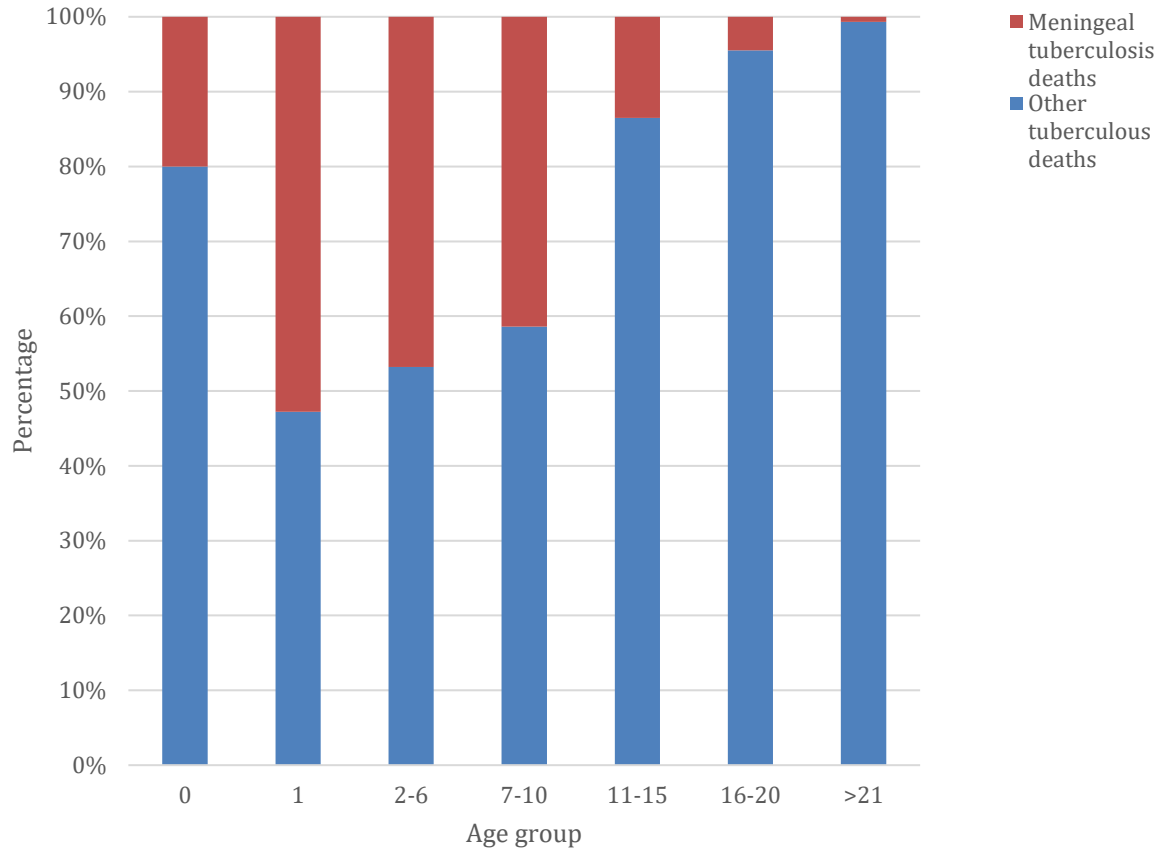
Source: NOS No. 185 1891: 246 – Under the list of "common chronic diseases"

[139] Grosset, Truffot-Pernot & Cambau 2000: 144
[140] Dormandy 2000: 220, 221
[141] Dormandy 2000: 330

As Tables 4a and 4b show, these are numbers from Tromsø Amt, ten years apart from the end of the 19th century. The tables are divided into morbidity and mortality, men and women, as well as children and adults, where adulthood is considered 15 and upwards. Here we can see how the medical reports changed after Koch's discovery; "Svindsot" became "Lungetuberkulose", while the other forms of tuberculous infections were compiled with the meningeal cases. The meningeal cases stand out in two regards from the pulmonary; the lethality is higher, and the age group is lower. So where as pulmonary tuberculosis primarily activated in adults, and killed on average 47% of the diagnosed cases, the meningeal cases killed on average 95% of the diagnosed cases, most of whom were children.[142] That is if we look at the country-wide and the regional tables from 1878 to 1886, when those are available annually, on average both of these add up to 95% lethality in the same period.[143] It is possible to examine these numbers from Tromsø town in the medical reports, but as mentioned in chapter 3, they are widely inconsistent in how they are compiled, and not even given a column on municipality level before 1896. Which is unfortunate, as this form of tuberculosis likely would have shown very different numbers in rural and urban environments. However, looking at the 81 meningeal mortalities in the *burial registers* it is possible to see how exposed children were to this form:

[142] NOS C No. 4 1875 through NOS No. 185 1886 – The percentages are acquired by looking at the reported cases and deaths. For more details see appendix 1.
[143] NOS 1878 to 1886 – After 1886 they become compiled with the other tuberculous infections.

Figure 11: Meningeal tuberculosis mortality compared to other tuberculous deaths in Tromsø town 1878 to 1920 according to burial registers



Source: 1872-1925 Burial Registers NHDC, UiT

As Figure 11 shows, the 81 meningeal tuberculosis deaths are displayed across relevant age groups in comparison to other forms of tuberculosis deaths. Children aged 1 to 11 seem to be the most exposed age group, while infants and teenagers are comparatively less susceptible, adults on the other hand, are only very rarely killed by this form.

These numbers fit well with an observation Puranen made while looking at child mortality from tuberculosis. [144] She argues that many tuberculous parents reproduced, and that even if the disease is not hereditary, the children might have inherited the parents lack of resistance or immunity to the disease. The more important note, however, is that tuberculous child mortality was found to be far more common where there was proven bovine tuberculosis bacilli in the milk from cows. She concludes that this kind of primary infection through milk

[144] Puranen 1984: 360, 361

often gave children this very deadly form of tuberculous meningitis.[145] Perhaps the infants were somewhat spared due to mother's milk being less likely contaminated than cow's milk.

The bovine strain of the bacillus is perhaps the most unfortunate aspect of this story, as Dormandy explains; "[...]infections with the bovine organism were eminently preventable for at least fifty years before the introduction of chemotherapy. They continued only in countries where they were not prevented."[146] It most commonly came from cow's milk but was neither exclusively found in cows nor just in milk, but before pasteurisation, milk was the most common product people consumed unprepared. Dormandy analyses numbers from the 1930 British Ministry of Health Statistics and estimates that "28 per cent of all non-pulmonary tuberculosis deaths […] in Britain were of bovine origin. Over a thousand children under the age of fifteen died in England and Wales every year from the bovine strain."[147] It likely caused half the meningitis cases and most of the tuberculous peritonitis cases.[148] Another British study from the 1930s blamed the insufficient legislation, as 60% of meningeal cases in rural areas were of bovine origin, while only 22% of the urban cases were bovine.[149] Granting solid arguments in favour of pasteurization, which was far more common in the urban milk market than in the rural one.

The tenth paragraph of the 1900 Tuberculosis Law in Norway *allowed* the local health commissions to forbid distribution of milk from places where *people* with tuberculosis had partaken in the treatment of either the cattle or the milk. The risks of spread through milk are clearly stated, and this also explicitly mentions women who work as wet nurses, but it does not imply the inherent risks of the cattle itself being infected with the bovine strain.[150] This paragraph simply encourages the isolation of potentially infected individuals, in order to prevent spread to a crucial nourishment supply, but this meant little if the supply was inherently contaminated with the bacteria. Even if Louis Pasteur proved the hygienic benefits of pasteurisation in the 1860s, there was little effort and resources invested in this until it could be proven with tuberculin tests.[151]

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[145] Puranen 1984: 357, 361
[146] Dormandy 2000: 330
[147] Dormandy 2000: 329
[148] Dormandy 2000: 329, 330 - Peritonitis means it would develop gastrointestinal infections, and commonly cause acute intestinal obstructions.
[149] Munro & Scott 1936: 394 and Dormandy 331: The reason for this limitation could be that Koch himself at the time considered it unlikely that the bovine strain would transmit to humans. See appendix 5 for more about tuberculous zoonosis
[150] Øverland 1926: 7
[151] Lie 2009: 129

Much like in Britain, there was no wide-reaching law for pasteurization of milk in Norway until the late 1930s.[152] In Tromsø the local dairy was established in 1907, but there is no mention of pasteurisation equipment in their first establishment budget.[153] Not until 1921 is new equipment mentioned, where a pasteurizer, among other machinery, is bought to modernise the production. Tuberculin testing of cattle occurred somewhat earlier, as mentioned in chapter 2. The district doctor P. Hansteen wrote already in 1907 that there should be more tuberculin testing of the cattle.[154] In 1914 city doctor P. G. Lie reported: "Throughout the winter the veterinarian has inspected all the cattle, which provides milk to Tromsøysund Dairy. Fortunately, not many tuberculous animals were discovered."[155] From 1916 the dairy also made new members agree to let their cattle be tuberculin tested before they could deliver milk to the dairy.[156] By these measures the majority of Tromsø's milk supply should have been relatively safe from the bovine strain by 1914, or at least by 1921. Unfortunately, Wekre also elaborates in his book about the dairy, that there was milk being sold under quite unhygienic conditions from open milk canisters on the town square as late as 1931. Which, even if it was boiled, something that is unlikely, could still easily be contaminated with the human strain through coughing. That year this practice was forbidden and all sale of milk in town had to be done through the dairy.[157]

Through these findings it is safe to assume that the unboiled milk supply in Tromsø was at least partially to blame for some of those 914 tuberculous deaths, and likely a considerable portion of the 81 meningitis deaths. Figure 11 could indicate that it was more likely cow's milk these meningeal cases came from, but infected wet nurses and mothers are not to be excluded from the equation, however, mother's milk does give an immune system boost that cow's milk cannot replace. The tragedy with the cow's milk is more the lack of effort for the sake of safety. Surely it cost a bit of fuel or power to boil milk, but in the long run this was likely more of a habitual problem than an economic one. It can be compared to the spitting problem, people kept doing it out of habit long after the majority was convinced that

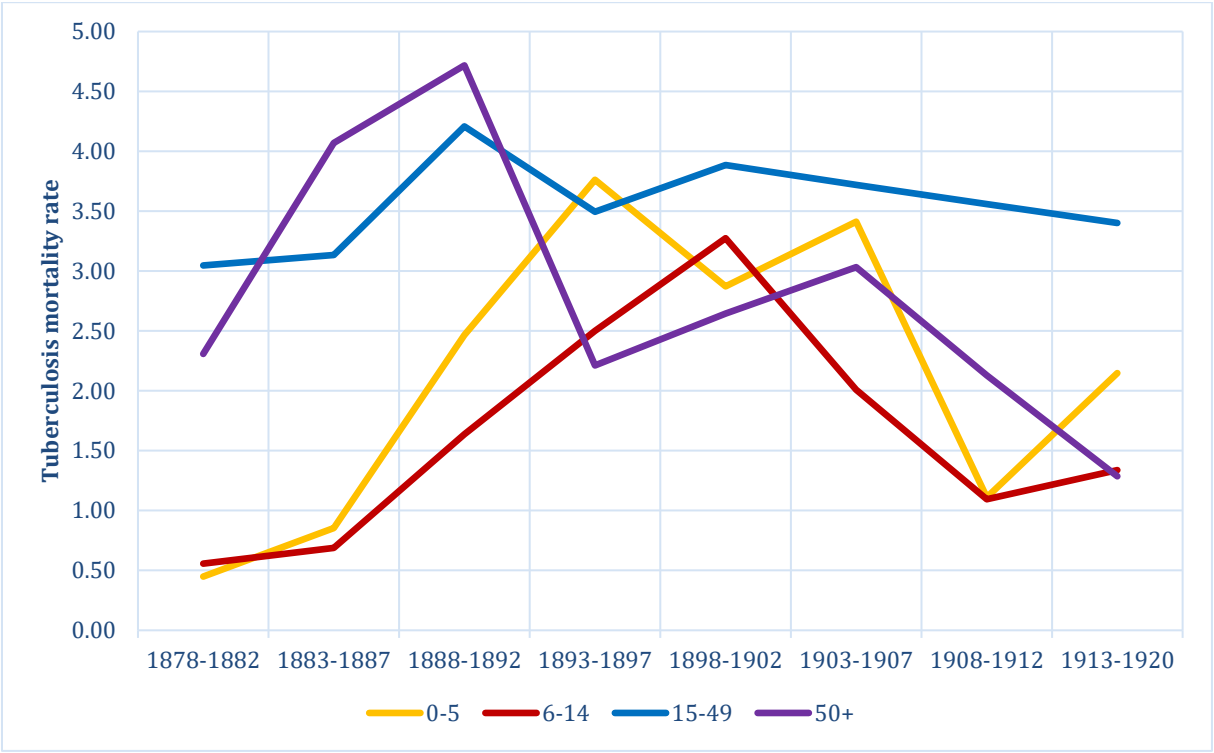
[152] Lie 2009: 129
[153] Wekre 1970: 130-137
[154] NOS V. 98. 1907: 242
[155] NOS VI. 94 1914: 240 – "I vinterens løp har dyrlægen undersøgt med tuberkulin alle de kjør, hvorfra der leveres melk til Tromsøysundets meieri. Der har heldigvis ikke været mange tuberkuløse dyr at finde." (Provides own translation)
[156] Wekre 1970: 47
[157] Wekre 1970: 22, 23, 24 and 25

tuberculosis was spread this way.[158]

4.2 Age and Risk Groups

It seems clear from both the literature and the medical reports that meningeal and pulmonary tuberculosis affected each their age groups.[159] This gives incentive to inspect the ways the 914 tuberculous deaths were spread out across age groups in Tromsø:

Figure 12: Tuberculosis mortality in Tromsø town, in yearly intervals and within four decisive age groups.



Source: Censuses 1875, 1885, 1900, 1910, 1920 and burial registers 1872-1925 NHDC, UiT

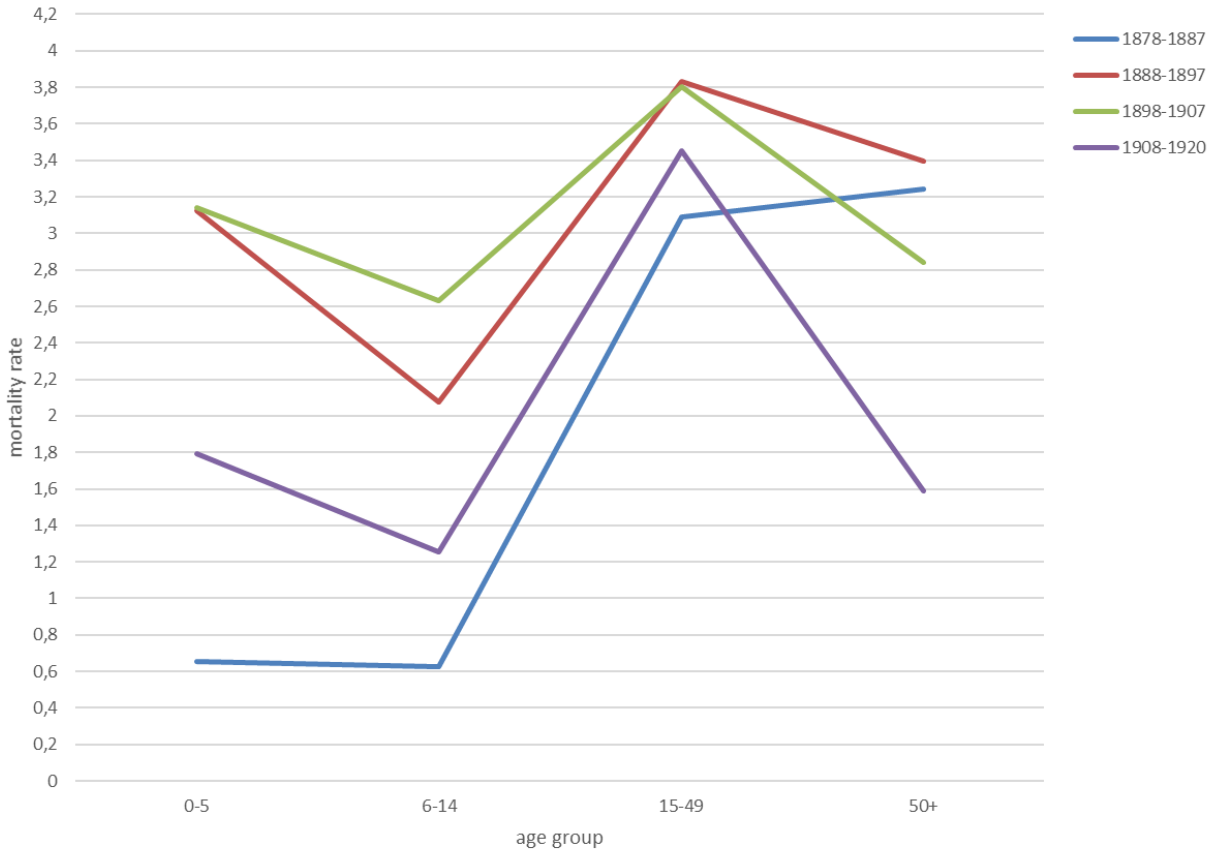
As Figure 12 shows each of the four lines portray a decisive age group's tuberculous mortality rate within Tromsø's population over the formerly used yearly intervals. The differences between them are remarkable and shows that the peak in the mentioned economic crisis was more due to the 50+ elderly group than the primary risk group of 15-49, even if the increase amongst these is also quite noticeable. The 15-49 risk group had, as expected, a higher mortality rate of tuberculosis. What was not expected however, was the remarkably high mortality rate for the 50+ age group during the late 1800s.

[158] NOS VI. 94. 1914: 235
[159] Backer 1961, Puranen 1984, Mcfarlane 1990, Dormandy 2000

Julie Backer mentions that tuberculosis mortality sharply decreased among individuals in their 40s and 50s, but that those in their 60s and 70s did experience a new increase in mortality, especially women before the turn of the century. "Experience shows that mortality amongst the elderly was primarily not due to new infections, but a recurrence of an old tuberculous infection that the individuals had acquired many years ago."[160]

The same figure takes on a somewhat more distinct form if the graph is flipped, portraying the decades as lines. This portrayal is more in line with Backer's figures and shows how the different periods treated each age group:

Figure 13: Tuberculosis mortality in Tromsø town, in yearly intervals and within four decisive age groups



Source: Censuses 1875, 1885, 1900, 1910, 1920 and burial registers 1872-1925 NHDC, UiT

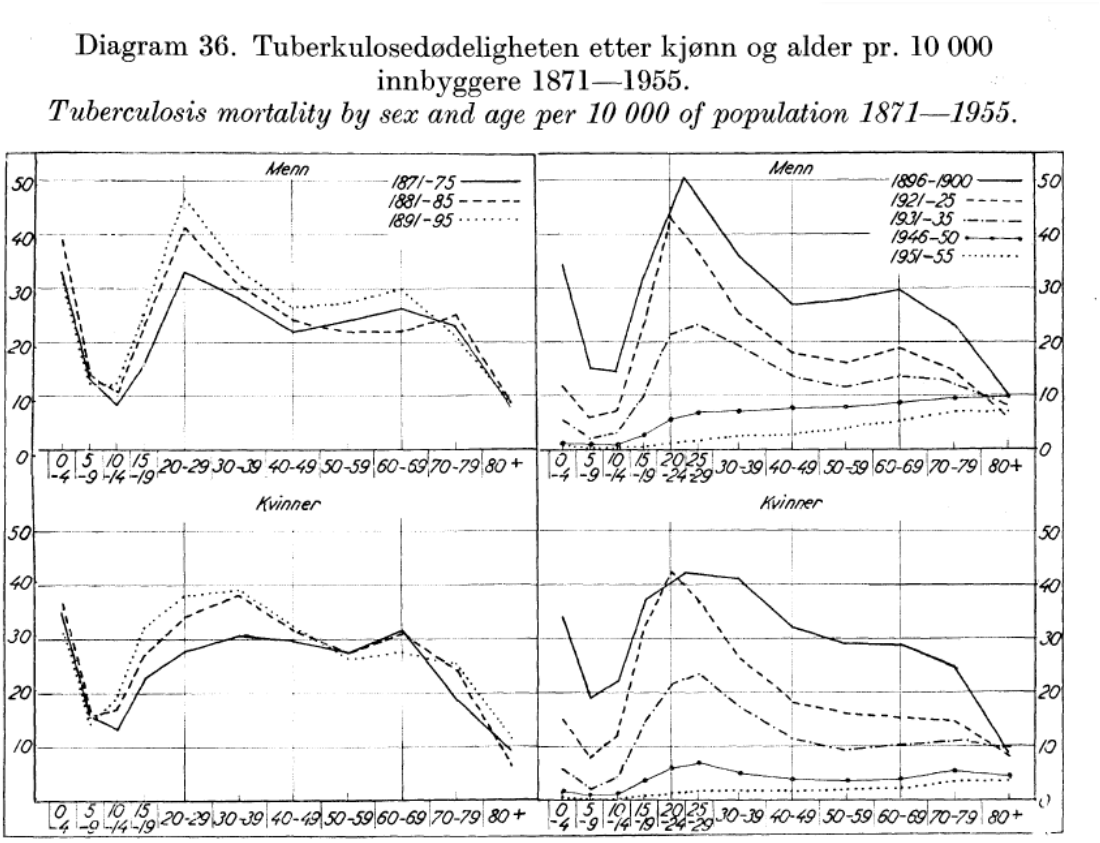
As Figure 13 shows, the lines are here represented by the approximate four decades, with the age groups illustrated along the x-axis. Here it is more visible just how at risk the 50+ age group was in the 1878-1887 years, being the only time period any other age group had a

[160] Backer 1961:131, 133 – "Dødeligheten av tuberkulose i eldre alder skyldes erfaringsmessig for en vesentlig del ikke nyinfeksjon, men en oppblussen av en tuberkuløs lidelse som vedkommende har fått ofte for mange år siden." (provides own translation)

higher mortality rate of tuberculosis than the 15-49 risk group. Through this it is increasingly clear that latent tuberculosis recurrence is dangerous in difficult times, as the elderly are commonly known to be the most exposed under such circumstances. Connecting this to the ways nourishment affects people's immune systems, these numbers can indeed portray that tuberculosis reactivation and mortality was dependent on the economic situation and living conditions.

Figure 13 does show some oddities for the early age groups of children and teenagers however. As mentioned in chapter 3, the meningeal cases are more difficult to estimate for the burial registers before 1889, but the overall impression from Figure 12 does indicate a similar graph as the one Backer has for the whole country:

Figure 14: Backer's Tuberculosis mortality by sex and age per 10 000 of population 1871-1955.



Source: Backer 1961: 130

As Figure 14 shows, tuberculous mortality differed for each graph, as both age group, sex and yearly interval inspected makes a difference. It becomes apparent that the 1890s and early 1900s overall show higher mortalities across nearly all parameters, but especially in the risk group of 15-49. Combined they do show similar patterns as Figure 12 shows across age

groups in Tromsø, the early age groups stay relatively consistent during the late 1800s before they drop decisively at the turn of the century. The 5-14 age group remains perhaps the most consistent similarity in all these, as it is noticeably lower than for those around it.

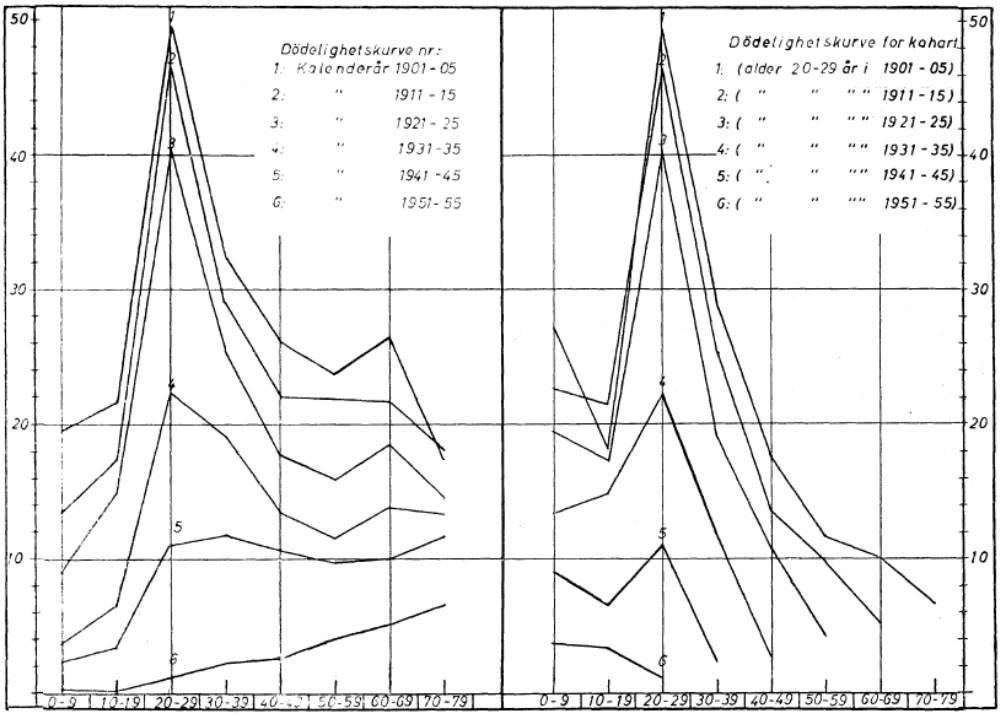
A recent study from Malmelund et. al. inspected exactly this age group's strengths and weaknesses, calling it "the honeymoon period of infectious diseases".[161] It suggest that they were easily infected, but that during this period of life "the capacity of the adaptive immune system […] seems to have reached maximal strength at the age of 10."[162] This meant that a majority of them survived or supressed these infections while their immune system was at its peak, but that their diseases could have reactivated when this strength subsided.

Like the recent studies, Karlsen and Skogheim suspected that those who died in their twenties and thirties had been infected already at childhood, and that pulmonary death was just the long-awaited result of that infection.[163] Comparing to Great Britain, McFarlane claims that: "Until the 1960s most people in Great Britain had been infected by the bacillus at some time in their lives."[164] Purposing that most of the population contracted it, supressed it and survived. Perhaps a *majority* of the population in Norway as well was infected around 1900 before measures were put into place. Backer gives clues by looking at age group cohorts over time:

[161] Malmelund, Haneberg & Mjaaland 2017: 1918 and Ahmed, Oldstone & Palese 2007: 1188, 1192
[162] Malmelund, Haneberg & Mjaaland 2017: 1918
[163] Karlsen & Skogheim 1990: 121, 122
[164] McFarlane 1990: 12

Figure 15: Backer's Figure 37 about:

Current mortality from tuberculosis by calendar year periods compared with that of survivors of cohorts in the same ages.



Source: Backer 1961: 132

As Figure 15 shows, these are mortality rates per 10 000 shown specifically to highlight age group exposure, and confirms how high the risk for especially the 20-29 age group was. Indicating that those in their 20s were the ones that decisively benefitted over time from the struggle against the disease. By the 1950s it seems there were only the elderly who had acquired the infections long ago.

This confirms another point that Karlsen and Skogheim make about the developing testing in Norway; the bulk of the infected seems to get progressively older from the surveys done in 1912, 1920 and 1930.[165] Those infected that survived were not rid of it, the disease was not curable, only suppressible once obtained.[166] Which explains why the age group distributions in Backer's figures were very different from one period to the next, and likely a result of the gradual efforts against the disease coming to fruition. Even if the Tuberculosis Law and measures against the disease were strictly put in place after 1900, the effects of this would

[165] Karlsen & Skogheim 1990: 121 – These were primarily smaller sample studies done in controlled environments like schools and institutions.
[166] Nielsen 2008: 164

hardly be noticeable to the contemporary physician. This is something the district doctors from Tromsø concerningly mention at times in the medical reports. As early as 1907 they elaborate that people are willing to be committed to isolation and sanatorium, but that the results of the measures are not very uplifting.[167] The report from 1917 writes; "No noticeable regression of this disease is demonstrable. But the interest to contribute in the struggle is in considerable growth"[168] The 1920 report underlines this by writing: "The disease is certainly not in any regression in Troms county. It seems on the contrary that the opposite is the case"[169] Claiming that it is in fact on the rise. Backer's numbers and conclusions show that these mortality rates would of course gradually decrease, thanks to sanitorium isolation, BCG vaccines and streptomycin dissemination.[170]

Despite that, this early fight against tuberculosis was a slow and demanding one, often relying on volunteer work from young individuals. As Figure 12 shows, individuals aged 15 to 49 had the overall highest mortality rates. This group also makes up the majority of the active and working population, which relatively to other age groups are quite numerous in Tromsø town.[171] This was typical of urban environments that experienced booms to these age groups due to its employment market opportunities.

Most of these young people came from the surrounding countryside of Tromsø *amt* or county, which was quite rural and somewhat isolated a hundred years ago. It is hard to estimate how exposed to tuberculosis the outlying villages were, but it is safe to assume that disease and infection was more likely in Tromsø town. The other factor to consider is that those who migrated from the surrounding countryside rarely assumed the best of living or working conditions in the town once they arrived.[172] The upstart entrepreneurs of the middle class are one thing, but it was the third and fourth sons and daughters of farmers, that were practically forced to seek a living, who likely had the hardest transitions into the urban environments. Like it was throughout the rest of Norway, most of these short-distance migrants were women, which gave the town a slight gender imbalance, and suggests that gender should also

[167] NOS V. 98. 1907: 242
[168] NOS VII. 3. 1917: 239 – "Nogen merkbar tilbakegang av denne sykdommen er ikke paaviselig. Men interessen for å delta i kampen mot den er i god vekst."(Own translation provided)
[169] NOS VII. 138. 1920: 227 – "Sygdommen er sikkert ikke i nogen tilbakegang i Troms fylke. Det synes tvertimot som det motsatte er tilfellet." (Own translation provided)
[170] Backer 1961: 93, 240
[171] See population pyramids in appendix
[172] Andresen 1994: 300, 319, 321

be studied when considering tuberculous mortality. Which is partially why this will be inspected first; the migration exposure argument shall instead be covered towards the end of this chapter.

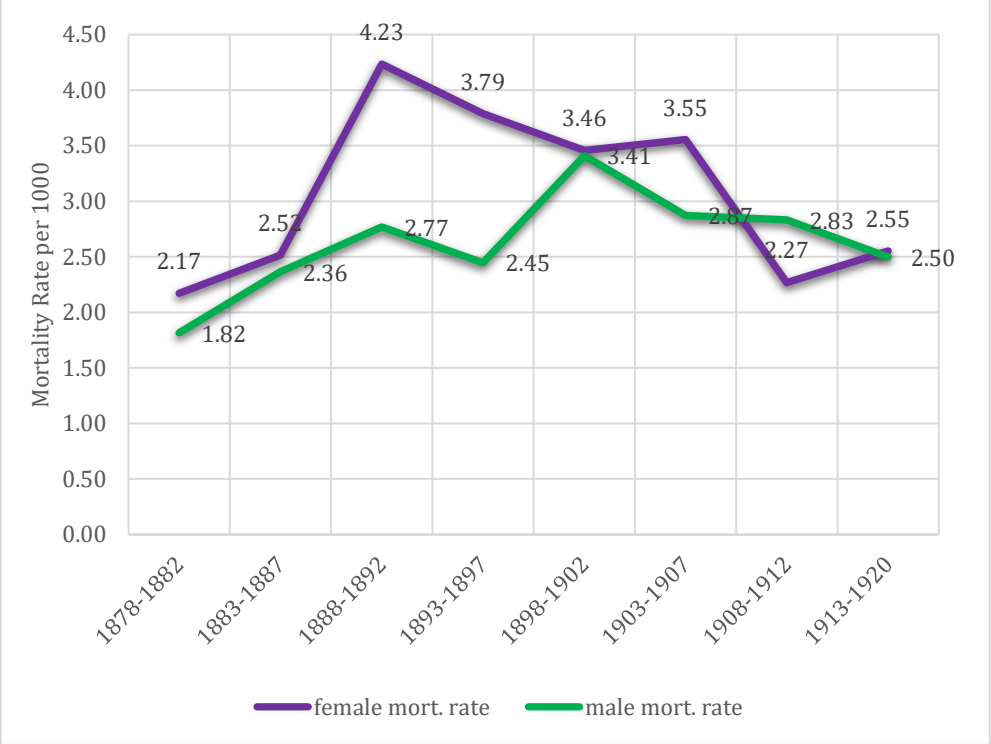
4.3 Gendered Differences

As clarified in chapter 2, it is important to distinguish between sex and gender. When considering a long-lasting disease of the lungs like tuberculosis, an individual's gender role in society is considered a more decisive influence on tuberculosis exposure and mortality than the direct effects of their biological sex. With this in mind, the gender roles in 1878 were more pronounced and affected the individual's life and possibilities to a greater extent than we are used to today. The population censuses paint a clear picture when it comes to this, as they commonly include the position or profession of a person. As mentioned in chapter 3, they are often noted down in families, where the profession of the household head (in most cases the husband) is detailed, while the wife is often noted as "housewife" or "his wife". The big exception here is the unmarried young women, often employed as seamstresses or servant girls, a majority coming from the countryside to find employment and marriage. They were consistently paid less than men, because men were commonly responsible for feeding a family. Even the difference between "servant boys", paid 197 kroner a year, and "servant girls", paid 64 kroner a year in 1895, is quite considerable.[173] Comparing salaries is perhaps the closest approximate comparison of living standards available, something that is said to be crucial for tuberculous mortality, but this will be set aside for now, taken into account more closely in chapter 5. Here direct results of the tuberculous mortality shall primarily be considered.

If we look at the differences between the sexes in tuberculosis mortalities in Tromsø burial register between 1878 and 1920 we get some interesting results:

[173] NOS III. 321. 1890-1895: 9 – On servant salaries in Tromsø

Figure 16: Sex differentials in tuberculosis mortality rates in Tromsø town 1878-1920



Female avg.: 3.07

Male avg.: 2.63

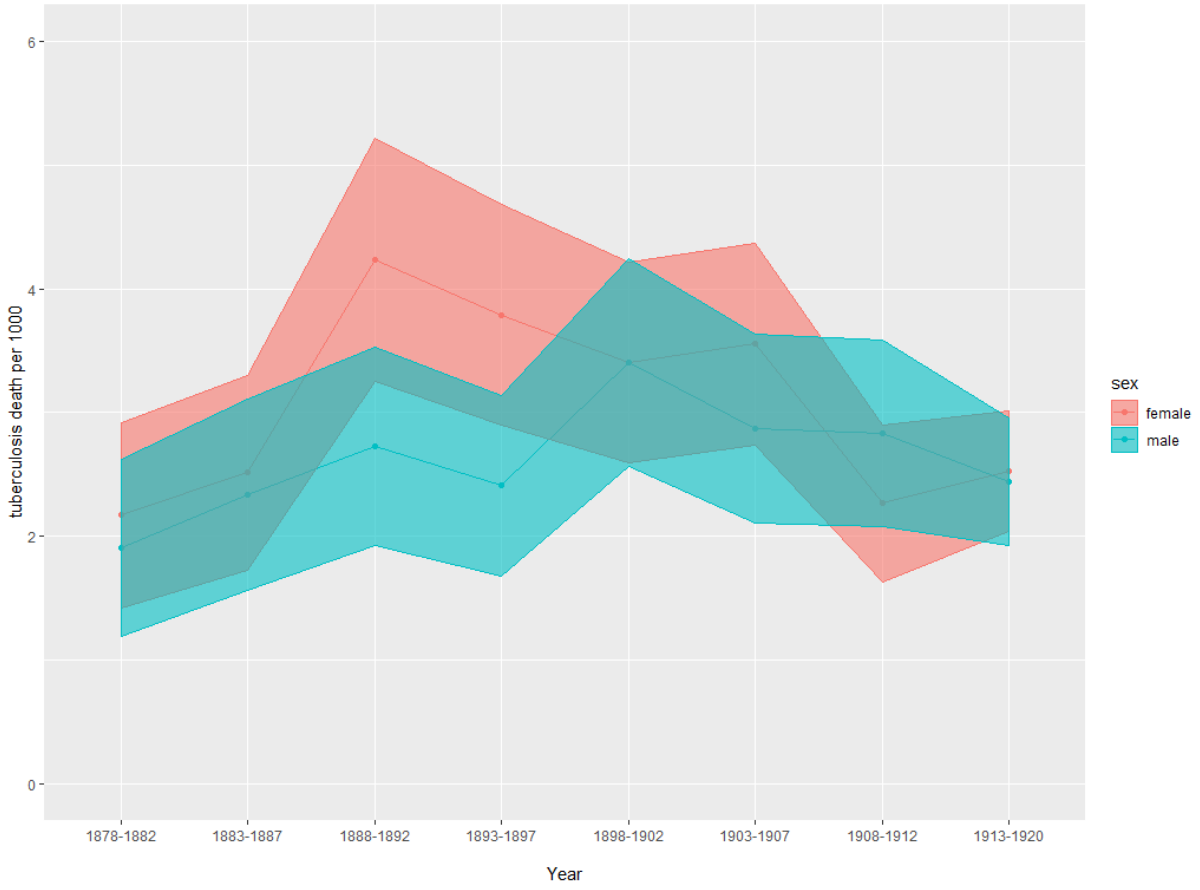
Source: Burial registers 1872-1925 NHDC, UiT and Censuses 1875, 1885, 1900, 1910 and 1920 NHDC, UiT

As Figure 16 shows, the purple and green lines indicate female and male mortality rates per thousand for approximately every five years in Tromsø town. The female rate peaks much earlier at 4.23 in 1888-1892, while the male rate does not peak until 1898-1902 at 3.41, after which they both gradually decline. The first impression of this is to assume that females did have a higher mortality rate, and indeed the 0,44 higher average rate is an indicative difference. The significance of this on the other hand is questionable. If we look at how varying the inclination in the lines themselves are, and the fact that some years male mortality dominates, the indication may seem somewhat coincidental. This is also because the number of deaths for each year are not that many and presenting them in yearly intervals is also more ideal here. For instance, the female deaths vary from two in 1878 to twenty in 1898, and for a majority of the period the sex differences are not so high at all, rather there might even be an anomalous trend, caused by the economic crisis between 1882 and 1892.

With extensive statistical supervision a stochastic probability calculation was done for the standard deviation of mortality rates. In order to pin-point if there was a significant difference between the mortality rates by sex between 1882 and 1892. Simply put; was this difference just an improbability, or was it significant enough to say that women died more than men of

tuberculosis?

Figure 17: Sex differentials in tuberculosis mortality rates in Tromsø town 1878-1920, with standard error rates included



Source: Burial registers 1872-1925 NHDC, UiT and Censuses 1875, 1885, 1900, 1910 and 1920 NHDC, UiT

As Figure 17 shows, the same lines from Figure 16 are here accompanied by an expanded field for the possible standard error rate. The average rates for the most differing ten years were 2,77 for males and 4,23 for females, and they are here shown to *not* be statistically significant, since the fields continuously overlap. Had for instance the female rate been more than 4,75, it would have been statistically significant, and the fields would have separated during those years. This means that it is possible to claim that tuberculosis, within the bounds of probability, *did not significantly* kill more women than men, in Tromsø between 1878 and 1920.[174]

The likelihood of dying, however, can be assumed closely tied to the immune system's strength or bodily resistance, depending upon a lot of things according to McFarlane: "Given

[174] Chiang & WHO 1979 and calculations done by supervisor H. Sommerseth

the universality of infection, resistance was clearly all important. Resistance itself, however, is dependent upon a number of closely interrelated variables, notably age, sex, heredity and, most influential of all environment, particularly with respect to diet and living conditions."[175] His main notable argument for sex or gender difference here comes from a housing study done by A. K. Chalmers done in Glasgow in 1913.[176] The conclusion was that women as housewives were more exposed to the adverse effects of housing conditions than men, because women actually spent more of their time in these dwellings.

This fits with Karlsen and Skogheim's assessments for Norway, that one of the main reasons more women died of tuberculosis was because of their role as caretakers, both within the household and in the institutions. Nearly all the doctors were men, but likewise almost all the nurses and remaining staff at both hospitals and sanatoriums were women.[177] These gender roles were very common at the time and have long standing traditional perceptions as well as societally enforcement, that women as mothers were biologically better suited for nursing and caretaking. In regard to tuberculosis and the way it spread, this gave women a severe disadvantage, considering how much care and direct interaction with patients the disease demanded, often taking years. Even if a majority of the population in Tromsø was infected, it would make a difference if a decisively larger portion of the infected were women. There is also the short versus long migration argument, where Andresen argues that a majority of the women came from the neighbouring countryside while men very often migrated far if they did. This could give different predispositions or resistance to the disease, due to the rural isolation factor mentioned earlier.[178]

Ytreberg even mentions that the way the girls and young women in Tromsø dressed or were expected to dress might have made them more exposed to tuberculosis. Developing trends lead to thinner factory-woven fabrics that were made to look fashionable rather than provide warmth, along with elegant shoes that were far from effective at keeping feet dry. Sports and physical outdoor activities in fresh air were seemingly reserved for the boys and the young men.[179]

The historical demographer Hinde looks closely into gendered differences in tuberculosis mortality and argues that there was a bargaining-nutrition factor that might have had an

[175] McFarlane 1990: 12, 13
[176] Chalmers 1913: 168 and McFarlane 1990: 209
[177] Karlsen & Skogheim 1990: 122
[178] Andresen 1994: 322, 323
[179] Ytreberg 1962: 388, 389

impact on poor urban women. As men generally brought home the salary and did heavier physical labour, they had a stronger bargaining position on the available food in times of need.[180] His numbers are from inland English parishes in the 1860s, and he argues that in most environments women were disadvantaged, but that the differences were not vast, and that in some environments the numbers were reversed, that in London men were dying more frequently than women.[181] Therefore the environmental conditions and the availability of resources undoubtedly affected this parameter.

4.3.1 Gender, Age and Comparison

Backer's numbers from Figure 14 suggest that men and women were more exposed during different parts of their lives, and as mentioned earlier, that this rise in mortality among old women before the turn of the century seems to fit well with the numbers from Tromsø town's numbers over age groups, as Figure 12 portrays. These mortality rates are useful portrayals, but if we compare the number of tuberculosis deaths to the total number of deaths by age and sex, we get a different picture:

Table 5: Percentages of tuberculous mortality compared to all other mortalities within age groups, sex and period, in Tromsø town 1878 to 1920

	1878-1888		1889-1899		1900-1910		1911-1920	
age group	**female**	**male**	**female**	**male**	**female**	**male**	**female**	**male**
0-5	2.1	0.6	5.9	4.6	7.0	10.7	2.8	6.6
6-14	7.9	12.5	30.2	33.3	38.0	39.4	34.1	24.1
15-49	37.3	33.1	54.8	36.7	50.0	39.3	41.4	29.7
50+	10.5	9.5	13.1	4.1	8.8	5.9	4.4	2.5
Total	13.9	10.8	19.8	14.8	21.5	18.2	16.0	12.9

Source: Burial registers 1872-1925 NHDC, UiT

As Table 5 shows, percentages of tuberculosis deaths are here proportionately displayed in contrast to *all* other deaths within age groups, sex, and approximate decades, in Tromsø town. It makes it clear just how devastating tuberculosis was for especially women in the risk group aged 15 to 49; it was more common than all other causes of death combined from 1889 to 1910. The Table also shows a larger contrast between the risk group and the youngest and the oldest parts of the population. The percentages for the 0 to 5 and 50+ age groups are here

[180] Hinde 2015: 387-389
[181] Hinde 2015: 379

overall low primarily because these groups had significantly many other common causes of death.. Tuberculous meningitis may have had a terrifying lethality rate, but as did most diseases infants and young children acquired. Simply by being at the troublesome start or end of the natural life span, the youngest and the oldest had a greater biological risk of dying of anything. While teenagers and young adults on the other hand, simply had the highest chance of surviving anything. Which is why this Table is so important; it shows that tuberculosis was exceptionally good at killing those who were exceptionally good at surviving.

The difference between men and women here is large, likely due to those who died of external causes, like for instance drowning or murder, were 84 per cent men. If we inspect external causes for the ages 15 to 49, that percentage rises to 95, which accounts for most of the percentage difference in this age group. Due to this, it could be unfair to assume sex differences based on Table 5. As a significant portion of those sailors and fishermen lost at sea could very well have died of tuberculosis if they had survived the more direct risks of their profession. On the other hand, gender roles for men at the time did often imply risky professions, at least in Tromsø's fishing and shipping economy. Gender roles are, on the other hand, also more influential on an individual's life during these years, as childhood and retirement ages are less influenced by the burdens of reproduction. With Table 5's portrayal, it becomes clearer that the risk group's percentagewise suffering of tuberculosis was quite astonishing.

4.3.2 Morbidity and Gender Differences

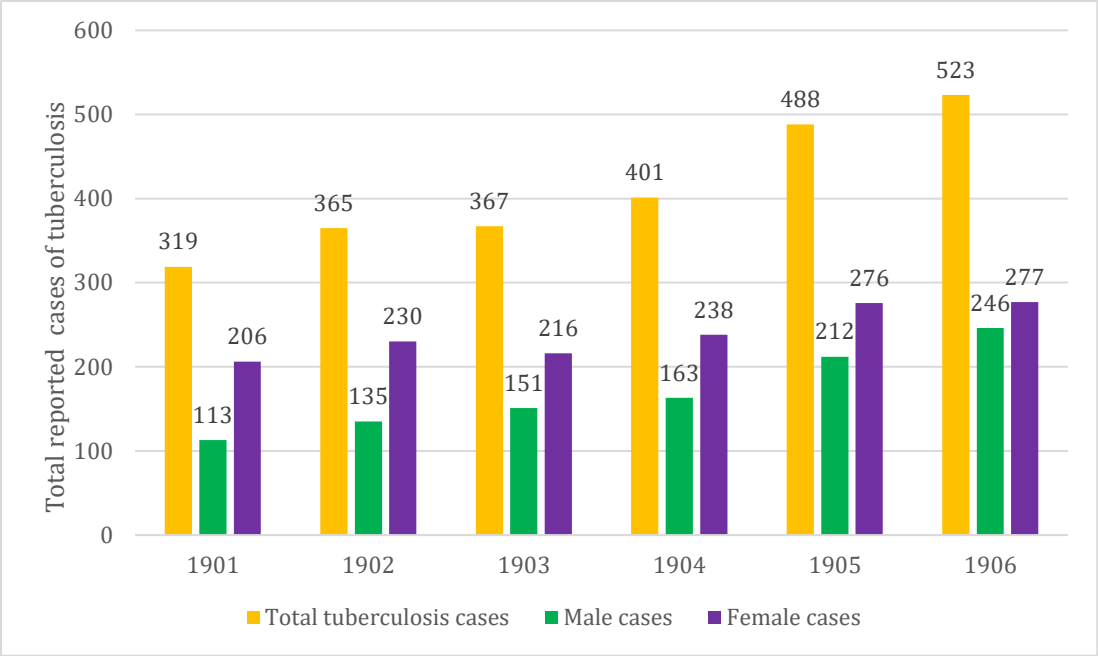
Even if the significance of mortality is then not gendered, as Figure 17 shows, more women still died, especially in this decisive period. How decisive immunity or resistance was, or how hereditary it was is hard to determine. Which gender was more infected, or the lethality of these cases would perhaps have been a better indicator of differences, but it returns us to the difficult question considered in chapter 2, who was actually infected? We can assume, based on how the district doctors consider reported cases, that an *active* tuberculosis infection was the most likely contemporary "case", as *latent* tuberculosis did not spread the bacteria, show symptoms or cause the individual any harm.[182] After 1907 and the availability of tuberculin testing allowed for detection of latent tuberculosis as well, something that must be taken into account.

The medical reports give some material to examine and compare, which is far from fully

[182] NOS V. 98. 1907: 342, NOS VII. 3. 1917: 239 – On descriptions of tuberculosis.

covering but can give us some indication. For a brief period after the Tuberculosis Law of 1900, there were gendered numbers for reported incidences, or cases of tuberculosis on county level:

Figure 18: Reported cases of tuberculosis in Tromsø county 1901 to 1906 by sex and total



Source: NOS Fjerde Række 1901-1903, NOS V. 1904-1906

As Figure 18 shows, these are the reported cases of *any* kind tuberculous infection within the *county of Tromsø*, which includes the town and a vast rural countryside. Note that these numbers are not rates per thousand like the previous figures showed, which means they do not account for any possible gender imbalance of the population or the population increase, which went from 73,000 to 77,000 in this timespan. Though on a larger and more varied area like Tromsø county the gender imbalance is unlikely to be significant, and the proportional increase of 319 to 523 cases is a lot higher than the comparative population increase.[183] On the other hand this is not the town of Tromsø, and the rest of the county was more rural and isolated than Tromsø town was, as Figure 8a showed, the mortality rates were very different in the county.

Despite these factors, there is something important to note with this Figure; the numbers are clearly on the rise, but does it mean that there in reality were more cases progressively? Knowing that this was right after the law came into force, these numbers may be very skewed. As there were likely many unreported cases the first few years, since new laws took a while to

[183] NOS Fjerde Række 1901-1903, NOS V. 1904-1906

practically enforce, especially ones as comprehensive as this one. The other aspect, as was explained in chapter 2, is the layman's ability to diagnose or report someone, which was not just difficult, even for doctors in the early stages of the disease, but also devastatingly decisive for the reported person's life and family, meaning that a lot of people might have hesitated or exploited this.[184]

The other trend to notice in the graph is the gradual balancing of cases between the genders. This can likely be attributed to the rising knowledge about the disease, which was enforced and quite decisive for the nurses, maids, servants or family caretakers. Even the simple advice to cover one's mouth, spit in buckets rather than on the floor, or to clean anything the infected were in contact with would have made enormous differences for those in closest proximity to the patients. This information was on the other hand also available when the tuberculosis plaque was hung up in public places back in 1889 but was likely less influential than the law.[185]

Backer mentions that there is no *sufficient* data for tuberculous morbidity throughout this early period in Norway.[186] Considering the complicated nature of the disease and the difficulty of tracking this in the medical reports over time, it is very understandable. Closer study of tuberculosis morbidity is therefore instead recommended for future projects, that should investigate later periods. This project will remain focused on the tuberculosis mortality.

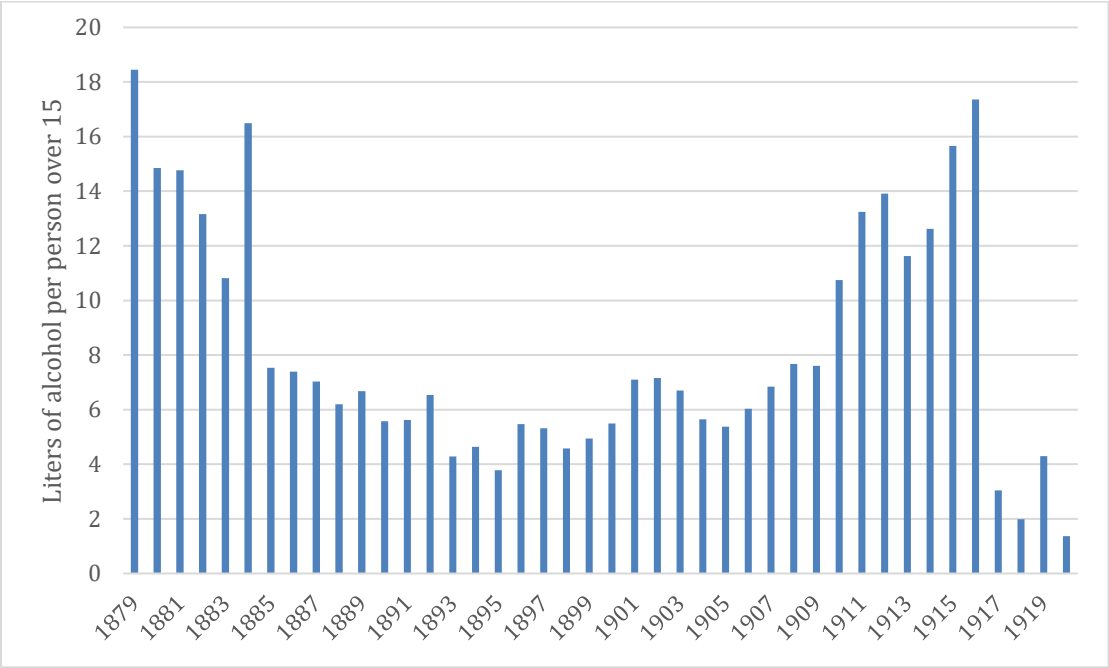
4.3.3 Alcohol and Tobacco

Gender differences and expectations, poverty and lack of nutrition did account for serious risk exposure to tuberculosis, but as did alcohol intake, something men did more easily than women.[187] These two are of course commonly intertwined, something that concerned the district doctors in Tromsø, which they continuously remark from 1878 to 1881. "Due to the lack of money, unemployment and unsuccessful fishing ventures, the commoners' living conditions are lower, but as is their intake of intoxicating beverages."[188] This sporadically

[184] Schiøtz 2003: 65
[185] Holmboe & Hanssen 1895
[186] Backer 1961: 127, 135 – Mentions that these numbers are only available from 1931
[187] NOS C. Nr. 4 1877: 192 – Remarks about alcoholism ventures in Tromsø Town.
McFarlane 1990: 52, 53 – refers to a 1910 Superintendent report where cause of pauperism in Scotland are primarily blamed on "spending all the wages on drink"
Ågotnes 1991: 23, 24 – About men's drinking habits compared to women's
Nielsen 2008: 249, 250
[188] NOS C. Nr. 4 1878, 1879, 1880 and 1881: Under Tromsø Amt's segment of "Levemaade og hygiæniske forhold" – A combined interpretation of similar remarks in all four annual reports.

continues until the 1890s, where proper or good fishing conditions are gradually mentioned. With these improvements alcohol intake also increases, to the doctor's great dismay.[189] With it, male and female mortality rates seem, oddly enough, to even out again, at least according to Figure 16.[190] Puranen and Holmin also emphasize how alcohol intake likely made a difference between different occupations, where traditions of excessive alcohol intake was higher amongst the workers.[191] Sanner confirms this for Tromsø's case, according to him the commoners, which included workers, sailors and fishermen, had little else to do in their spare time than to drink liquor.[192] Sanner also mentions that alcohol abuse was likely a bigger problem in Tromsø than other place, due to the beer-drinking culture being adapted so late, thereby leaving many to the destructive high-percentage spirits.[193]

Figure 19: Litres of spirit and wine imported to Tromsø toll station, per person in Tromsø over the age of 15 – 1878 to 1920



Source: NOS I. c 3a. 1878 to VII. 36. 1920 – official trade numbers for Norway and Population census 1875, 1885, 1900, 1910, 1920 NHDC, UiT

As Figure 19 shows, the town's imported quantities of spirits and wine per year, have been divided by the total population over the age of 15.[194] This totalled at 1.17 million litres of

[189] NOS Tredie Række Nr. 116 1888, Nr. 143 1889, Nr. 162 1890, Nr. 185 1891, Nr. 222 1892: Fishing results are sometimes also mentioned under "Veirliget" along with the harvests.
[190] The economic troubles seem clearly portrayed in the mortality rates.
[191] Puranen 1984: 288, 290, 292 and Holmin 1911: 13
[192] Sanner 1953: 38
[193] Sanner 1953: 46
[194] Johansen 1994 – consistently uses "over the age of 15" as a way to assume those who likely could have consumed alcohol.

spirits and 0.64 million litres of wine, the percentage of the spirits varied from 40 to over 90 per cent, but between 50 and 60 per cent was the most common.[195] It was likely also distributed to the nearby rural municipalities who did not have toll ports of their own, but it does not account for the local distilling or brewing, which was unrestricted for personal use and quite common in the countryside. In addition, Mack's major beer brewery which in the period produced between 300,000 and 450,000 litres of beer annually, which adds up to an average of 74.4 litres per person in town over 15.[196] The population numbers do include women, but as both Nielsen, Schiøtz and Ågotnes underline, very few women had the habit of consuming alcohol in excessive amounts.[197] If Sanner's claim that "commoners" were the main consumers is accurate, then these litres per person over 15 can likely be tripled for working class men.[198]

Johansen writes that Norway in general indeed had a considerable alcohol problem during this period, which reached its peak in 1916, with 2.51 litre spirits per person over 15, and 4.51 litres of beer and wine. What is more impressionable is that there was a total of 62,281 reported "drunkenness delinquency", which meant 24.7 reported per 1,000 people.[199] This supports McFarlane's claim that drink was a severe detriment to the working-class population, and in combination with WHO's estimate of alcohol abuse tripling the risk of active tuberculosis, it puts working-class men at a severe disadvantage in connection to tuberculosis mortality.[200] It might seem like the district doctors' concerns for the alcohol abuse in their reports was highly justified.[201]

Another factor the district doctors do *not* mention is inhalation of tobacco, which is, as mentioned in chapter 2, well-documented in recent studies, but was not considered hazardous for the lungs during this period. This severely reduced the lungs defence mechanisms and could much easier lead to severe tuberculous infections. Unfortunately there are no sources to document the use of tobacco in Tromsø, but expositions from Bergen show that cigarette tobacco became commonly used in Norway in the late 19th century, by men that is, but that it was uncommon for women until the 1920s.[202] Tromsø toll station luckily kept import totals of

[195] NOS I. 3a 1878 to VII. 36. 1920 – Official trade numbers for Norway
[196] Sanner 1953: 86
[197] Nielsen 2008: 249, 250, Schiøtz 2017: 6 and Ågotnes 1991: 23, 24 – "Excessive amounts" is also part of the criteria for the amount of alcohol WHO considers immune-system reducing, thereby increasing risk.
[198] Sanner 1953: 38
[199] Johansen 1994: 35, 36 – "drukkenskapsforseelser" (provides own translation)
[200] McFarlane 1990: 52
[201] NOS C. Nr. 4 1878, 1879, 1880 and 1881
[202] Ågotnes 1991: 5, 6, 23, 24, 25

all kinds of goods, including tobacco and cigarettes. The yearly imports varied from 149 kilos of cigarettes and cigars to 1713 kilos from 1878 to 1920, averaging at 489 per year and totalling at 21,043 kilos.[203] This meant that a significant portion of the male population likely had developed a smoking habit during the period, further increasing the risk of active tuberculosis by a factor of 1.6.[204]

If alcohol and tobacco consumption are taken into consideration it might seem like men had a considerably higher risk of active tuberculosis, and yet the tuberculosis mortality rate remains lower for men throughout most of the period. Sanner and Johansen do mention that alcohol consumption did follow the economic trends, meaning that there was, much like the district doctor reported, an increase in alcohol consumption once the economy improved.[205] If Figures 16 and 19 are compared, and the numbers from 1883 to 1898 inspected, it seems like the years men drank least were also the years the gendered tuberculosis mortality differences were most considerably in their favour.

4.3.4 Migration Exposure

This is where migration exposure also comes into play, as the numbers of tuberculous deaths highly resemble the ones of migrating and especially urbanising individuals. As the majority of those who migrated were young people seeking fortunes, they also seem like the ones most exposed to the disease. The question is whether or not these young people were more exposed because of poor living and working conditions, or because they had a lacking resistance compared to the town's people. McFarlane blames both of these factors combined in his work, arguing that the poorest and most isolated rural societies like Lewis island, experienced nearly epidemic proportions once exposed to tuberculosis.[206]

Both burial registers and population censuses from the period provide place of birth for most individuals, providing a look into where the tuberculous dead migrated from. The identified risk group of 15-49 is focused here, as they are also considered the most mobile part of society:

[203] NOS I. 3a 1878 to VII. 36. 1920 – Official trade numbers for Norway, one cigarette weighing approximately 1 gram, meaning that just under half a million cigarettes were consumed annually on average in the town.
[204] WHO 2019 – about tuberculosis risk factors
[205] Sanner 1953: 61, 62, 63 and Johansen 1994: 26, 27
[206] McFarlane 1990: 187-189

Table 6: Percentages of tuberculous mortalities compared to other mortalities, seen through birthplace, risk group 15-49 and gender in Tromsø town 1878 to 1920

Place of birth	Female	Male
Tromsø town	51.6	40.1
Rest of the county	41.1	34.5
Rest of the north	51.5	31.7
Rest of Norway	37.5	26.7
Abroad	53.8	15.8
Missing information	11.5	15.2

Source: Burial registers 1872-1925 NHDC, UiT

As Table 6 shows, the proportion of tuberculosis deaths in age group 15-49, by sex and place of birth during the period 1878 to 1920. Among women born in Tromsø, between the age of 15-49, 51.6 per cent died of tuberculosis. These numbers fit well with Table 5's proportions for the period overview, and as such women were expected to have higher percentagewise deaths of tuberculosis. What should be mentioned, however, is that women in the risk group had a proportionately higher representation of migration from nearly all sources amongst the tuberculous dead. Most decisively from the other northern counties of Finnmark and Nordland. This might indicate that the rural resistance to the disease was not weaker than the Tromsø town resistance was, or that the town's densely populated environment counteracted the effects of this by having a higher overall infection rate amongst the population.[207] Women were a majority among the migrants from the north in all the censuses, confirming that there was a gendered difference in long and short distance migration.[208] That being said, there might be a clue to the gendered difference in tuberculosis mortality in these numbers

People from the north were likely more susceptible to dying of tuberculosis in Tromsø town. Since women came more frequently from the north than men did, this could to some extent have been an underlying cause for the gender differences in tuberculosis mortality as well. Comparing the Tromsø town and Tromsø county lines in Figure 10, also suggests a similar indication, where the Tromsø county line keeps rising throughout the whole period. Indicating

[207] As explained earlier in chapter 2, with a densely populated environment spreading the bacteria among individuals is far more likely, especially if lack of hygiene and trade connections are included in the town's factors.
[208] Andresen 1994: 322, 323

that Tromsø, despite its trade and regional centre privileges, perhaps still had more in common with the rest of the north, due to its proximity, than it did with the more urban south, at least when it came to tuberculosis mortality. A number of factors could have contributed to this; the harsh climate, nutritional uncertainties and expenses, but also lack of inherited resistance to the bacteria.[209] The earlier generations of migrants to the north could have been spared exposure to the disease, only to have it introduced later through traders and more recent migrants, thereby having less resistance to it. Perhaps the increase of trade and mobility of people in the last half of the 19th century, with steam ships and improved technology, made sure the yet unaffected northerners finally did get exposed, like the Lewis Islanders.[210]

4.4 Conclusion

Tuberculosis mortality differences seem to stem from gender-role expectations and differences. The caretaker, migration origin location, bargaining-nutrition and housing condition factors therefore likely played a part in female infection and mortality. Likewise, it can be assumed that work environment conditions, risks, alcohol abuse and smoking habits were likely factors for male infection and mortality. [211]

In conclusion, tuberculosis mortality was high in Tromsø town between 1878 and 1920, compared to the rest of the country, amounting to around 15.9 per cent of all deaths. Tuberculosis killed people of all ages, but was by far the most efficient killer amongst the risk group of 15- to 49-year-old people, amounting to 38.8 per cent of all deaths within this group. More women than men died of it, especially within the risk group and because of the gender roles and expectations of men and women at this time. Though not significant results, there was a considerable age risk and to some extent a gendered difference to tuberculous mortality in Tromsø between 1878 and 1920.

[209] Puranen 1984: 358, 359, 360, 361 and McFarlane 1990: 172, 173, 185, 187, 188 and 189 – Both suggest there might be inherited resistance or immunity to the disease over generations, but neither are certain of why, or to what extent.
Ryymin 2008: 2864, 2865 – Considers the contemporary view of lack of modern society and civilization in the north as a factor that could have kept the work against tuberculosis back.
[210] McFarlane 1990: 173, 187, 188 and 189
[211] Puranen 1984, Fredriksson 2012, Karlsen & Skogheim 1990, McFarlane 1990 and Hinde 2015

Chapter 5. Socioeconomic and Spatial Differences

This chapter will consider socioeconomic differences within Tromsø town and in turn how they affected tuberculosis mortality in the population. As mentioned in chapter 2, living standards affect a plethora of factors that can potentially increase the risk of contagion and the risk of dying of tuberculosis, therefore this chapter is largely dedicated to investigating these factors. Certain profession groups and key occupations will also be looked into for their working conditions, and how these combined with living standards might have affected tuberculosis mortality. The last part of the chapter will also consider spatial differences, how population density or neighbourhood wealth may have affected tuberculosis mortality.

Social hierarchy and economic differences are constant fluctuating factors within any society, but perhaps the added risk factors that characterise Tromsø made economic fluctuations even more decisive here. The district doctor's annual descriptions of the weather, harvest and fishing season is here used as the most proximate source of yearly flux, salary lists, and price indexes are also useful however. The burial registers undeniably have the final say of the toll tuberculosis did have, as it is assumed that living standards and affordable nourishment were decisive for tuberculosis activation and mortality. Unlike the gendered perspective, these differences are a great deal harder to narrow down in pure numbers, as dividing people into socioeconomic categories can never be done perfectly or as black and white as gendered divisions can. Though upward social mobility was more difficult in this period than it is today, it was far from unheard of, and became easier with the gradual break-up of traditional societal structures.[212]

The main idea is that a disease like tuberculosis would affect and kill more of the poor. The reasons could be diverse and intertwined as McFarlane puts them[213], but with living standards varying, it can be assumed that those with access to less diverse and less healthy food, poorer housing, poorer clothing and less fuel for the winter, would more easily get sick and die. Most research around tuberculosis agrees that a majority of these factors matter to some extent, what is uncertain is to what extent, and which matters most.[214] The goal here is to test those factors available in the sources and see if the factors had resulting differences. Classes are, however, very generalising rough overviews, throughout the chapter more detailed profession

[212] Hegstad 1993: 21, 22, 23
[213] McFarlane 1990: 12, 13
[214] Dormandy 2000, Puranen 1984, Oren et. al. 2012, Schiøtz 2003, Karlsen & Skogheim 1990

and salary factors will also be taken into account, in an attempt to isolate certain suspect causes of tuberculosis mortality.

5.0.1 Justifying the Class Divides

As mentioned in chapter 2. Tromsø town was established with the mindset of trade and growth, and traditional societal estate privileges were virtually unheard of. Anyone could become a member of the burgher class for a relatively modest sum of two *riksdaler*, which anyone willing to start trading or crafting could likely afford.[215] Paternalistic relations did despite that establish within the economic boundaries of the population, the merchants still were quite a different sort of people than the dock workers they employed. There was not much industry to speak of in 1875,[216] but this did gradually change especially by 1920, as the wealthy entrepreneurs invested more in modern machinery.[217] Through that there is what Hegstad calls a gradual development into a class society. In that regard it seems most appropriate to divide the towns population into upper, middle and working class, as Hegstad did in his project. [218] This project however, will primarily base these divisions on the notes in the population censuses and the burial registers.

As mentioned in chapter 4, the head of the household, in most cases a man, is commonly the only one with a specified profession in the population censuses. Any person in the household, who did not have an occupation has therefore been linked to the profession of the head of the household. The exception is often servants, who are commonly seen within upper class households, but are consistently placed in the working-class category. By combining residency codes and last names, most people are easily linked, only requiring judgement calls when there are complicated cases of visitors or several different families within a residence, *if* neither have specified professions.

Sveinulf Hegstad's thesis goes into great detail about the social and economic differences of the people in Tromsø and also elaborates on how difficult it is to place people into separate categories, but that it is necessary for meaningful analysis of the differences that existed in the town. It is these very economic differences that are equally important for this project, because of the disease's association with nutrition and living standards. Hegstad bases his

[215] Hegstad 1993: 42
[216] Benum 1980: 14 and Hegstad 1993: 64 – Only 1.6 per cent of men in Tromsø had a primary occupation in industry
[217] Bratrein 1988: 97, 98, 99
[218] Hegstad 1993: 76

socioeconomic divisions on income tax records for Tromsø 1900 to 1920.

Table 7. Hegstad's Socioeconomic Divisions from Tromsø town 1900 to 1920

Upper class	**Middle class**	**Working class**
Government officials	Craftsmen	Workers
Civil servants in leading roles	Traders, trade supervisors	Worker foremen
Merchants	Lower income entrepreneurs	Fisherman and sailors
Wealthiest craftsmen masters	Civil servants	Crafts journeymen
High income entrepreneurs	Middle management positions	Carpenters
	Military officers and sea captains	Servants
	Other educated functions	Paupers

Source: Hegstad 1993: 76

As Table 7 shows, these are primarily income-based professional divisions. They are very typical of the period, and for the most part intuitively also divided into what kind of work is done. While the working class predominantly does hard physical labour, the middle class has some education or responsibility and often deals with more delicate work, and the upper class has the influential leading roles of both private and public sectors. This project will primarily follow these divisions, with the exception of the craftsmen hierarchy.

The Craftsmen are a bit problematic, without individual income numbers, they can be placed in any one of the three classes, ranging all the way from a wealthy goldsmith master to a simple carpenter's apprentice. Judging the hierarchical positions within each profession would be overwhelmingly complicated, and it is possible to assume that those apprentices and journeymen one day could become independent masters, their placement is thus considered diachronically. Simply put, most of them were at some point during this period the average craftsmen within their trade. Hegstad also makes a point of the important bond that apprentices had with their masters, most commonly residing with them, and often also being related to them.[219] Thereby this professional link should be more important both socially and economically than their household link. The NAPPCODE historical occupation coding, which I have chosen to use, also ignores these hierarchical differences within the craftsmen trades, as masters and apprentices are given the same code. Lastly, these positions within the trade are commonly unmentioned in the population censuses. Goldsmiths, being clearly the

[219] Hegstad 1993: 44, 45

wealthiest of the craftsmen, are the only ones placed in the upper class, while all kinds of carpenters are placed in the working class, their income and type of work being more closely related to the working class standards. The rest of the craftsmen are placed within the middle class.

With the diachronic principle, seminary students were also bound to become teachers at some point, easily placing them within the middle class, even if their lives as students could depend very much upon their families or benefactors. It is at any rate safest to assume they were sent to the seminary by someone who could afford to support their education, more likely being middle or upper class than working class. The same can be said of the Latin school, or gymnasium students, though these would more commonly reside with their parents and are therefore easier to place through household. Likewise, when there is mention of someone unrelated being supported or fed by a patron, the patron's class is applied to the supported, assuming that the living standards are shared if the residency is shared. By this logic servants employed amongst the upper class are also likely to have had a higher standard of living and better working conditions than the rest of the working class. Despite that, the wages were far lower than for any of the workers and there was very little social mobility within this profession, compared to the craftsmen trades.[220]

Through these justifications, the following numbers of individuals within each census have been divided into each their respective classes:

Table 8: Total assigned individuals within each class according to population census material of Tromsø town 1875 to 1920 (proportions in percentage are given in parenthesis for each census)

Census	Upper class	Middle class	Working class
1875	556 (10)	2,434 (44)	2,513 (46)
1885	415 (7)	2,093 (35)	3,519 (58)
1900	437 (6)	2,789 (36)	4,447 (58)
1910	351 (4)	2,735 (34)	4,885 (61)
1920	672 (6)	4,924 (47)	4,943 (47)

Source: Population censuses 1875, 1885, 1900, 1910 NHDC, UiT

As Table 8 shows, there is a shifting number of people within each class over the period. Whereas the middle class and working class are just about as populous at the start of the period, the working class almost doubles while the middle class does not grow much in

[220]NOS III. 321. 1890-1895: 9 – On servant salaries in Tromsø

comparison, until the last census. This is to be expected from a town based on fishing and trade, where there is a market limit on demanded craftsmen goods, all the while many of the craftsmen are competing with the developing industry which demanded more workers instead.[221] Though this total worker increase is not visible on this Table, as there are more sailors and fishermen than workers in the early censuses of 1875 and 1885. The last census sees another change to that trend however, as the craftsmen diversify, and a growing service industry populates the middle class. The merchants are the bulk of the upper class, and the Table shows a clear reduction in their numbers until 1910, but in turn there seemed to be an increase in middle management in these professions. Just like the craftsmen, the merchants were also partially forced to adapt to the changing technology within shipping and fishery, steamships becoming far more common throughout the period, likely putting several out of business.[222] The 1920 census however shows more of them than ever, part of this is a large amount of diverse shops opening up. Like for several of the profession denominations, "Kjøbmann" or merchant seems change its meaning and inclusion somewhat over time, likely tied to the prestige the title entailed.

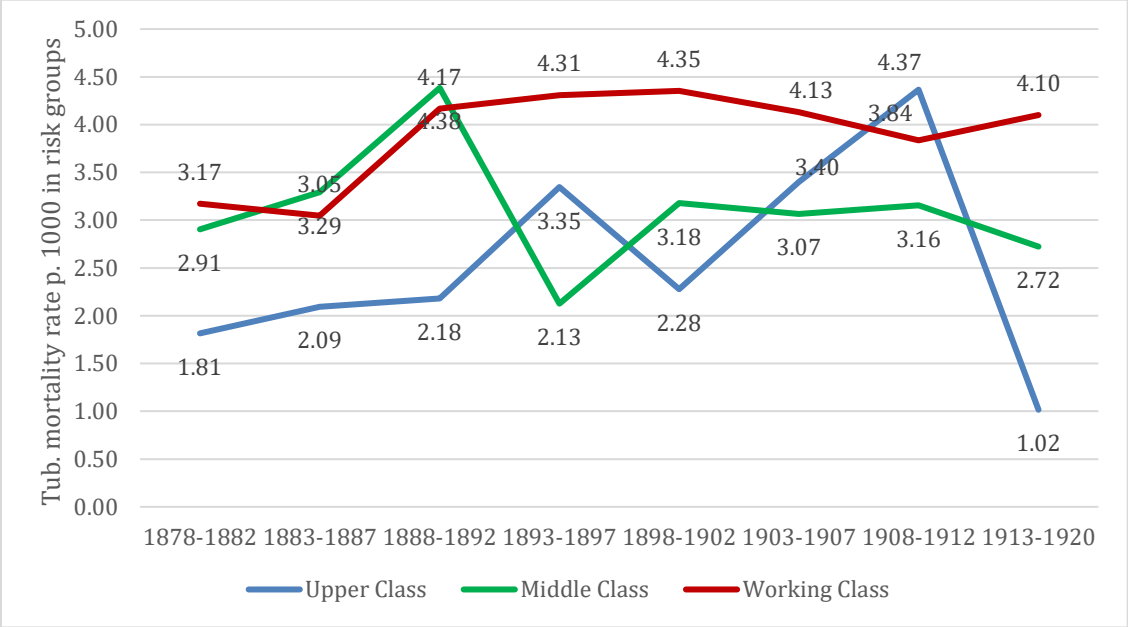
Fishermen and sailors combined by far make up the bulk of the working class, even in the later period where there is a significant increase of industry and workers. This made the majority of the working class exposed to the unpredictable fluctuations within the fishing industry. As mentioned, the district doctor's reports underline how important success at sea was.[223] Not only for the income of the actual fishermen, but also for the food supply of the town as a whole, as lack of it would also have pushed up prices of other food stuffs like grains and potato. At the same time, years of successful fishing adventures also meant the fishermen were at times quite prosperous, and likely wealthier than many craftsmen during these booms, unlike the workers, journeymen or servants that were paid more fixed salaries.[224] The merchants that bought and exported large quantities of the fish were also quite dependant on the success of the fisherman. A majority of the fishing export was dried or salted cod, while cod-liver oil became a very lucrative trade when the industry around it developed. As such the whole town's fate was in many ways dependent on the fishing industry.[225]

[221] Christensen 1995: 27, 34
[222] Hegstad 1993 and Population censuses 1875, 1885, 1900, 1910 and 1920 NHDC, UiT
[223] NOS: I C.No.4 1877, 1878, 1879, 1880, 1881, 1882, 1883 and 1884 – On local fishing failures
[224] NOS III. 321. 1890-1895 – On annual and daily worker salaries.
[225] Bratrein 1988: 98, 99, 100, 101

5.1 Socioeconomic Class Mortality

As with the age and gender results, the class results shall be portrayed in several parameters where deaths in the burial registers are combined with the population censuses. The numbers and conclusions from chapter 4 indicate that the risk group of 15 to 49 is indeed the most meaningful age group to analyse.[226] This is even more relevant in this chapter, as class conditions, even though real throughout the whole life of an individual, are most decisive for the adult working population. As then the factor of the work environment is added on top of the living conditions, and this time is in effect the part of life where the individual has the most influence and responsibilities in the town's socioeconomic environment. Simply put, a 23-year old worker is a more accurate representative of the working-class conditions than for instance his son at the age of three, or his grandfather at the age of 82. The 15 to 49 age group will therefore be the primary focus in this analysis.

Figure 20: 15-49 Risk group tuberculosis mortality per thousand in Tromsø town 1878 to 1920, with socioeconomic divides



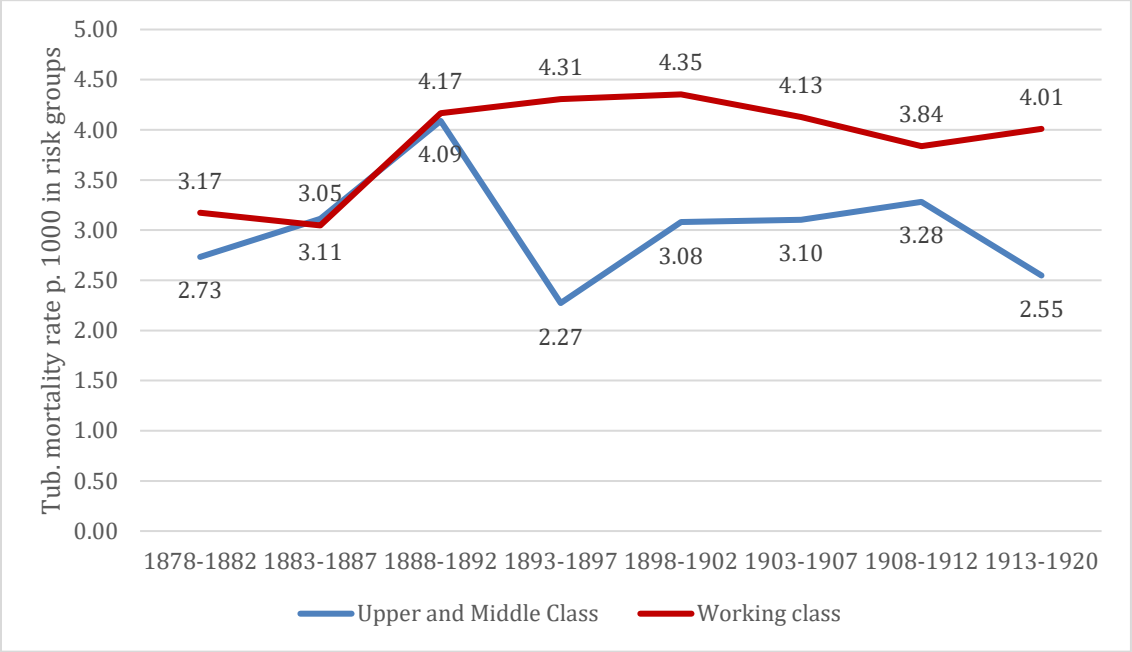
Source: Burial registers 1872-1925 NHDC, UiT and Censuses 1875, 1885, 1900, 1910 and 1920 NHDC, UiT

As Figure 20 shows, the three lines each represent their class' tuberculosis mortality rate per thousand. The working-class line is more consistently high than the others, and its plateau from 1888 to 1907 closely resembles the overall tuberculosis mortality line from Figure 6. With the exception that the rate here is higher, and averages at 3.89. The middle-class line changes more with the yearly intervals, but is comparable to the worker's rates only during the early decades, it averages at 3.10. Most noticeably the frequently mentioned economic

[226] See discussion and references to other works in 4.1

crisis during the 1880s.[227] This would make sense, as the craftsmen and other small business owners were likely more vulnerable to economic troubles than the merchants. The upper-class line for the most part maintains a low mortality rate, averaging at 2.36, and the spikes after the turn of the century are more likely due to an unfortunate clustering than any good indication. As they are so few in total, just three deaths during the 1903-1907 interval results in a 3.40 mortality rate. If we merge the upper and middle classes it is possible to isolate the working class from the rest of society, and reduce the problematic upper-class deviation:

Figure 21: 15-49 Risk group tuberculosis mortality per thousand in Tromsø town 1878 to 1920, with two socioeconomic divides



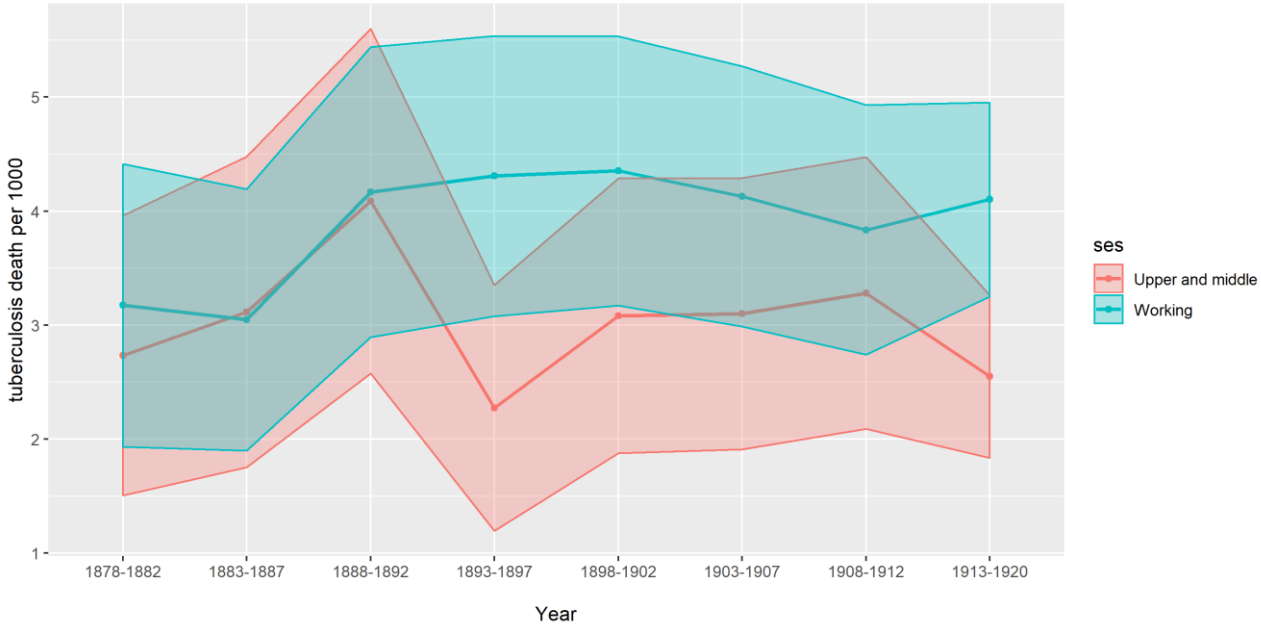
Source: Burial registers 1872-1925 NHDC, UiT and Censuses 1875, 1885, 1900, 1910 and 1920 NHDC, UiT

As Figure 21 shows, merging the upper class with the middle class for this purpose slightly altered this line from the middle-class line from Figure 20. Illustrating in itself how insignificantly few the total populace and tuberculous deaths of the upper class were. Their combined average with the middle class adds up to 3.03, compared to the working class 3.89. Here it is possible to assume periodic development, as the economic crisis of the 1880s here seemed to be so bad for the upper and middle class, that they died of tuberculosis as much as the workers did. Still keeping in mind that the middle-class line from Figure 20 shows that this was the most challenging time for the craftsmen. The period from 1893 and onwards however, seems like a more beneficial time for business, at the same time, the middle class

[227] Nerbøvik 1999: 72, 73 and NOS: I C.No.4 1877, 1878, 1879, 1880, 1881, 1882, 1883 and 1884 - reports from district doctors about local and regional effects of economic crisis.

becomes increasingly diverse throughout this period. As mentioned in 5.0.1, this is mostly due to the increase in the service sector and bureaucracy of the municipality, giving room for many middle management positions and thereby more people with more stable incomes. These factors combined could indicate that more stable income sources and less dependency on business profits is connected to tuberculosis mortality.

Figure 22: 15-49 Risk group tuberculosis mortality per thousand in Tromsø town 1878 to 1920, with two socioeconomic divides and standard deviation rate



Source: Burial registers 1872-1925 NHDC, UiT and Censuses 1875, 1885, 1900, 1910 and 1920 NHDC, UiT

As Figure 22 shows, the standard deviation rate is here included to account for the level of difference. Even though the working class has a higher average, and for most of the period does have a higher mortality rate of tuberculosis, it is here shown that this is not a significant difference, compared to the two other classes combined. The 1893-1897 and 1913-1920 intervals do seem to approach a significant level, as the expanded deviation fields come close to separation during these years, but even here they are interpreted as being not significant enough.

Despite that, in Figures 20, 21and 22, the working class is easily identified as the class with the highest tuberculous mortality throughout the period. Even though a majority of the working class in 1875 and 1885 were fishermen, they seem either less affected by the economic crisis, or to simply never recover from it. Another important aspect to keep in mind when analysing these figures is gender, as large majority of the female professions were very

low income and naturally placed most unmarried women in the working class.[228] Most of the women in the upper and middle classes were either married to or were children of merchants and craftsmen. There are exceptions to this, but they are few in most of the censuses. The result is a very female dominated working class.

Table 9: Ratios of men per 100 women within each class of the 15-49 risk groups of five population censuses in Tromsø Town 1878 to 1920

Census 15-49 risk group	Upper class ratio - men per 100 women	Middle class ratio - men per 100 women	Working class ratio - men per 100 women	Total people in risk group
1875	70.0	130.0	84.5	2,900
1885	82.0	148.6	76.1	2,966
1900	57.3	106.9	82.8	3,983
1910	107.1	100.8	66.5	4,063
1920	80.6	94.8	66.7	5,627

Source: Population censuses 1875, 1885, 1900, 1910 and 1920 NHDC, UiT

As Table 9 shows, the 15-49 risk group is here shown in ratios of men per 100 women within classes for each census. Meaning that there were for instance only 66.5 working-class men for every 100 working-class women in 1910. In turn, men seem to dominate the middle class early on, but are even here outnumbered in the last census, something that can illustrate the developing patterns of diversification in the middle class. Referring to the gender mortality rates in Figure 16, where women had 0.44 higher average rate and the percentages in Table 5, where women in the risk group had 5 to 12 per cent higher proportions, it is possible to see what some of the working-class figures are affected by. This kind of factor consideration quickly leads into regression analysis, lying outside of the scope of this project, but a point is here made of it to encourage future projects to investigate these kinds of analyses.

5.1.2 Profession Group Mortality

Living standards and working conditions likely influenced the overall class rates more than gender proportions. It is however hard to ascertain these factors without a closer look at specific professions, as there were vast differences within both the middle class and the working class. In order to isolate a bit further, the 914 tuberculous dead have been categorized into 20 different profession groups, based largely on IPUMS International occupation codes,

[228] NOS III. 61. 1875-1885 and III. 321. 1890-1895: – On women's salaries in Tromsø

focusing more on work environments and type of work rather than income or position. They fit more or less into the three class divisions, with some being slightly mixed.[229]

Table 10: Total tuberculosis mortalities in Tromsø 1878 to 1920 divided into profession groups, with comparative census avg. totals and percentages of the amount of people belonging to each class.

	Tuberculosis dead	% of tub. dead
Upper class	28	3.2%
Government officials	2	0.2%
Merchants	26	3.0%
Middle class	324	37.0%
Butchers and bakers	25	2.9%
Civil servants	21	2.4%
Clothing crafters	30	3.4%
Middle managers	34	3.9%
Engine men	16	1.8%
Other craftsmen	48	5.5%
Ship captains and mates	29	3.3%
Shoemakers	31	2.9%
Smiths	37	3.5%
Working class	523	59.8%
Carpenters	58	6.6%
Farmers	5	0.6%
Fishermen	145	16.6%
Paupers	30	3.4%
Sailors	62	7.1%
Servants	85	9.7%
Workers	138	15.8%
Missing profession	39	4.3%
Total	914	100%

Source: Burial registers 1872-1925 NHDC, UiT and Censuses 1875, 1885, 1900, 1910 and 1920 NHDC, UiT

Table 10 shows in detail the underlying professions within the respective class categories, portraying the total tuberculosis mortality and the percentages of all tuberculosis mortality.

[229] Minnesota Population Centre – IPUMS International: Occupation, NAPP modified HISCO codes
Also see appendix 4 for clarification of profession grouping.

Almost 60 per cent of the tuberculosis dead are within the defined working class, while more than a third are in the middle class.[230]

Within the profession groups themselves there are, as expected, most deaths among the workers and fishermen, which combined make up almost a third of all the tuberculous deaths. However, there are merchants and government officials in this Table as well, which were definitely wealthy individuals that died of the same disease. What is worth noting is that only seven of them were the actual men who had these affluent professions, meaning that a majority of the upper-class tuberculous deaths were the women or children of these wealthy men. Considering that a majority of these families had household servants, who could have been more in contact with the women and children of the household than the busy man of the house. This suggests that perhaps the ones who had the various professions should be inspected.

Table 10 gives a rough impression, and even though mortality rates are necessary for a more precise comparison between the professions, a majority of the various professions had single digit tuberculosis deaths. Which, if portrayed as rates, would have very deviating lines, hardly possible to interpret, as mentioned for the upper-class lines in Figures 20. The reliability of big numbers in quantitative methods quickly loses its potency if the numbers are small enough to be easily affected by coincidences. Despite that, there is merit into looking into certain key professions, which were numerous enough and perhaps represented the socioeconomic classes better than others.

5.1.3 Key Occupation Mortality

Servants, servant *girls*, all kinds of female household servants, of which there were quite a few, throughout the whole period, seem to have had a high amount of tuberculous deaths. Due to their ties to the upper class and their work environments being some of the best, inspecting them in detail can indicate contrasts between income, class belonging and work environment. Workers in contrast, are often said to have had the worst work environments, the most demanding physical work and the least favourable conditions. The fishermen might have had fluctuating affluences and sufferings to a greater extent, but the worker salaries are, much like the servant ones, possible to compare and track.[231] The third contrast to these are the craftsmen, who combined also did see quite a few tuberculous deaths. There are however also

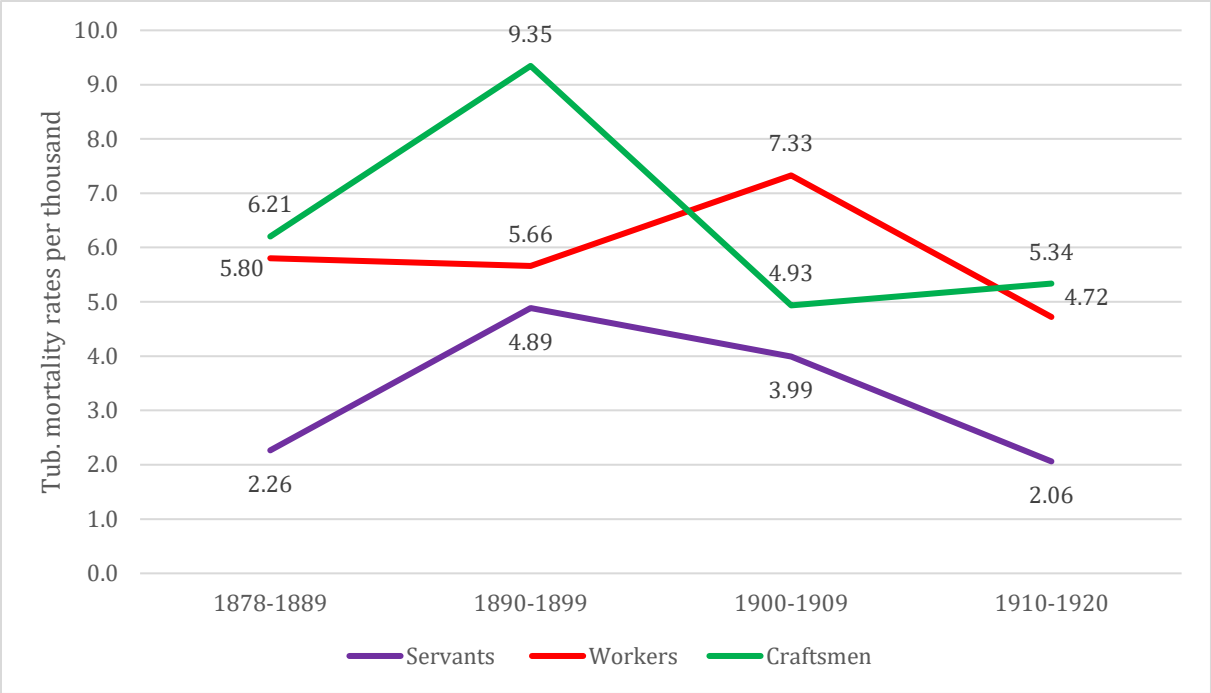
[230] Though it should be noted that of the 30 cloth crafters put in the middle class, 23 are seamstresses that are actually considered working class, but are here included due to related type of work as the tailors do.
[231] NOS III. 61. & NOS III. 321. – On salaries between 1875

large variations between them, a few of the most typical ones, that share factors worth looking into, have therefore been isolated: Butchers, bakers, shoemakers and five different kinds of smiths.[232] Their most crucial similarities are that they all made small scale products, which were likely bought frequently by large portions of the population. As a result, their often cramped and busy workshops would be hotbeds for infection, and their income and well-being would have been highly dependant on people in town having money to spend on their refined goods.

These selections aim to inspect tuberculous mortality on groups of individuals having certain professions. Unlike the earlier selections of class or profession groups, these will only include the individuals that themselves were noted down as having had that profession. In other words, none of the relatives belonging to the same household will be counted here, as the effects of the workplace will be clearer if only the ones working there are considered. As a result, these selections are very few individuals, and all have, coincidentally, an approximately equal number of tuberculous dead; 51 servants, 50 workers and 47 craftsmen. Throughout out the five population censuses, there was an average of 389 servants, 209 workers and 174 craftsmen. If we portray these in rates over the years, we get somewhat surprising figures:

[232] See appendix 4 for more details on selections and coded search words.

Figure 23: Tuberculosis morality rates within key occupations in Tromsø town 1878 to 1920



Source: Burial registers 1872-1925 NHDC, UiT and Censuses 1875, 1885, 1900, 1910 and 1920 NHDC, UiT

As Figure 23 shows, the key occupations are here portrayed over roughly the four decades, instead of the eight yearly intervals used earlier. Their tuberculous mortality rates are very high, in fact they are all above the 2.84 average for the town. The servants average being 3.30, the workers average 5.88 and the craftsmen average at a staggering 6.46. The risk group age is not isolated here, but a majority of them are within the risk group, as the most productive age for physical labour was within the 15 to 49 age.[233] The deviation potential is high in all of them, as there are only 149 deaths in total over 43 years, but they tell volumes despite that. Even if significant coincidences could have struck and for instance caused several of the craftsmen to die in the 80s and 90s, this pattern is also clear in several of the earlier figures and shows indications that these craftsmen, much like the rest of the middle class were severely affected by a prolonged economic downturn. The district doctor reports in 1889 of the commoners' deep debt to the merchants,[234] while in 1893 there is emphasis on the overburdened poverty measures due to several years of scarcity.[235] These conditions likely affecting many of the craftsmen. The craftsmen Figure 23 refers to, dwindle in numbers from 200 in 1875 to 148 in 1885, indicating that the situation might have put many out of business

[233] The retired ones are included seeing as a life working as a smith likely had an effect on those, who even after retirement, died of tuberculosis.
[234] NOS III. 143. 1889: 258
[235] NOS III. 252. 1893: 257

or forced downsizing. The servant girls show a lower average than the rest of their socioeconomic class, but also lower average than their gender, which was at 3.56. This could indicate that the servant girls were somewhat spared by their working conditions. Even if their salaries were among the lowest, many of them had incorporated board and lodging, highly raising their living standards.

The worker's average of 5.88 is far higher than the 3.89 average of the working class, but is in a way expected, due to their working and living conditions. Many of their jobs were hardly safety regulated or well paid, but it is perhaps the clue of industrial exposure to metalworks that gives them many things in common with the smiths. Puranen takes a detailed look into the quickly industrialising metalworks-town of Eskiltuna in Sweden during this same period. It is riddled with high tuberculosis mortality, especially among the metallurgy workers. Those who operated grinders, or other equipment that produced microparticles, seemed to have a much higher tuberculosis mortality rate than the other workers, amounting to around 40 per cent of all the tuberculous deaths amongst workers, even if they were only 10 per cent of the workers.[236]

Several other studies have also investigated tuberculosis mortality amongst industry workers, slate workers, miners and quarrymen as well. [237] The consensus seems to be that inhalation of particles can cause silicosis or pneumoconiosis, in itself very harmful for the lungs, but also dramatically accelerating tuberculosis infections, as it reduces the macrophages ability to defend the lungs. This kind of disruption in the lung tissue can come from particles in a wide range of industries, from mining to shipbuilding, and even agriculture.[238] Which means that a the craftsmen and worker rates from Figure 23 are to be expected in accordance with these risks of their professions. As 24 of the 47 craftsmen deaths were of the smiths working with metals and any tools needed to shape and cut these. Likewise, many of the workers that died also often had jobs in the wharf or as road builders and engine stokers.[239] This means that lack of work safety equipment and occupational hazards likely caused a significant amount of tuberculosis mortality. Jones et al. even suggest that this cut the life expectancy of many workers having these occupations for long, as particle accumulation over the years eventually also killed the most resilient lungs, showing that a majority of the quarrymen and ex-

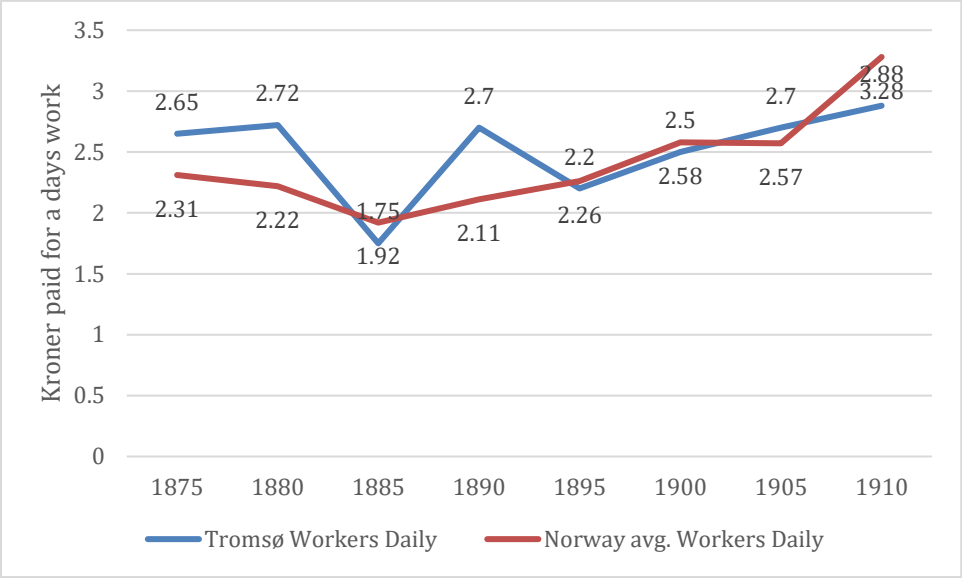
[236] Puranen 1984: 290, 291, 292 and Holmin 1911: 13
[237] Shih 2019, Jones et al. 1967, Edwin&Morgan 1979
[238] Shih 2019, Jones et al. 1967, Edwin&Morgan 1979
[239] Burial Registers 1872-1925 NHDC, UiT

quarrymen tuberculosis deaths were while they were in their 50s and 60s.[240] This could explain some of the reactivations of tuberculous infections acquired and supressed in an individual's youth, and why the tuberculosis mortality rate in Tromsø spiked for the late 60s age group. [241]

5.1.4 Salaries, Prices and Living Standard Differences

Isolating key occupations like those mentioned in 5.1.3 indicates that occupational hazards could indeed have increased tuberculosis mortality, at least among the individuals in the workshops and factories. In that regard, parts of the worker mortality factors should be exclusive for the workers and not their closest family members. Most of these male workers had families to take care of however, and in that regard, it is important to consider their salaries and the resulting living conditions for them and their families.

Figure 24a: Daily worker salaries in Tromsø town and on average in Norway 1875-1910



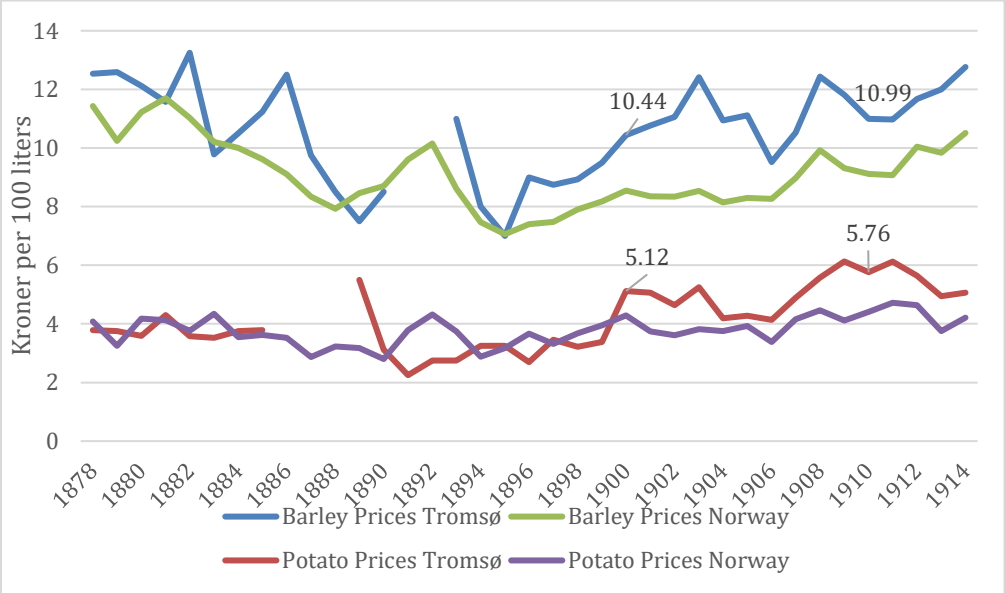
Source: NOS III. 61, NOS III. 321, NOS IV. 60, NOS V. 60, NOS V. 212, and NOS VI. 93. Arbeidslønninger 1875-1915

As Figure 24a shows, the workers of Tromsø town were on average paid 2.51 kroner a day, which is slightly higher than the Norwegian average of 2.40 kroner a day. These are provided twice decennially by the NOS, but in reality, do not change very significantly throughout the period, that is until the Great War breaks out in Europe. At that point both prices and salaries skyrocket, setting the stage for very different conditions, which would be difficult to properly portray next to the stable monetary years before it. These salaries by themselves say little if

[240] Jones et al. 1967: 140, 141 – Though this could be because their study was done in the 60s, at a stage where few other age groups still had tuberculosis infected people, due to BCG vaccines.
[241] See Figure 10 in chapter 4.1

not compared to something that the workers commonly bought:

Figure 24b: Prices of barley and potato in Tromsø county and on average in Norway from 1878 to 1914



Source: NOS VI. 23. Markedspriser paa korn og potet 1836-1914

As Figure 24b shows, the prices of barley and potato are here displayed for Tromsø county and on average for Norway during most of the period. In Tromsø county the barley average being 10.63 kroner and the potato average being 4.19, while the Norwegian average for barley is 9.11 and the 3.78 for potato. The abrupt disappearance of barley in Tromsø 1891-1892 is due to the Russian Empire forbidding exports these years as a result of a famine.[242] This confirms the crucial importance of the Pomor grain trade mentioned in chapter 2. For similar reasons the potato likely disappeared during 1887-1889, which certainly made the economic crisis during this period even more difficult.

If we compare numbers from Figures 24a and 24b, ideally we could have assumed that the average worker in Tromsø had to do two days of physical labour in 1900 to be able to almost afford a barrel of potatoes, and four days for a barrel of barley. [243] However, most goods were first bought and distributed by the merchants in the town, who took cuts to make profit.[244] In addition, food though the primary necessity, was hardly the only one the worker had. Ellingsæther estimates that the average Norwegian consumer in 1900 spent 41.2 per cent on

[242] Rygg 1914: 14*
[243] NOS III. 61, NOS III. 321, NOS IV. 60, NOS V. 60, NOS V. 212, and NOS VI. 93. Arbeidslønninger 1875-1915
[244] NOS VI. 23. Markedspriser paa korn og potet 1836-1914 and Tromsø Amtstidende 24th of December 1896: 1 – In an article about the values of different grains, there is an increased cost of the distributed barley compared to the market price for the county.

food, 16.3 per cent on housing, lighting and heating, 11.9 per cent on clothing and footwear, 8.5 per cent on equipment and home assistance and 6.7 per cent on alcohol and tobacco. Considering that these were averages, the percentage spent on life necessities, like food, were likely higher for workers, and considering the long and dark winters in Tromsø, the percentage spent on lighting and heating were likely also higher.[245] In addition, Ellingsæther's numbers along with the import reports from Tromsø's toll station confirm that tobacco cigarettes and alcohol was indeed consumed regularly in Tromsø in high amounts.[246]

Hegstad's numbers from 1900 grants possibilities for comparison, as his study investigated individual yearly incomes and estimated averages for each profession group. Workers on average making 632kr, craftsmen journeymen making 750kr, craftsmen master making 1,653kr, while the merchants were in the lofty 3,933kr. But amongst the last two groups the differences are vast, where some of the wealthiest butcher masters made 6,000kr and one merchant made 22,500kr. In contrast, even the independent shoemakers and tailors usually did not make more than most journeymen.[247] Ellingsæther does point out that the real wages of all consumers *did* increase from 1871 to 1910, but for those who had small salaries to begin with, the changed pattern in spending was mostly just on more essential commodities.[248]

These numbers combined give a rough impression of the monetary inequalities and difficulties of the people in Tromsø during the period. It is hard to estimate exactly how much this affected tuberculosis mortality, but there are many individual factors that could have been decisive. Contemporary numbers from WHO indicate that undernourishment tripled the chance of active tuberculosis, combined with the risky environments of contamination the workers and craftsmen were exposed to, it is understandable why their mortality rates were so high. It can be assumed that they brought on some of these risks and misfortunes to their families, directly through the spreading of the disease, or indirectly through being incapacitated by the long-lasting disease, reducing their nourishment and living standards.[249]

Hinde doubts the importance of nutrition on tuberculosis mortality and argues epidemiologists should look at alternative causes.[250] The rest of the literature however speaks volumes in favour of nutrition and nourishment's importance. McFarlane argues it was the real wage of

[245] Ellingsæther 2007: 13, 14
[246] NOS III. 297. 1897: 140 – See also chapter 4.2.1 Figure and numbers
[247] Hegstad 1993: 60, 61, 62
[248] Ellingsæther 2007: 13
[249] WHO 2019
[250] Hinde 2015: 386

the family or rather the de facto availability of nutritional food stuffs, clothing, and housing capabilities.[251]

5.2 Spatial Differences

Epidemics are often studied within the densely populated environments of the urban landscape. This was often in fact seen as one of the great drawbacks of early urbanisation, that cramped environments would become so unsustainable for the masses that epidemics were bound to happen. This is not new, or nor is it only a tendency for human populations, it can easily be compared to basic ecology and its circles of sustainability.[252] For this undeniable reason it is fundamental to consider the spatial importance of a disease like tuberculosis. This chapter will therefore look into population density, patterns in dwellings and the composition of streets and neighbourhoods. Another important note, as mentioned in chapter 3, this spatial analysis will consider 16 years of the period, from 1904 to 1920, at a time where tuberculosis mortality was on the way down.[253]

Tromsø was not a very large town in this timeframe, as was expressed in the introduction and background chapters, it grew intact with expectations of Norwegian cities at the time. Though there are fluctuating differences in this period, where both hardships and flourishing times are apparent, the population density of its small area remains undeniably noticeable. Its population almost doubles from 5,506 in 1875 to 10,566 in 1920, but the municipal area is not expanded between 1872 and 1915.[254] It remained a rough 0,72 square kilometres, which towards the end of the period was causing ever increasing housing shortages. The streets and their contents did however change over time. Both names and lengths of the streets, not to mention that the number of streets grew from around 20 in 1876 to around 45 in 1918.[255] This makes a diachronic comparative analysis of the streets throughout the whole period rather difficult. The three dominating parallels; Storgaten, Grønnegaten and Vestregaten dwarf many of the other streets, and those who are populated just towards the end of the period cannot be compared to those who have existed since 1878. Due to this, and other reasons mentioned in chapter 3, it becomes more feasible to compare larger portions of the town from 1904 to 1920,[256] based primarily according to what Hegstad, Andresen and Ytreberg considered

[251] McFarlane 1990: 347
[252] Paschek 2015 – An elaborate article on contemporary urban sustainability
[253] Due to the lack of street address references in the burial registers, the deceased are very difficult to pinpoint before 1904.
[254] Population censuses 1875 and 1920 NHDC, UiT and Klettum 2001: 214, 215
[255] Norges Geografisk Opmaling 1876 and Edelsteen 1918.
[256] Due to the 1904 address system change and use of addresses in burial registers

different districts and boundaries.[257]

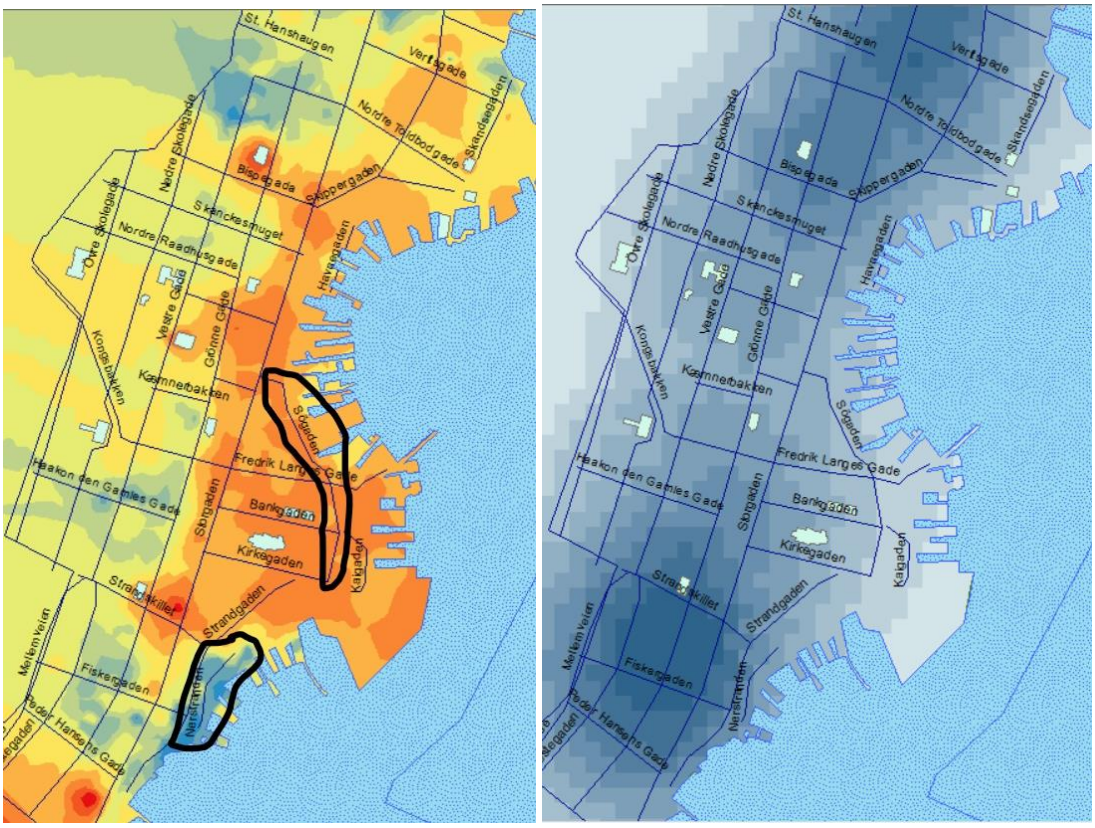
The town did grow beyond its borders into Tromsøysundet municipality, especially in the last part of the phase. According to Hegstad, these new areas became vital for the town's growing working-class population. As the prestigious central area around Storgaten remained dominated by the upper-class merchants and did not change its composition or inhabitants much over the years.[258] After the turn of the century the town grew more outwards instead, the traditional centre area having become too congested. The district doctors continuously bring up this topic when considering the well-being of the population in their annual reports, it seems a troubling factor that did not change much for the better. The way the growing concern for Tuberculosis intensified, it seems likely that it gradually changed people's mindsets. The district doctor writes in his 1914 report that he believes the reasons for the widespread tuberculosis to be many; "The miserable sanitary conditions, tight, unhealthy, poorly ventilated dwellings, unfavourable living conditions and the long, dark winters are all factors that contribute in favour of tuberculosis."[259] He further elaborates that he does not believe the disease to have decreased its grip on the population, but that the people's willingness to participate in the struggle is growing every year. This can be seen through Tromsø Sanitetsforening's growing membership and donations.[260]And even though the majority of these efforts go towards treatment of the already infected, there is an increased effort from the municipality to take the dwelling situation seriously.[261] The wartime years see a comparatively immense increase in the investments of public dwellings along the town's outskirts.[262] It is possible to assume, due to this correlation, that tuberculosis in fact encouraged more spacious and modernized dwellings. At least that is the indication as assumed by the district doctor's recommendations, and McFarlane's similar conclusions in Scotland.[263]

Though both Andresen and Hegstad point out that there was no real working-class district compared to the clearer cut divides in bigger cities, there were some implicit street and spatial

[257] Hegstad 1993: 73-112 and Andresen 1994: 319, 320, 321
[258] Hegstad 1993: 81
[259] NOS IV. 94. 1914: 235 – "De i mange henseender mislige sanitære forhold, trange, usunde, daarlig ventilerte boliger, uhensigtsmæssig levemaate, den lange morke vinter, alt dette er jo faktorer, som arbeider i tuberkulosens tjeneste"
[260] NOS IV. 94. 1914: 237
[261] Ytreberg 1962: 386
[262] Hegstad 1993: 106, 107
[263] NOS VI. 186. 1916: 244 – On the expansion of new housing in the north of town.
Mcfarlane 1990: 252 and 345 – On improved housing in Glasgow, becoming one of his focal points.

divides they make note off. Nerstranda or "Strandområdet" though not far from Storgata or the busy docklands, are generally considered to be mainly populated by the working class.[264] Hegstad in fact choses three streets that are expected to be most typically dominated by the three class divides he uses. Storgata and the upper class, Vestregata and the middle class, Nerstranda and the working class.[265] In addition, Hegstad considers Sjøgata "pængegata", to be an exceptionally merchant-populated street, where many upper-class families exclusively owned their own dockside house.[266]

Figure 25a and 25b: Geospatially portrayed property tax value and population density for Tromsø town 1904 to 1920



Sources: Cadastral register 1904, population census 1910 NHDC, UiT and Edelsteen map 1903

As Figures 25a and 25b show, (these colour schemes are the same as introduced in 3.4) the centre of town is portrayed with the tax-valued properties from the 1904 cadastral register in 25a, while 25b portrays the population density based on the 1910 population census and the corresponding addresses. There is a noticeable correspondence between low valued properties in blue and yellow on 25a, and high population density in dark blue on 25b, and vice versa.

[264] Andresen 1994: 320 and Hegstad 1993: 82-96
[265] Hegstad 1993: 83-96
[266] Hegstad 1993: 82

These portrayals fit with Hegstad findings of where the "money" in town was concentrated.[267] Taxed property value is used throughout this spatial analysis to measure wealth of an area, and it is assumed that both affluence and living standards are higher in those areas that are tax valued higher. [268]

The valued difference between the marked Sjøgaten and Nerstranden is particularly noticeable. The combined tax value of Sjøgaten was 453,000kr, while Nerstranden comparatively had only 32,000kr. If these values are divided by population, Sjøgaten had 2,224kr tax value per person, while Nerstranden had 654kr tax value per person, less than a third of Sjøgaten's per person value. The amount of working-class people is even higher in Fiskergaten, there the tax value per person is a meagre 231kr, almost ten times less than Sjøgaten. This illustrates the vast differences in property value between the poor and rich.

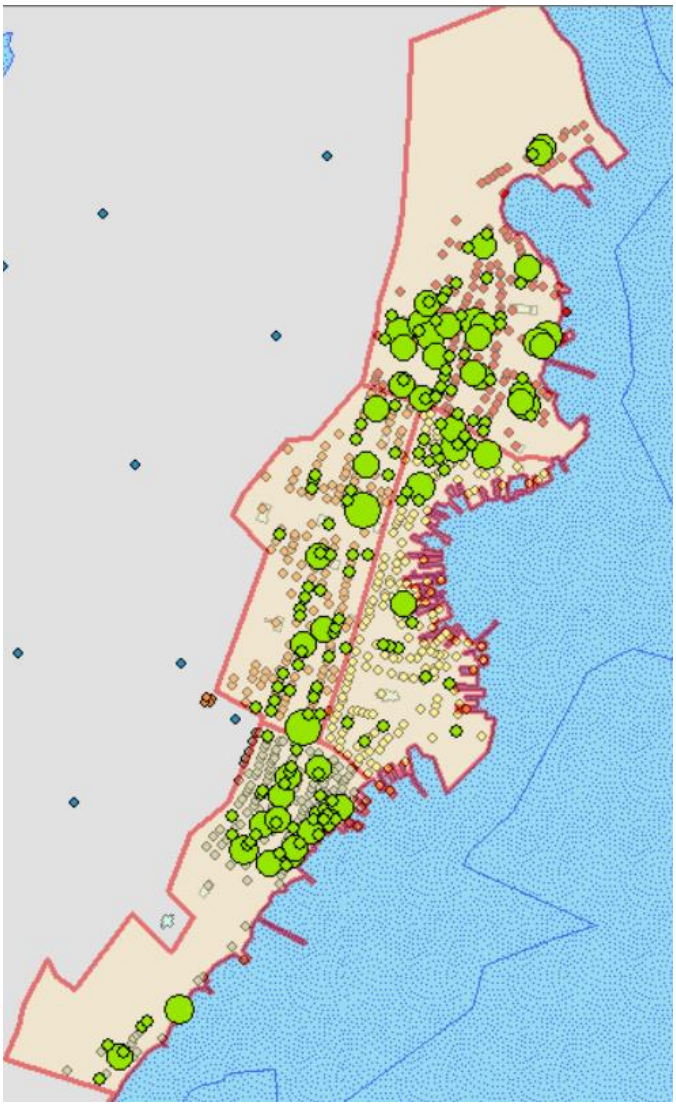
5.2.2 District Spatial Analysis

Comparison between these typical streets is possible, but Storgaten and Grønnegaten for instance are too varied and diverse depending on which parts one inspects. Dividing the town into districts, where socioeconomic divides approximately did separate people, should provide the initial overview for an analysis of the town as a whole.

[267] Hegstad 1993: 82

[268] These tax values are, as mentioned in chapter 3.4 extracted from the cadastral register of Tromsø town 1904.

Figure 26: District divisions of Tromsø town 1904 to 1920



Source: Cadastral register 1904 and Edelsteen map 1903

As Figure 26 shows, the Tromsø's property dots are here divided into four roughly equal districts; south, north, upper middle and lower middle, having about 130 to 180 objects or properties each. Their boundaries are set along assumed socioeconomic boundaries, based on both literature and estimated tax value differences, primarily isolating the wealthy centre as portrayed in 25a. The olive-green dots layered on top of the districts represent a majority of the tuberculosis mortalities in town from 1904 to 1920. To be exact, 268 of the 361 dead who did have residence in town have been placed.[269] The smallest dots represent only one death, while the bigger ones represent two, three and four. The only address that has more than four is the retirement home in Grønnegaten 48, with 29 tuberculosis deaths. As mentioned in

[269] This is due to challenges with the burial registers' level of detail when expressing place of residence. Of those 361, many are simply on a street or in Tromsø, without any street address, while others are described with colloquial place names no longer in use.

chapter 2, the hopeless tuberculosis cases were sent here to die, as the doctors did not want to spare hospital resources on them, and there was no sanatorium built within town during this period.[270] The retirement home is excluded from any of the districts due to that, as it received people from all over town and would unfairly misrepresent any district's numbers.

Table 11a: Characteristics of the four districts of Tromsø town 1904 to 1920

District	Population 1910	Total tax value	Area km^2	Tub. mort.
South	1,928	712,200	0.16556	56
Lower middle	1,284	**2,338,100**	0.13822	30
Upper middle	1,948	831,800	0.14812	54
North	**2,055**	880,400	**0.17292**	**82**

Source: Cadastral Register 1904, Population Census 1910 NHDC, UiT, Burial Registers 1899-1925 NHDC, UiT

As Table 11a shows, the four districts' population, total property tax value, square kilometres of populated area and tuberculosis mortalities are here compared. The largest value of each column is highlighted in bold, to ease comparison. As expected, the lower middle has least people, highest tax value and fewest tuberculosis mortalities. If the districts' tuberculosis relevant values are portrayed more proportionately, it is possible to assume which ones are most relevant:

Table 11b: Calculated tuberculosis mortality relevant characteristics for the four districts of Tromsø town 1904 to 1920

District	Pop. density km^2	Tax value per person	Tub. mort. rate[271]
South	11,645.4	479.73	2.90
Lower middle	9,289.4	**2,059.26**	2.34
Upper middle	**13,150.9**	533.06	2.77
North	11,884.1	515.15	**3.99**
Average	11,492.5	896.80	1.88

Source: Cadastral register 1904, Population Census 1910 NHDC, UiT, Burial Registers 1899-1925 NHDC, UiT

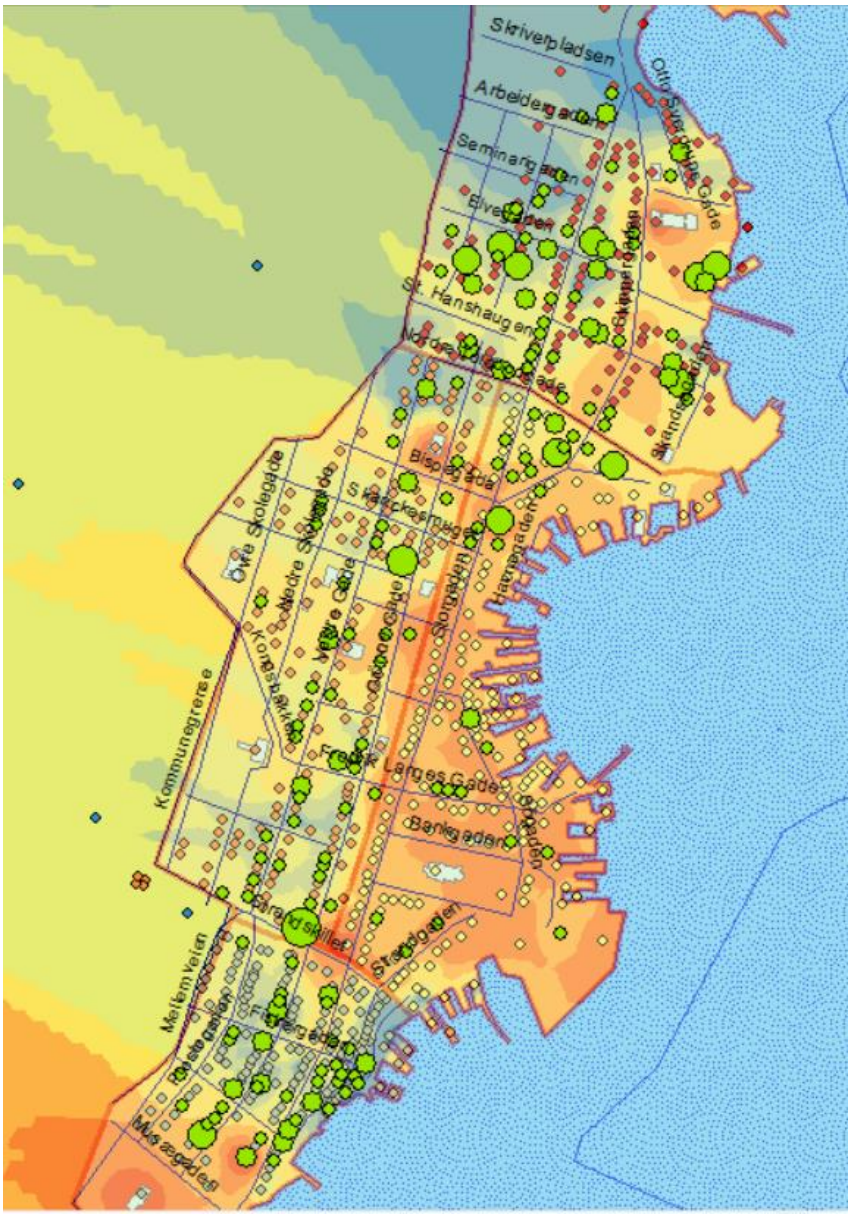
As Table 11b shows, population density is not very different for the four districts. The district with the highest tuberculosis mortality rate has just above the average population density,

[270] Ytreberg 1962: 388 - After 1913 they were sent to Hvilhaug tuberculosis home, which remains outside of the towns boundaries even in the 1915 expansion.

[271] Tuberculosis mortality rate per hundred, the sixteen years of burial registers in contrast to one year of population from 1910 census make these much higher than for the other tables and figures, and as such are not comparable.

while the district with highest population density has a lower than average mortality rate. This could indicate that population density is in fact not that decisive for tuberculosis mortality. Perhaps because the density is overall high, or because the differences in density are not big enough to be very significant, especially in a time of decreasing mortality. The tax values per person, on the other hand, differ more between the districts. The district with the highest tax value also has the lowest mortality rate, but the one with the lowest tax value per person does not have the highest mortality rate. This means that there could be some correlation between taxed property value and tuberculosis mortality rate, but judging by how much bigger the district differences are in tax value than in tuberculosis mortality rate, this correlation does not seem very significant. There is despite that, an indication that large amounts of wealth can reduce the tuberculosis mortality rate, but it is hard to estimate to what extent.

Figure 27: Spatial tuberculosis mortality, districts and tax value portrayed for Tromsø town 1904 to 1920



Source: Cadastral register 1904, burial register 1899-1925 NHDC, UiT and Edelsteens map 1903

As Figure 27 shows, the tuberculosis mortalities are here layered over the districts and the property tax values. What is most noticeable with this portrayal, is how rare the mortality dots are in the most expensive areas, and how frequent they are in the least expensive areas. Compared to other districts, the North district has a higher degree of mortality clustered at the same addresses within in close proximity to similar clusters in other dwellings nearby, suggesting that this district had more infections among family members. While the south seems to have more dispersed clusters, and even if the district as a whole did not have the highest population density, it definitely had the highest density in its poorest neighbourhood around Nerstranden and Fiskergaten. The northern edge of the lower middle district seems to

have had a very deviating tendency compared to the rest. It becomes apparent that the northern half and the southern-most part of Storgaten were very different from the most central parts of the street, as the stretch between Strandskillet and Skanckesmuget saw only one death of tuberculosis, while north of Skanckesmuget saw quite a few of them. The lower middle district as a whole had very few tuberculosis deaths, especially in the wealthiest central areas, indicating that wealth and living standards likely did help in preventing tuberculosis mortality.

There were many other factors that did affect the tuberculosis mortality rate within each district as well. Hegstad for instance, mentions that north side of town did see a significant growth in this period, as many workers settled here. As new arrivals and workers are said to have difficult conditions to cope with, this could explain some of the underlying factors in the north districts high mortality rate. This part of town was also generally less attractive for upper- and middle-class people due to its industrial characteristics. Holmboe's coal storage and nearby factories likely did not improve the air quality or potential silicosis issues. [272] In other districts there was shifting as well, upper middle supposedly saw more workers moving in, while the south saw more middle-class people in traditional working-class neighbourhoods. Hegstad also mentions that it was more likely the market and prices that decided who lived where, and not the social preferences, meaning that the growth in the 1900 to 1920 period was generating a more socially integrated town. [273] There were of course exceptions too, Nerstranden was particularly close to the local sewage outlet, and the smell alone could scare off anyone who had the means to live elsewhere. The high tide often left sewage along the beach and coast, likely reducing hygiene and living standards of the area.[274]

Though the indicators in Figure 27 and Table 11b may not show perfect correlations between district poverty and tuberculosis mortality, there are numbers from a multitude of other contemporary studies that confirm these effects.[275] Overcrowding, unemployment, alcohol intake and environmental factors were found to be strong notifiers of tuberculosis mortality in different districts of Cape Town.[276] While a state-wide analysis of socio-economic status and tuberculosis mortality found "a significant inverse association", even after adjusting for age,

[272] Hegstad 1993: 106
[273] Hegstad 1993: 110, 111
[274] Ytreberg 1962: 371
[275] Wang et. al. 2012, Munch et. al. 2003, Oren et. al. 2012
[276] Munch et. al. 2003: 271

sex, ethnicity and foreign birth.[277] Tromsø's districts might have affected or blended too much into each other for there to be a significant difference between them. In such a small area, with so many people, over such a long time, these districts and their populations must have been affected by a continuous fluctuation, making a definite correlation between their spatial differences and tuberculosis mortality hard to establish.

5.2.3 Street Comparison

Districts give a large-scale impression, but it is hard to isolate specific causes of high mortality when the districts also had these evolving diversities. Comparison of smaller streets like those mentioned earlier could tell of more crucial differences. As population density might vary greatly from one part of a district to the next, it might be more beneficial to inspect people per building in a street comparison. This being more relevant for the tuberculosis spread as well, since overcrowding effects on infection rates likely mattered more within a dwelling than within the area an individual lived in.[278]

Table 12: Street comparison with building population density, property tax per person and class percentages in Tromsø town 1904 to 1920

Street	People per populated building	Property tax per person	Percentage of each class	Tuberculosis mortality rate[279]
Sjøgaten	8.00	2,224.5	13/36/**50**	1.96
Nerstranden	6.22	654.1	0/12/**88**	**6.12**
Fiskergaten	15.16	231.9	1/12/**87**	2.15
Verftsgaten	**18.58**	404.2	1/40/**59**	**5.78**
N. Toldbodgate	12.70	367.7	0/41/**59**	4.72
S. Toldbodgate	9.50	3,053.9	26/**42**/33	**6.98**
Strandgaten	9.94	974.1	5/42/**53**	1.77
Elvegaten	7.63	341.8	1/20/**79**	**7.14**
Fr. Langes gate	13.13	1,764.6	1/41/**58**	2.91
Skippergaten	12.28	856.8	3/45/**52**	2.53
Average	11.31	1,087.4	Upp/mid/work	2.63

Source: Cadastral register 1904, Population census 1910 NHDC, UiT, Burial register 1899-1925 NHDC, UiT, Edelsteen map 1903

[277] Oren et. al. 2012
[278] Zürcher et. al. 2016
[279] Tuberculosis mortality rate per hundred, the sixteen years of burial registers in contrast to one year of population from 1910 census make these much higher than for the other tables and figures, and as such are not comparable.

As Table 12 shows, ten different streets have been chosen for a detailed comparison of their potential overcrowding, property tax per person, class divide and tuberculosis mortality rate. People per building does not necessarily mean people per dwelling however, as building sizes and functions varied greatly. Seeing it in combination with the property tax per person is useful, as this can often indicate how big or expensive the building was. Of these streets, Verftsgaten seems to be the one with a significant overcrowding, low tax value and high tuberculosis mortality rate. While Sjøgaten seems to be in the other end of the scale on all these characteristics. The clustering of working-class people seems highest in Nerstranden, Fiskergaten and Elvegaten, all of which are small streets with few dwellings. Others are more diverse, and a majority of streets see a pattern of very few upper-class people, around forty per cent of middle class and between fifty and sixty per cent of working-class people. Even Sjøgaten, which was called "money street" had a significant amount of working-class people, a majority likely hired by the merchants, who were quite numerous in this street.[280]

There are two streets that are somewhat contradicting in comparison to the rest, namely Fiskergaten and Søndre Toldbodgate. With Fiskergaten's high overcrowding and lowest tax value per person, one would expect a higher tuberculosis mortality rate, and yet it has the third lowest rate on the list. Søndre Toldbodgate has the highest per person tax value, but there were very few people living in any of those buildings, as very few of them were dwellings, most actually having functions connected to the harbour and the trade industry.[281] Despite that, it had one of the highest tuberculosis mortality rates, though with a very high deviation possibility. Fiskergaten though having a low rate, intersected with a Storgaten and Grønnegaten in the south, where there was a significant amount of tuberculosis deaths on these streets. If Figure 27's visual clustering of tuberculosis cases in these crossings are inspected, it might seem like a lot of the deaths in the crossings might very well have been addresses along Fiskergaten.

A majority of those who died of tuberculosis in Verftsgaten were carpenters, boatbuilders and other workers at the wharf, the street being named the "wharf street" for a reason. Which could explain the high tuberculosis mortality rate, combining the factors of occupational hazards, low salaries and overcrowding in dwellings. Both Elvegaten and Nerstranden share similar victims, other working-class occupations or the poorest of the middle-class occupations. There are many deviation possibilities, but there are also strong indicators for

[280] Hegstad 1993: 82
[281] Edelsteen map 1903, and Population census 1910 NHDC, UiT

increased mortality risks of living in unhygienic areas and dwellings as well.[282] McFarlane mentioned that female mortality rates of tuberculosis were higher than male in areas where dwelling quality and overcrowding was an issue. The argument being that women and children spent more time in these dwellings than the men who spent long working days elsewhere.[283] This seems to fit with the numbers from the burial registers, as most of those streets that had more than average people per populated building in Table 9, also had a majority of female deaths from tuberculosis.[284]"Given that small housing is not a monocausal explanation for tuberculosis incidences, one would not expect a perfect correlation, but […] such statistics do highlight that a definite relationship existed between overcrowding and tuberculosis mortality."[285] – Neil McFarlane

McFarlane seems convinced that there was a *definite relationship*, but he is not the only one looking into this. The effects of dwelling quality have been assessed directly in a Swiss study from 2016. Where very specific parameters were chosen; number of persons per room, percentage of rooms without sunlight, and number of windows per apartment. As expected, the tuberculous mortality increased with the number of persons per room and percentage of rooms without direct sunlight, and decreased with the number of windows per apartment. [286] The study concluded that "Improved living conditions and public health measures may have contributed to the massive decline of the TB epidemic in the city of Bern even before effective antibiotic treatment became finally became available in the 1950s."[287] This gives reason to believe that crowded dwellings and air quality could have increased the likelihood of dying of tuberculosis, considering these factors both increase the likelihood of infection, and the spread of microparticles into the lungs. Though some of these factors can be counteracted with proper cleaning and regular ventilation, these measures often came at the expense of resources like soap and precious firewood in cold winters. Most people were likely not aware of the necessity of these measures against tuberculosis before the law came into effect in 1901. The numbers showed in Tables 11b and 12 portray no definite relationship or correlation with overcrowding and tuberculosis mortality, but there are strong enough indicators to claim that it played a considerable role.

[282] Dormandy 2000: 235, 242, 247 and Puranen 1984: 341, 342
[283] McFarlane 1990: 209
[284] Burial register 1899-1925 NHDC, UiT – See Table 11 for more details.
[285] McFarlane 1990: 227
[286] Zürcher et al. 2016: 1
[287] Zürcher et al. 2016: 1

Chapter 6. Conclusions

This master thesis has explored the history of the infectious disease of tuberculosis in a small Northern Norwegian port town. The scope was set within four decades of a rapidly developing environment, with considerable gender roles and socioeconomic differences. The effects of these roles and differences have been investigated in order to determine their importance for tuberculosis mortality within the population.

Tuberculosis was and is an overly complicated disease to study, with few certainties and many indications. Once it infected it remained with a person until they died, either latently as a silent passenger, or actively as a devouring menace, tearing through lung tissue. It spread relatively easily and could survive for weeks on most surfaces, easily finding hosts in densely populated environments. Morbidity was due to these factors and others, almost impossible to trace or accurately chart, much more so 140 years after the events occurred in the town.

Tromsø was an island port town in the far north during the turn of the 20th century. It relied heavily on fishing and maritime trade, which both enriched it in prosperous times, and condemned it to poverty and strife in difficult times. The sea had abundances of fish at times, but growing reliance on them also made the economic crisis of the 1870s and 80s disastrous to many of the town's people.[288] For the merchants it meant closing down a business or two, but for the poorer craftsmen, workers and fishermen it could have brought pauperism and starvation, and with malnourishment often came tuberculosis mortality.

6.1 Tuberculosis mortality in Tromsø

At least 914 people died of tuberculosis in Tromsø town from 1878 to 1920, 506 females and 408 males. This totalled a 15.9 per cent of all deaths in the burial registers of the period. 752 of those tuberculosis deaths were of the most common pulmonary form, while the second most common form of meningeal tuberculosis totalled 81 deaths throughout the period, most of them children. Both the data material and the literature indicated that the age group most at risk of dying of tuberculosis was the 15 to 49 age group, thereby called the risk group.[289]

Tuberculosis mortality rates in Tromsø were higher than in the rest of the country during the

[288] Sanner 1953: 60, 61

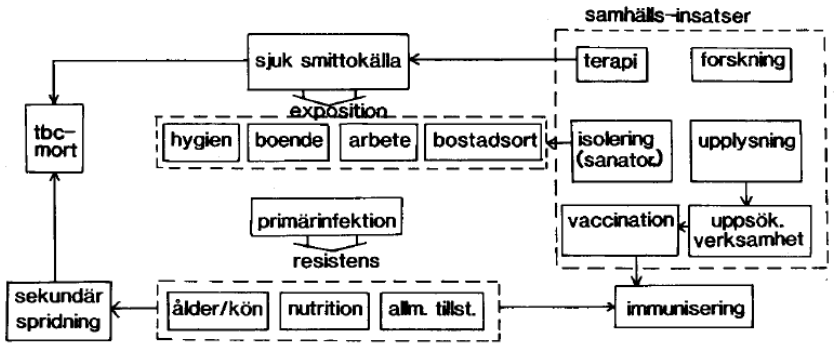
[289] Backer 1961, Puranen 1984, Dormandy 2000, McFarlane 1990, Burial registers 1872-1925 NHDC, UiT – Though the literature is not in complete consensus as to exactly which years, the teenage years and the forties seem to be the safest estimate. The WHO consistently uses the 15-year-old lower boundary, but has no clear upper boundary.

period, and saw their peaks and plateau's earlier.[290] This was likely due to Tromsø's densely populated urban environment, and its economic foundation relying on trade and commerce with other port towns. These characteristics certainly increased spread of tuberculosis within the population and could have ensured that a majority of the town did have a latent tuberculosis.[291]

Puranen's causality flowchart has been reconsulted continuously throughout this project, and attributes significant weight to my own conclusions. In large due to many of the same factors being investigated in both projects.

Figure 28: Puranen's 33rd Figure, "Illustration of the cause factors' connection by occurrences of tuberculosis within a population" (provides own translation)

Figur 33. *Illustration av orsaksfaktorernas sammanhang vid förekomst av tuberkulos hos en befolkning*



Source: Puranen 1984: 346

As her 33rd Figure shows, the living standard and work conditions factors are what allow exposure and spreading, while the nutrition, gender, age, and general healthiness of a person will determine their resistance and potential immunisation. Assuming that only active tuberculosis infections spread the bacteria, both contagion and resistance were decisive for tuberculosis mortality, as such all these factors likely played each their circumstantial roles in Tromsø.

[290] See Figure 10 on page 50

[291] McFarlane 1990: 162 – Argues based on the reported rate of active tuberculosis that the majority of all people in Britain did have tuberculosis by 1960.
WHO 2019 – They use numbers of active cases and deaths to estimate latent cases.

6.2 Gender differences

More women than men died of tuberculosis in Tromsø. As Figures 16 and 17 showed, the mortality rate per thousand started off at 2.17 for women and 1.82 for men in 1878-1882, but the rates grew to a peak of 4.23 for women in 1888-1893, and 3.43 for men in 1898-1903. After which both rates gradually decline towards 1920. The differences between the genders were found to be non-significant, even in the most differentiating years, and tuberculosis mortality did, at least in Tromsø, not portray a considerable gendered inclination. That being said, the lives and choices of men and women in town likely affected if they got infected, and if they had the immune system to fight it off.

The women as caretakers, with their more commonly northern migration origin location, possible forced to bargain for food, and most of all the housing conditions. These factors likely played a part in female infection and mortality. Likewise, it can be assumed that work environment conditions, especially with inhalation of dust and microparticles, alcohol abuse and smoking habits were likely factors for male infection and mortality. As the latter censuses of 1910 and 1920 showed, the diversification of the local economy allowed more women into various professions, possibly removing some of the largest gaps in the gendered differences.

6.3 Socioeconomic and spatial differences

The working class was varied, and in Tromsø it contained more fishermen and sailors than typical workers. Mortality rates within the isolated working class were higher than it was in the middle class and the upper class. As Figure 20 showed for the discussed risk group of 15-49, both the working class and middle class had a rate of around three tuberculosis deaths per thousand in the 1870s and 1880s, after which the middle-class peaks at 4.17 deaths per thousand during the start of the 1890s. The working-class, however, plateaus at this point and maintains rate of more than four until 1907, peaking at 4.35 at the turn of the century. The steep rise during the late 1880s is likely caused by the economic crisis that affected both the country and the town, and is quite visible on the mortality rate among private entrepreneurs of the middle class.[292]

Due to there being both few individuals and few tuberculosis deaths in total, the statistical significance of the upper class seemed hard to pinpoint. Combined with the middle class, the two were compared with the working class, and showed that even though the working class had a 0.81 higher tuberculosis mortality rate, it was not significant during any part of the

[292] See Figure 20 on page 81

period, even if it at times was almost significant.[293] This difference was considerably greater than it was between the genders, indicating that socioeconomic condition was more impactful on tuberculosis mortality than gender was.

Different professions and key occupations were also inspected, and craftsmen and workers were in particularly found to have a significantly higher mortality rate than the rest of their class. The craftsmen peak during the 1890s at 9.35 tuberculosis deaths per thousand, in the same decade the servant girls peak at 4.89. The workers on the other hand, peak later at 7.33, during the first decade of the 1900s.[294] These occupations were however isolated due to their deaths being many compared to how many they were. Their numbers, nonetheless, strongly indicate that work environments and conditions of certain craftsmen and workers did highly likely increase their chance of tuberculosis mortality.

In combination with the spatial analysis, the factors against the men that did these working-class jobs seems to stack up, with the cheapest and least hygienic places in town being mostly populated by the poorest. The spatial analysis showed that population density did not influence tuberculosis mortality noticeably, though this was hard to control for. Tromsø's population and population density increased noticeably during the years of this spatial analysis, despite that, tuberculosis mortality was on the decline.[295] The richest district did however show a significantly lower tuberculosis mortality rate throughout, indicating that enough wealth and security could highly likely save lives. But as the salary and alcohol figures show, living standards were also likely on the rise for the middle and working classes, which could indicate that this did play a more noticeable role for the tuberculosis decline than the population density.

6.4 Final thoughts

Societal differences without a doubt played a considerable role in tuberculosis mortality in Tromsø from 1878 to 1920. If we compare two examples; the wealthy merchant in Sjøgaten, with a spacious, clean and warm dwelling, a mindful and varied diet and with several servants and workers to tend to every need, likely had a far better chance at avoiding infection and surviving it if it did occur. A fisherman's widow from a village, with several children, who might have lost all forms of income once her husband died, forced to work as a cleaning servant with the smallest, filthiest and coldest of dwellings, and only scraps of the cheapest

[293] See Figure 22 and analysis of results on page 84.
[294] See Figure 23 on page 89.
[295] See Figure 8a on page 47

and most easily available food to eat. She likely had a much higher chance of both infection and a much weaker immune system to fight it off once it occurred. If one of them were ever to die of tuberculosis, it is more than convincing enough that the widow would draw the short straw in nine out of ten scenarios, but that did not necessarily mean that the merchant, with all his resources was safe or immune to the bacteria.

Both the results of this study and the supporting literature shows that the factors that increase or decrease the chances of dying of tuberculosis were at the time various and complex. Therefore, there is an abundance of possibilities for future research in this field. A comparative study of two large port cities, with different industries from this period could certain shed light on the socioeconomic aspect. A study focused on migration of northerners or urbanising individual's mortality rate could perhaps solve the mystery of the north's high tuberculosis mortality rate.

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Appendices

Appendix 1. Excerpt from excel sheet for medical report number

	1875	1876	1877	1878	1879	1880	1881	1882	1883	1884	1885	1886
Befolkning i **Riket**	1807306	1829600	1839850	1865527	1891034	1 908 513	1913600	1912600	1914000	1923000	1938000	1954000
Totalt døde i **Riket**	33949	34607	31471	29694	28616	30 550	32427	35325	32834	31730	32111	31566
Døde av lungetuberkulose i **Riket**	2906	2182	2291	2237	2431	2607	2595	2649	2664	2619	2862	2701
Tilfeller av lungetuberkulose i **Riket**	4630	4950	5013	5277	5453	6120	5664	5716	5875	5556	6032	5844
Døde av tuberkuløs meningitis i **Riket**	342	441	409	468	513	501	559	619	539	526	610	631
Tilfeller av tuberkuløs meningitis i **Riket**	357	467	445	504	547	532	582	651	560	538	644	660
Døde av tuberkuløse betændelser og miliærtuberkulose i **Riket**												
Tilfeller av tuberkuløse betændelser og miliærtuberkulose i **Riket**												
Tilfeller av all tuberkulose i **Riket** (protokoller)												
Behandlede/tilfeller av all tuberkulose hos menn i **Riket**										2544	2796	2767
Behandlede/tilfeller av all tuberkulose hos kvinner i **Riket**										2975	3243	3115
Prosentvis lethalitet av lungetuberkulose i **Riket**	63 %	44 %	46 %	42 %	45 %	43 %	46 %	46 %	45 %	47 %	47 %	46 %
Prosentvis lethalitet av tuberkuløs meningitis i **Riket**	96 %	94 %	92 %	93 %	94 %	94 %	96 %	95 %	96 %	98 %	95 %	96 %

Appendix 2. Karlsen & Skogheim 1990 Table from p. 127

Tabell 1. Dødstal av tuberkulose i landet for menn og kvinner i dei ulike aldersgrupper 1871–1927.

Menn	Pr. 10 000 innbyggjarar													
	1871 –75	1876 –80	1881 –85	1886 –90	1891 –95	1896– 1900	1901 –05	1906 –10	1911 –15	1916 –20	1921 –25	1926	1927	1928
0– 1 år	68.6	64.1	70.4	58.1	61.9	60.1	49.1	34.9	29.4	24.1	22.1	20.8	24.4	16.0
1– 4 »	26.1	30.4	30.0	26.5	23.7	27.4	20.4	18.5	15.1	11.3	9.3	7.2	8.5	7.1
5– 9 »	12.9	11.5	13.4	12.8	12.5	15.0	11.9	10.3	8.6	7.7	5.9	4.8	5.4	4.6
10–14 »	8.6	9.1	10.6	10.5	11.9	14.5	13.0	11.6	8.7	8.6	7.3	5.2	3.9	5.2
15–19 »	15.4	22.0	22.7	21.1	25.2	31.9	30.9	28.9	27.2	26.6	22.9	16.4	16.9	12.8
20–24 »	32.8	37.6	41.2	40.0	46.5	50.4	49.5	45.8	48.8	49.3	43.8	35.5	35.6	28.6
25–29 »									43.6	41.2	37.0	35.6	31.4	32.1
30–39 »	27.7	28.4	30.6	28.9	33.5	36.0	32.4	31.2	29.0	28.4	25.2	21.1	22.8	22.0
40–49 »	21.7	23.9	23.9	23.4	26.5	27.0	26.0	23.2	22.0	21.1	17.7	17.6	15.6	14.8
50–59 »	24.0	22.9	22.2	21.6	27.6	28.1	23.7	23.4	21.9	18.6	15.9	15.3	14.3	13.2
60–69 »	26.3	24.8	22.1	21.8	29.8	29.6	26.4	24.0	21.7	19.6	18.5	16.0	15.4	15.7
70–79 »	22.8	16.2	25.1	17.5	21.1	22.8	17.4	19.0	18.1	15.4	14.6	13.1	12.3	13.6
80 år og derover	7.9	3.2	8.7	8.2	92	10.2	9.1	7.5	8.4	5.8	6.3	7.7	10.2	6.3
I alt	23.2	25.0	26.5	24.3	27.2	29.9	26.8	24.4	23.0	22.2	19.7	16.9	16.7	15.3

Kvinner	Pr. 10 000 innbyggjarar													
	1871 –75	1876 –80	1881 –85	1886 –90	1891 –95	1896– 1900	1901 –05	1906 –10	1911 –15	1916 –20	1921 –25	1926	1927	1928
0– 1 år	59.7	56.0	60.6	60.6	57.5	57.5	43.1	31.0	27.1	21.8	17.0	18.2	16.0	14.9
1– 4 »	27.4	28.0	29.8	24.0	23.8	27.3	20.9	16.2	12.6	11.7	8.9	8.0	8.3	7.4
5– 9 »	15.5	16.6	15.4	14.4	14.6	19.2	14.3	12.9	10.4	8.5	7.0	6.2	5.4	3.8
10–14 »	13.1	16.5	17.1	17.9	19.1	22.3	20.8	19.1	15.4	13.3	11.9	8.2	8.2	6.2
15–19 »	22.8	27.5	26.9	28.5	32.1	37.5	39.0	35.5	33.3	32.8	31.9	21.6	22.7	19.8
20–24 »	27.5	32.1	34.0	35.7	38.3	41.9.	43.8	43.9	40.6	40.7	42.0	34.5	30.6	29.2
25–29 »									39.5	37.5	36.6	31.5	31.8	32.6
30–39 »	30.3	34.0	37.9	37.3	39.2	41.1	40.4	38.5	33.6	31.8	25.7	21.5	21.7	20.8
40–49 »	29.7	28.7	31.6	28.3	32.4	31.8	30.4	27.9	25.4	22.9	18.1	15.0	15.7	15.8
50–59 »	27.4	25.8	27.4	24.7	26.4	28.9	25.3	23.8	19.3	18.9	15.7	12.1	14.9	11.9
60–69 »	38.7	23.8	31.0	23.0	27.6	29.3	24.4	22.4	19.5	16.9	15.3	14.3	15.3	13.3
70–79 »	18.6	16.8	24.3	18.8	25.4	24.8	18.3	19.9	16.7	14.4	14.5	11.8	15.2	13.3
80 år og derover	9.6	9.4	6.6	5.1	11.9	9.2	8.1	8.1	9.2	6.8	8.2	7.9	11.0	9.1
I alt	25.6	27.0	29.2	27.2	29.3	31.9	29.5	27.4	24.2	22.9	20.9	17.0	17.3	16.0

Appendix 3. Profession grouping

Justifying the profession grouping for those that are not entirely self-explanatory.

1. **“Smiths”** are here all craftsmen considered to work with primarily metals, like goldsmiths, tinsmiths, blacksmiths.
2. **“Other craftsmen”** is the grouping for any craftsmen profession with less than ten tuberculous dead that did not fit well with either of the other set groupings.
3. **Middle managers** are everything from managers in bigger enterprises to smaller entrepreneurs, in a way the private sectors bureaucrats.
4. **“Civil servants**” are public sector employees, and can be anything from a toll station supervisor to a policeman, and include various middle men positions in the municipality.
5. **“Clerks”** are any kind of more routine desk or counter jobs, be it in a shop, bank or telegraph.
6. **“Teachers and students”** could have been divided, and the teachers could be civil servants, but due to their number and the seminary producing new teachers annually, where most of these students are found, it was seen as purposeful to have a category for the learning institution.
7. **“Ship captains and mates”** could have been with the sailors or fishermen, but their somewhat higher status, education and often ownership of the vessels set them somewhat apart, in addition to their being enough for a separate group.
8. **“Engine men”** or machinists, as most of them are denominated as, are often unspecified, as there would be various differences between machinists on steam ships and in a factory, as such they were instead here assumed to be a group that is either a modern form of craftsmen or skilled workers, not really fitting perfectly with either.
9. **“Clothing crafters”** could have been craftsmen, if there were more of them, but the type of work tailors and seamstresses did seemed to have more in common with each other, than say tailors had with shoemakers, or seamstresses had with servants.
10. **“Workers”** are here any kind of workers, if so denominated, and a few others that do the same kind of simple physical labour, like stokers. This same isolation was done for

the worker selection, with the exception of excluding family members, simply selecting the male workers themselves.

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11. **“Servants”** are primarily household servants, but also include errand boys and other kinds of basic assistants and drivers. The same selection was taken for the servant girl data, except that only females that were specifically denominated as some form of household servant were included.

As for the craftsmen detail analysis; Bakers, Butchers, Shoemakers and all kinds of smiths, both black, gold, tin, copper, gun and watch makers.

Searching for the NAPPCODES: Like "88*" Or Like "873*" Or Like "8422*" Or Like "836*" Or Like "831*" Or Like "815*" Or Like "7762*" Or Like "773*"