SN 7390 - Disease in the Royal Navy during the Nineteenth Century, 1856-1898

Royal Navy data in the 19th century: Factors affecting data quality.

Contact address: Wellcome Unit for the History of Medicine, 4547 Banbury Road, Oxford, OX2 6PE

Between 1840 and 1899, the Admiralty produced annual Statistical Reports of the Health of the Royal Navy. Disease data was collected by medical officers on board Her Majesty's naval ships and relayed back to London, where it was condensed into general reports annually. These reports provide a longitudinal overview of health throughout the Royal Navy, covering almost 70 years. They are therefore a valuable resource for 19th medical history. This paper evaluates the a range of factors that impacted on the quality of this important dataset

Introduction

The data provides a quantitative record of disease in the Royal Navy from 1856 to 1898. During this time, disease was recorded by medical officers on board naval ships, and reported to London on a regular basis. Naval clerks would then condense these records into annual Reports on the Health of the Royal Navy. The data presented in these databases are gathered from these reports.

Database A: Diseases in the Royal Navy by geographical station

Time period: 1871-1898 (27 years).

Number of cases or respondents: The data are presented as summary statistics of entire naval stations, each of which included several thousand individuals (the average total size of the Royal Navy during the 19th century was 52000). There are 9 naval stations, which together reflect the entire British maritime empire.

Number of variables: Data is reported for each of the 9 stations. For each, 19 different disease categories are reported. Each of these categories is reported for morbidity, invaliding and mortality. In total, therefore, there are 46 variables for each of the 36 years.

Number and format of data files: This database consists of one data file in *Excel* format, containing 28 worksheets/28 files in *Tab delimited text* format.

Database B: Total force mortality disease and non-disease

This database presents mortality figures for the entire Royal Navy from 1856 to 1898. These are disaggregated by disease and non-disease causes.

Number of cases or respondents: Each statistic represents, on average, 52000 individuals.

Number of variables: 2 variables: disease mortality and non-disease mortality

Number and format of data files: 1 data file in *Excel*/*Tab* delimited text format

Introduction

In 1836, the Lords Commissioners of the Admiralty ordered the compilation of Statistical Reports of the Health of the Royal Navy (SRHN). Disease data was to be collected by medical officers on board Her Majesty's naval ships and relayed back to London, where it would be compiled into reports on an annual basis. Thus, the SRHNs provided an overview of the state of health throughout the Royal Navy. The first SRHN was published in 1840 and annual editions continued almost uninterrupted into the 20th century, except for a period between 1849 and 1856 as a result of resources being diverted to the Crimean war effort.[1] The first three editions (1840, 1841 and 1852) differed from subsequent editions by providing a retrospective of naval disease for the decade before 1840. Thereafter, the SRHNs reported disease data for their year of publication only. Considered as a whole, then SRHNs include almost 70 years of 19th century naval disease data, making it a potentially valuable resource for historical epidemiologists interested in the period. Moreover, the quantitative data is supplemented by qualitative description and explanatory notes, thereby providing valuable insight into some of the key factors underlying disease rates. The 'catchment area' of the data was incredibly broad: during the period, the Royal Navy (RN) enjoyed a near global presence, with the British maritime empire subdivided into a number of geographically defined Stations. These included the Home, Mediterranean, North American and West Indies, South East Coast of America, Pacific, China, East Indies, Australia, and West Coast of Africa and Cape of Good Hope Stations. The underlying structure of the SRHN reflects this geographical arrangement, with each Station being treated in a separate chapter. Additional chapters present data related to health in the Irregular Force (ships which traveled between Stations), Royal Marines embarked, and various naval dockyards and hospitals. Finally, there was an overview section considering the navy as a total force. Chapters all followed the same format and throughout the period there was very little variation to the layout and disease nomenclature, making for easy chronological and spatial comparisons. The reports therefore amount to a geographically extensive and longitudinally coherent record of nineteenth century disease in the RN and as such have great potential to contribute to 19th century historical epidemiology. While range and volume of the data are impressive, its quality and reliability is not self-evident. Historical quantitative data is subject to a range of potential pitfalls, not all of which are obvious. This paper aims to evaluate the SRHN data in light of these pitfalls, thereby throwing some light on its quality.

The paper will proceed with an overview of the SRHN data, after which they will be evaluated according to a range of threats to data quality. These include the introduction of bias as a result of the motivation behind its collection [2]; missing data and incomplete records [3]; problems with nomenclature [4]; accuracy in original data observation (diagnosis) [5]. Other

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[1] C. Lloyd and J Coulter, *Medicine and the Navy 1200-1900*, iv, (London, 1963), 273.

[2] G. Alter and A Carmichael, 'Studying Causes of Death in the Past: Problems and Models', *Historical Methods,* 29, (1996), 44-48.

[3] C. Mathers, 'Counting the dead and what they died from: an assessment of the global status of cause of death data', *Bulletin of the World Health Organisation,* 83:3, (2005), 171-177.

[4] G. Alter and A. Carmichael, 'Studying Causes of Death in the Past: Problems and Models', *Historical Methods,* 29 (1996), 44-48.

[5] S. Preston, *Mortality patterns in national populations*, (New York, 1976), 76
N. Williams, 'The Reporting and Classification of Causes of Death in Mid-Nineteenth Century England', *Historical*
F. Meslé, and J. Vallin, 'Reconstructing Long-Term Series of Causes of Death', *Historical Methods,* 29, (1996).

issues include subclinical diseases [6]; and recurrent disease.

Overview of the SRHN data

The creation of the SRHNs occurred within broader events in England and Europe. While the production of ledgers of disease, including quantitative data relating to disease had long since been collected by institutions prior to the mid 19th century, it was only during the first decades of the 19th century that it became possible to imagine sickness as being subject to statistical laws of nature.[7] Moreover, during this period it became increasingly possible to understand these laws of nature by investigating the accumulated numbers. As a result of this new found knowledge, a host of new bureaucracies emerged in order to collect information about populations and disease and deposit them into well organised data banks.[8]

This 'era of enthusiasm' ran from approximately 1830 to 1849, during which time public statistics attracted public interest to a high degree in many major European centres.[9] In England, civil registration of vital statistics was established, under the Registrar General; similar steps were taken in Denmark, France, Germany, Prussia, Holland and Norway. Several statistical congresses were also arranged in the European centres and statistical associations sprang up. In the subfield of vital statistics, the Registrar-General of England made headway in using quantitative data to explain epidemic phenomena. Furthermore, it is during this period that disease nomenclature was improved and the notion of cause of death much refined.[10] British administrative apparatuses were disinclined to integrate statistical knowledge and expertise into bureaus which depended on them. These existed, but they were far more scattered than in other European countries, such as France.[11] Beyond the administrative sphere existed another sphere of scholars and researchers and these two spheres remained autonomous but informed each other. The production of the SRHN data tables was therefore on a par with wide ranging developments across Europe, i.e., a belief that quantification could reveal the iron laws which controlled disease and facilitate their mastery.[12]

Each chapter of the SRHN is divided into three subsections reflecting three levels of disease severity - cases, invalidings, and deaths. Between 1830 and 1878, individual diseases were reported at the level of the ship, making the ship the unit of analysis. After 1878, diseases were reported at the level of Station, with only some disease rates being reported at the ship level; the rationale for this abandonment of detail was the result of the Parliamentary Committee on Official Statistics' move toward standardising tabulations and data across the services and the obvious irrelevance of ships in this scenario.[13] There is also, in each chapter, tabulations of absolute loss of service from disease and injury and average

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[6] J. Gay, 'Epidemiology Concepts for Disease in Animal Groups', retrieved 7 June 2013 <http://www.vetmed.wsu.edu/courses-jmgay/documents/GroupEpidemiologyConcepts.pdf>.
[7] I. Hacking, 'Biopower and the Avalanche of Printed Numbers', *Humanities in Society*, 5, (1982), 279-95.
[8] ibid., 286.
[9] H. Westergaard, *Contributions to the History of Statistics* (New York, 1932).
[10] ibid., 236.
[11] A. Desrosieres, *The Politics of Large Numbers* (Cambridge, Mass., 1998)
[12] E. Higgs, *Making Sense of the Census: The Manuscript Returns for England and Wales, 1801-1901*,(London, 1989)
[13] BPP, *Statistical Report on the Health of the Navy, for the year 1870*, in Navy (health) (ed.), (1872) , 15.

number of men sick daily on the respective Stations, together with the average number of men sick daily or inefficient from each disease and from injury separately. Each chapter contains additional non-disease information about the ships from which the disease data had been collected, including the number of guns, horse power, the period of time spent on Station, the average complement, and the mean force of each ship. Finally, an overview chapter is also provided, in which the navy was considered as a whole. In this chapter a number of aggregate statistics are presented for all Stations in the same table, making for easy comparison (Figures 1 and 2).

STATION.	Average Force.	Number of Cases of Disease and Injury.	Number of Cases per Man.	Number of Days' Sickness on Board.	Average Number of Men Sick Daily on Board.	Ratio per 1,000 of Force.	Number Discharged to Hospital.	Ratio per 1,000 of Force.	Number of Days' Sickness in Hospital.	Average Number of Men Daily in Hospital.	Ratio per 1,000 of Force.	Total Number of Days' Sickness.	Average Number of Men Sick Daily.	Ratio per 1,000 of Force.
Home - - -	22,100	19,892	·9	177,788	487·	22·	2,042	133·1	131,264	359·6	16·2	309,052	846·7	38·3
Mediterranean -	3,970	5,669	1·4	57,633	157·8	39·7	326	82·1	19,326	52·9	13·3	76,959	210·8	53·
North America and West Indies -	3,500	5,210	1·4	47,409	129·8	37·	547	156·2	18,572	50·8	14·5	65,981	180·7	51·6
South-east Coast of America - -	930	1,402	1·5	14,035	38·4	41·2	36	38·7	940	2·5	2·6	14,975	41·	44·

Figure 1

CAUSE OF INVALIDING.	Home.	Mediterranean.	North America and West Indies.	South East Coast of America.	Pacific.	West Coast of Africa and Cape of Good Hope.	East Indies.	China.	Australia.	Irregular.	Total.
I. General Diseases, Section A.:											
Enteric Fever - - -	-	-	-	-	-	-	2	-	-	-	2
Simple Continued Fever - -	2	-	3	-	-	1	-	3	-	-	9
Ague - - - - -	-	6	1	-	1	2	1	8	-	-	19
Remittent Fever - - -	-	1	-	1	-	18	11	6	-	-	37
Influenza - - - -	-	1	-	-	-	-	-	-	-	-	1
Erysipelas - - - -	1	-	-	-	-	1	-	-	-	-	2

Figure 2

The quantitative data contained in the various tables are complemented by qualitative descriptions. These aimed to provide additional insight into the tabulated data and describing the circumstances in which diseases were assumed to have arisen, the supposed cause of the diseases, the preventive and therapeutic measures employed, et cetera.

Pitfalls to data quality

Motivation of collecting body affecting data collection

Evaluation of historical data should include consideration of the motivation behind its collection, as this may introduce bias.[14] This 'motivational bias' may influence reported rates in that lower or higher mortality rates may promote certain agendas.[15] In the early editions of the SRHN, some political motivation is evident. In the 1850s, the immediate intention of the Admiralty was that the SRHNs would render cast naval life in a more salubrious light than its civilian equivalent and

[14] G. Alter and A. Carmichael, 'Studying Causes of Death in the Past: Problems and Models', *Historical Methods,* 29, (1996), 44-48.

[15] R. Becker, 'A method for deriving leading causes of death', *Bull World Health Organ,* 84:4, (2006), 297-304.

that this might

> disabuse the public mind…of many old and deep-rooted prejudices, and to show how carefully the comfort and well-being of seamen are studied, both by the makers and administrators of the law.

and show that naval seamen were in a more advantageous position than most other men who 'earned their bread by the sweat of their brow'.[16] The objective was to encourage citizens to join the RN, as it was understaffed at the time and the Admiralty had incentive to bias disease rates downwards. There were, however, powerful disincentives to intentionally bias the data: the Admiralty had a deep understanding of the potential for the data to clarify of a range of scientific challenges related to disease. These issues were of great importance in an era during which disease exacted a high toll on the RN and will have motivated for objective and unbiased data. The Admiralty clerks constructed a wish list of impending scientific revelations that the forthcoming data was to provide. These included guidance on 'what means were to be employed in order to prevent disease when men were placed in localities of a notoriously unhealthy character'; correct information regarding the origins of epidemics; an answer to their communicability; insight into the ongoing debate about whether disease originated from an inherently infectious character or from spontaneous generation; an exposition of the precipitating factors of disease, such as foul holds or other endemial causes of as yet unknown character; and a generation of knowledge about the possible risks run in certain geographic areas as opposed to others [17]

Most keenly anticipated were revelations about the role of climate and health in the production of disease, especially that of the Home Station relative to others - not because it was necessarily the healthiest climate but 'because its influence was more familiarly, however loosely, known'.[18] It was also felt that there was a 'general tendency to overestimate the benefits of the British climate', especially insofar as inter-tropical positions were concerned and to enhance the value of things which lay nearer and in possession to the disparagement of those which were distant and alien.[19] The South American climate, for example, exhibited better rates of health than the Home Station; a 'singular and unexplained power' which warranted extensive investigation, at least in its operation on board ship. This phenomenon exposed the ignorance that prevailed on the subject of medical climatology and suggested that 'much would have to be unlearned, as well as

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[16] Return to an order of the Honourable the House of Commons, dated 5 October 1841; for Statistical Report of the Health of the Navy, For the years 1830, 1831, 1832, 1833, 1834, 1835, and 1836, (In continuation of Parl. Paper, no. 159, ordered to be printed 24 March 1840.) Part II, (Cape of Good Hope and West coast of Africa, and East India commands, Home, and Various forces, together with the totals for seven years throughout the service.)', in Navy (health) (ed.).

[17] BPP, *Statistical Report of the Health of the Navy, for the years 1830, 1831, 1832, 1833, 1834, 1835 and 1836. (South American, West Indian and North American, Mediterranean and Peninsular commands.)*, in Navy (health), (30 March 1840), v

[18] BPP, *Statistical Report of the Health of the Navy, for the years 1830, 1831, 1832, 1833, 1834, 1835, and 1836, (In continuation of Parl. Paper, no. 159, ordered to be printed 24 March 1840.) Part II, (Cape of Good Hope and West coast of Africa, and East India commands, Home, and Various forces, together with the totals for seven years throughout the service.)*, in Navy (health), (5 October 1841).

[19] BPP, *Statistical Report of the Health of the Navy , for the years 1830, 1831, 1832, 1833, 1834, 1835 and 1836. (South American, West Indian and North American, Mediterranean and Peninsular commands.*, in Navy (health), (30 March 1840), 4

learned, before anything deserving the name of knowledge would be obtained on this subject'.[20] The question of how maritime and land-based rates varied and whether seamen in the RN were more prone to contracting certain types of disease than other civil or military communities was also considered to be of immense importance.[21] It was hoped that observing the effect of non-European climates on Europeans would provide insights into the relation between constitution, climate and disease would be forthcoming. [22] The Admiralty's awareness of these medical and scientific questions, and the high value they place on their resolution, suggest an incentive to collect data in a scientifically rigorous manner. It is therefore unlikely that a 'motivational bias' would have affected the data included in the reports, and by extension, the rates exhibited by disease.

Data collection and compilation of the SRHNs

Data quality may also, of course, been threatened by factors in play at the point of collection. The actual collection of the data was undertaken by the naval MOs, who were expected to direct their 'most zealous exertions in order to accomplish these tasks and to benefit the scientific branches of medicine'. [23] MOs were instructed to take advantage of their foreign deployments to obtain any medically relevant knowledge of the varied topographies of the ports and shorelines they visited. This included the nature of the seasons, the characteristics of the most prevalent diseases, the general method of treating them, and the history, properties, preparations and uses of the medicinal plants or productions. To this end, it was required that a 'rough and fair journal' and a sick book were maintained by the MO. [24] The daily sick book contained a list of those sick on board, as well as details of their complaints, treatment, et cetera. Every morning the sick book would be updated by the MO and would then be submitted to the Captain or Commanding Officer, along with suggestions for increasing the comfort and suitable accommodation of the sick. These records were, upon completion, transferred into the journal and both the journal and the sick books were forwarded to the Director-General on the 31st of December each year. [25] The MO was also required to compile a separate nosological return of the state of the sick, accompanied by an account of the various diseases, the state of the weather and climate, the average height of the thermometer, and 'every other circumstance that may have had an influence in promoting health or generating sickness in the ship's company'. [26] The compilation was submitted to the Captain for his information before being sent to the Director-General and Deputy Director-General. These nosological returns were submitted four times a year; at the end of March, June, September, and December. Finally, the MO provided a weekly return of the sick on board to the Captain or Commanding Officer.[27] There were in total, therefore, four separate returns maintained by the MO and which provided the bulk of the

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[20] BPP, *Statistical Report of the Health of the Navy, for the years 1830, 1831, 1832, 1833, 1834, 1835, and 1836, (In continuation of Parl. Paper, no. 159, ordered to be printed 24 March 1840.) Part II, (Cape of Good Hope and West coast of Africa, and East India commands, Home, and Various forces, together with the totals for seven years throughout the service*, in Navy (health), (5 October 1841).

[21] G. Longstaff, The recent decline in the English death rate considered in connection with the causes of death', *Journal of the Royal Statistical Society,* 47, (1884), 221-58.

[22] M. Harrison, *Climates and Constitutions: Health, Race, Environment and British Imperialism in India, 1600-1850*, (Oxford, 2002).

[23] H.M. Stationery Office, *Queen's Regulations and Admiralty Instructions for the Government of Her Majesty's Naval Service* (1861), Chapter LII, Section II, Article 40.

[24] ibid., Article 36.

[25] ibid., Article 32.

[26] H.M. Stationery Office, *Queen's Regulations and Admiralty Instructions for the Government of Her Majesty's Naval Service*, (1861), Chapter LII, Section II, Chapter LII, Section II, Article 31.

[27] ibid.

materials used in the compilation of the SRHNs. In addition to these documents there were various regularized returns that were drawn up. The first, submitted on an annual basis, exhibited the patient's name, the date of entry on the surgeons list, age, nature of disease or hurt, date of discharge from the list, and the issue of complaint whether in care, removal to hospital, invaliding, or death. The second return provided a more detailed view of the information contained in the first. In it, the names of patients were omitted but all cases of disease and injury were contained and arranged in a nosological table. This return was supplied at the end of each month from ships on the Home Stations and at the end of every three months from ships on foreign Stations. In the case of prevalent or of unusually fatal disease, returns were furnished more often. There was also information regarding the number of cases for each class, invalided, sent to hospital, dead, confined to bed, convalescent, under surveillance and remaining from the previous return. When considered alongside each other, these documents provided a wealth of information, including all the cases and their treatment, their terminations as well as the details regarding states of weather, degrees of temperature, the general interior economy of the ships, and whatever else may appear to be conducive to health or to disease. They formed an immense corpus when collected together. In 1856, for example, the forms and returns from the various Stations around the globe amounted to approximately 100 thick folio volumes. [28] These documents were distilled into the SRHNs. At times, however, clerks would make requests for yet more information from naval, military and colonial hospitals, and from sick quarters. Despite the size of the collection, the huge task of arranging and condensing them into a report was undertaken annually.

Incomplete returns

Incompleteness is another major problem when dealing with historical disease data. [29] In the SRHNs, missing data had several causes. Returns from ships were, at times, lost altogether due to shipwreck, or only partially recovered.
MOs would, of course, often fall ill themselves. In these instances, MOs would often die or be so incapacitated that they were not able to keep records. The recording of disease would then be interrupted until recovery was achieved or a replacement MO was found, sometimes only after the passage of weeks. The Admiralty clerks would, in these situations, simply strike the strength of the ship's company from the mean force of the squadron to which she belonged for the relevant period. It was felt that this would provide a just view, if not of the absolute amount at least of the ratios of sickness, death and invaliding. [30] It also happened (although relatively rarely) that returns would mysteriously vanish altogether en route to England or that they were so flawed as to be of little value. In the case of *Rosario*, for example, the clerks reported that the returns were so defective that no information was to be obtained in any form. [31] The returns could also be deficient reporting sudden or accidental deaths, deaths occurring in sick quarters, deaths while on detached service or deaths amongst those absent on leave. When a deficiency was discovered, the clerks would go to great

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[28] BPP, 'Session 2 Navy, Return to an order of the Honourable the House of Commons, dated 5 October 1841; for Statistical Report of the Health of the Navy, For the years 1830, 1831, 1832, 1833, 1834, 1835, and 1836, (In continuation of Parl. Paper, no. 159, ordered to be printed 24 March 1840.) Part II, (Cape of Good Hope and West coast of Africa, and East India commands, Home, and Various forces, together with the totals for seven years throughout the service.)', in Navy (health) (ed.), 4.

[29] C. Mathers, 'Counting the dead and what they died from: an assessment of the global status of cause of death data', *Bulletin of the World Health Organisation,* 83:3, (2005), 171-177.

[30] BPP, 'Return to an order of the honourable the House of Commons, dated 1 August 1872; for a Statistical Report on the Health of the Navy, for the year 1870.', in Navy (health) (ed.), (1873), 324.

[31] BPP, 'Statistical Report of the Health of the Navy,1871.', in Navy (health) (ed.), (1873), 333.

lengths to remedy the situation. In the returns from *Ferret,* for example, the clerks were surprised to notice the extraordinary number of twenty six cases of rheumatism appearing in the returns - surprising because *Ferret* was a small vessel and this many cases would have accounted for about a fourth of the total number entered on the sick books of the entire squadron for the year. The clerks concluded that this apparent anomaly could only be explained by supposing that the MO had taken little pains to enter the various diseases that came under his notice under their proper respective heads and as a result recalculated the entry. [32] In the first instance these kinds of errors would be corrected by the commonsense view of what was required and by comparisons with the journals, daily sick books and pay books (from which the number of men that had been lost could be ascertained). Recourse was also made to other authentic documents besides those specifically in the Medical Department. One non-medical document that was frequently made use of in the correction of mortality figures was the pay book which was deposited in the office of the Accountant-General. In the event of defective returns from a ship the entries in the pay books that made reference to the ship of interest were carefully examined and the name and rating of every man recorded as 'discharged dead' was extracted, together with the date of the death and any other information which might assist alleviating the defect. Once gathered from the pay book, this information was arranged in a tabular form according to the name of the dead and a blank column was inserted in which the disease or accident responsible would be entered by referring to the medical returns and hospital books. In this way, the one set of documentation was used to check against the other. When this proved inadequate, the clerks would write to the officers for explanatory information at a considerable sacrifice, in the clerks' view, of time and trouble. The comparison of the returns against many documents also meant that omissions or double entries of the same death were alleviated with a corresponding degree of accuracy being achieved. Having such a wide range of documents available to the clerks was, therefore, of great value in the reconciliation of discrepancies or in complementing deficiencies in reports. It was also an effective mechanism whereby clerks could increase their effectiveness in producing an accurate and reliable record of disease. It is evident that the Admiralty clerks invested a great deal of effort in rectifying instances of missing returns and made use of rigorous and standardized means to adjust the data when rectification proved elusive. It is therefore unlikely that missing data was a serious threat to data in the SRHNs.

Nomenclature

Another major challenge, when working with historical data, relates to how sense should be made of historical disease categories. Historical nomenclatures differ radically from those in use today and some commentators have voiced concern that it is not possible to adequately capture the meanings contained in historical medical terminology using today's terms.[33] Analysis of the SRHN data cannot, therefore, be attempted without an examination of this issue. Prior to 1869, the naval categorization of disease was disorderly and unreliable. Fevers, for example, had been classified by place-names, localities or native names (e.g., Walcheren Fever, Levant Fever, Pucca Fever, Gall-sickness of the Netherlands, etc.[34] The imposition of order on febrile terminology was only partially due to a standardised nomenclature.

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[32] BPP, 'Return to an order of the Honourable the House of Commons, dated 30 March 1840; for Statistical Report of the Health of the Navy, for the years 1830, 1831, 1832, 1833, 1834, 1835 and 1836. (South American, West Indian and North American, Mediterranean and Peninsular commands.)', in Navy (health) (ed.), 210.

[33] G. Alter and A. Carmichael, 'Studying Causes of Death in the Past: Problems and Models', *Historical Methods,* 29, (1996), 44-48.

[34] E. Parkes, 'Goulstonian lectures on Pyrexia', in W Aitken (ed.), *Science and Practice of Medicine*, (London, 1968), 49.

Improvements in medical technology, most notably the availability of the clinical thermometer and the ability to measure temperature accurately, was also an important factor in the bid to classify fevers uniformly.[35] The compilers of the SRHNs understood the value of maintaining longitudinal uniformity and the layout of the SRHNs was, on the whole, maintained throughout the period. Three revisions to the SRHN nomenclature did, however, take place during the period. The most significant of these was the introduction to the SRHN of a new *Nomenclature of Diseases* compiled by the Royal College of Physicians (RCP) in 1856 (Table 1).

	SRHN nomenclature 1869-1878
I	General Diseases, Section A.:
	Eruptive Fevers
	Continued Fevers
	Periodic Fevers
	Other Diseases
II	General Diseases, Section B:
	Rheumatism
	Syphilis, Primary
	Syphilis, Secondary
	Phthisis Pulmonalis
	Other Diseases .
III	Diseases of the Nervous System.
IV	Diseases of the Circulatory System
V & VI	Diseases of the Absorbent System and Ductless Glands
VII	Diseases of the Respiratory System
VIII	Diseases of the Digestive System
IX & X	Diseases of the Urinary and Generative Systems
XI	Diseases of the Organs of Locomotion
XII & XIII	Diseases of the Cellular Tissue, &c.
	Unclassed
	Poisoning
	Wounds and injuries

Table 1: Disease nomenclature

The 1856 introduction of the *nomenclature* revolutionized disease classification to such an extent that the continuity of data collected prior and subsequent to this date was rendered near impossible. Despite this, the Admiralty clerks held the view that 'any temporary disadvantages will be amply compensated for by the more scientific basis upon which the new classification is founded, and the greater precision of technical phraseology their adoption is likely to ensure for the future, in the numerous returns from which these Reports are compiled'.[36] The introduction of the RCP *nomenclature* indeed ensured that there was good continuity of disease data after 1869, although each revision nevertheless brought about minor changes in the number and definition of items, introducing a degree of disruption to the continuity of statistical series.

The SRHN made use of a symptom based nosology, in which diseases were classified according to the symptoms they exhibited. This system was often responsible for generating some confusion. While for the most part, a symptom based nosology was able to separate various diseases adequately, in certain areas symptomatologies overlapped, creating so-called ill-defined causes. [37] In 1853, for example, a number of instances of vomitus were reported which had been entered under the head of dyspepsia. The clerks later decided that these should have been returned as cases of

[35] L. Rogers, *Fevers in the Tropics: Their Clinical and Microscopical Differentiation Including the Milroy Lectures on Kala-Azar*, (London, 1908).
[36] BPP, 'Statistical Report of the Health of the Navy,1879.', in Navy (health) (ed.), 3.
[37] F. Meslé, and J. Vallin, 'Reconstructing Long-Term Series of Causes of Death', *Historical Methods,* 29, (1996).

diarrhea, in which vomiting was a symptom.[38] Also, some diseases that had similar symptomatologies were erroneously separated on the basis of the relative force of the symptoms. Examples are diarrhea, dysentery and cholera, which were separated only by the strength of their symptoms. So it was possible for the clerks to lament the difficulty of establishing the exact number of cases of cholera because when it prevailed epidemically it was

> invariably accompanied with a large proportion of slight cases, which are generally placed under the head of diarrhea, though the malady in these instances is as truly choleraic as that which blackens the blood and terminates existence in ten or twelve hours. [39]

This example highlights an obvious confounding variable to correct diagnosis, especially in the case of fever and digestive system diseases, i.e., the severity of the disease. Milder cases may be classified as different types than those to which more lethal cases were ascribed. In the case of fevers, there were no doubt incidents in which cases were returned as 'continued' when they were in all probability cases of 'remittent' or yellow fever. This issue was explicitly referred to in the case of an outbreak of fever in 1836 when it was reported that

> the disease occurred at the same time, was produced, there can be little doubt, by the same cause, and consequently had the same character, as in that ship; yet, showing the uncertainty of nosological distinctions, in one case the fever is termed remittent, and the other, continued.[40]

At times, the degree of confusion verged on absurdity. During the entire year of 1836, for example, there were ten cases of fever in *Fair Rosamond,* which were formally entered under the heads of intermittent, bilious remittent, synochus, ephemera, and typhus mitior. This was considered 'an apt enough illustration of an attempt to draw distinctions where there was no difference.' [41] Of course, the subsequent introduction of the *Nomenclature* did much to alleviate this confusion but it may have persisted in a less potent form nonetheless. The fevers were known to display a symptomatological divergence with increased severity and therefore became easier to distinguish with increasing severity. It was sometimes difficult, especially for the inexperienced, to distinguish the mild cases of the one from the severe cases of the other.

The diagnostic skill of naval medical officers

Change in disease rates may be also be the result of revised diagnostic practices.[42] It is therefore important to

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[38] BPP, 'Statistical Report of the Health of the Navy, for the year 1857.', in Navy (health) (ed.), 115.
[39] ibid, 160.
[40] BPP, 'Return to an order of the Honourable the House of Commons, dated 30 March 1840; for Statistical Report of the Health of the Navy, for the years 1830, 1831, 1832, 1833, 1834, 1835 and 1836. (South American, West Indian and North American, Mediterranean and Peninsular commands.)', in Navy (health) (ed.), 24.
[41] ibid, 71.
[42] S. Preston, *Mortality patterns in national populations*, (New York, 1976).

understand the diagnostic practices in place in the RN during the period, insofar as they impact on data quality. From 1858, the Admiralty insisted that in order to apply to be a medical officer in the navy, a candidate should be a registered practitioner of either medicine or surgery.[43] In addition, upon application candidates were examined by the navy in order to ensure sufficient quality. If successful, the candidate would undergo a course of practical instruction in Naval Hygiene at a military hospital which included diagnosis of diagnosis of exotic diseases such as paroxysmal fever.[44] The procedure of making a diagnosis is something that naval MOs would have been familiar with. Additionally, these measures will have promoted uniformity of diagnostic practice throughout the RN.

Additionally, some of the problems encountered by physicians when registering diseases in the civilian population were not encountered in the RN. For example, in the civilian population, information regarding the illness leading up to the death was often hard to come by. In addition, embarrassing terminologies were also often avoided in the presence of family members and finally inconsistency between physicians' and clerks' registration nomenclatures persisted.[45]

Subclinical cases

Subclinical cases are cases that are undetectable by clinical examination and are only detectable with specialised tests and the number of observed cases will almost always be lower than the actual (total) number of cases. With most diseases, if clinical cases are present in a group, there will also be subclinical cases present. Indeed, with many infectious agents, particularly if the disease is endemic, more of the infections in a group are subclinical than are clinical.[46] The cumulative effect, therefore, is one of significant underreporting of cases. The data contained in the SRHN necessarily represents the observed or diagnosed cases. The relatively crude observational aids available to the naval MO means that the reported disease incidence in the SRHN data is almost certainly below the actual levels present in the nineteenth century navy. As yet, the role of subclinical cases in historical data is poorly understood and certainly mean that diseases, especially infectious diseases, are under reported in the SRHN. There was, however, another factor that systematically resulted in the under reporting of cases, viz, the non-detection of observable cases. These cases, while being clinically observable, where simply overlooked by or remained unreported to physicians. The non-reporting of cases was a constant problem with land-based medical data, especially civilian data. Naval life, however, facilitated the observation of clinical cases. It was remarked that

> in the navy every case of sickness, no matter how slight, if it unfit the person for duty for one day only, must be entered on the sick list. This will account for the apparent excess of fever cases in the navy over the civil population, for a large proportion of the above were either of an ephemeral character, or mere

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[43] C. Lloyd and J. Coulter, *Medicine and the Navy 1200-1900*, iv 1815-1900, (London, 1963).
[44] H. Dickinson, *Educating the Royal Navy*, (Oxford, 2007).
[45] N. Williams, 'The Reporting and Classification of Causes of Death in Mid-Nineteenth Century England', *Historical Methods,* 29, (1996).
[46] J. Gay, 'Epidemiology Concepts for Disease in Animal Groups', accessed 7 June 2013 <http://www.vetmed.wsu.edu/courses-jmgay/documents/GroupEpidemiologyConcepts.pdf>.

> solitary paroxysms of irregular intermittent of a few hours' duration.[47]

Life on board a naval ship, with its many duties and intense teamwork, minimized the non-reporting or non-observation of clinical cases. There were essentially four avenues along which cases could be brought to the notice of the MO. The first of these was detection by the MO himself; living aboard the ship meant that the MO was constantly moving amongst the crew and was therefore able to detect a wide variety of diseases firsthand. This could be a passive vigilance, as on *Minotaur* on which all the gun-room officers were warned by the MO to show themselves immediately if they had any symptoms of catarrh or perceive any rash on the forehead or face.[48] The Regulations went so far as to specify that the MO should inspect the men in order to ascertain if they have any concealed diseases requiring treatment.[49] This was especially important in detecting diseases that would ordinarily be concealed, such as syphilis. In addition, the MO was directed to

> watch attentively every circumstance likely to affect the health of the ship generally. Should he suspect the presence of disease or indisposition in any man, he is at once to examine and deal with him accordingly.[50]

The second avenue for disease detection was self presentation, in which patients would present to the surgeon. This was, of course, the most typical route of disclosure; the third avenue was disclosure due to patients not being able to continue their duties. Finally, a third party would sometimes report a fellow shipmate's disease to the MO such as on *Asia,* when a seaman was found, by his messmates to be

> tossing about in bed, very restless, and unable to answer properly any question put to him, his memory appearing altogether to fail him after the first few words, and his speech becoming exceedingly incoherent'.[51]

The MO was notified and found that he was suffering from delirium tremens, which with the passage of time proved to be fatal. Under these conditions, it would have been highly unlikely for clinical cases *not* to have been detected by the MO. This was a very different scenario to that facing land based doctors, for whom cases often self-medicated or sought treatment outside the medical profession and thereby remained undetected. The RN would therefore had a much greater accuracy in the number of clinical cases reported than would the civilian medical apparatus.

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47 BPP, 'Return to an order of the Honourable the House of Commons, dated 30 March 1840; for Statistical Report of the Health of the Navy, for the years 1830, 1831, 1832, 1833, 1834, 1835 and 1836. (South American, West Indian and North American, Mediterranean and Peninsular commands.)', in Navy (health) (ed.), v

48 BPP, 'Return to an order of the honourable the House of Commons, dated 1 August 1872; for a Statistical Report on the Health of the Navy, for the year 1870.', in Navy (health) (ed.), 4.

49 BPP, 'Statistical Report of the Health of the Navy,1879.', in Navy (health) (ed.), 333.

50 BPP, 'Return to an order of the honourable the House of Commons, dated 1 August 1872; for a Statistical Report on the Health of the Navy, for the year 1870.', in Navy (health) (ed.), 4.

51 BPP, 'Health of the Navy, Return to an order of the Honourable the House of Commons, dated 31 July 1866; for a copy of the Statistical Report of the Health of the Navy, for the year 1863.', in Navy (health) (ed.), 18.

Recurrent diseases

Some diseases have the ability to cycle between symptomatic and asymptomatic manifestations. The nineteenth century medical profession was aware of this phenomenon, but it was poorly understood. Although MOs tried to distinguish episodes from unique cases, there was little scientific basis on which to do so. The possibility therefore exists that MOs registered different symptomatic periods as unique cases, resulting in an overestimation of the frequency of the relevant diseases. Malaria (then classified as remittent or intermittent fever) was an obvious disease in point. In 1894, for example, a small flotilla made up of *Herald, Adventure* and *Pioneer* returned twenty cases of ague and fifty six cases of remittent fever; the MO reported that several of the cases were recurrences in the same person.[52]

The use of post mortems in cause of death data

In the case of mortality, diagnoses were routinely verified by post mortem examination. The post mortem findings held higher authority than the clinical diagnosis and any discrepancy resulted in the latter being brought into line with the former. Such was the case on board *Rodney* in 1868, when the MO initially diagnosed a case as enteric fever, in the light of its characteristic symptoms but as no maculae could be perceived during post mortem, the MO did not enter them on his sick-list as cases of enteric fever.[53] Although it is not possible to know exactly what proportion of deaths were verified by post mortem examination, the practice of doing so no doubt increased validity. The guidelines for when to conduct post mortem examination were clear. Every death that occurred on board or on detached service or amongst men on leave was to be reported as along with the particular details of the circumstances of the death, and

> in all cases of sudden death, where there has not been any previous indisposition, the surgeon is, with the sanction of the commanding Officer, to examine the body, with a view to ascertain the cause of dissolution, a full and explicit report of which is also to be transmitted Great Britain. Admiralty, 1861, Chapter LII, Section II, Article 19.

If the examination of a sudden death revealed anything of a suspicious character, the MO was to immediately inform the Captain so that an inquest could be arranged. These factors suggest that mortality data was generally of a better quality than morbidity data.

Conclusion: Quality issues in the SRHN data

Suggesting that the data are of a particular quality is not the objective of this paper. Rather, the quality of the data depends on the purpose for which they are used, within the framework of strengths and weaknesses pointed out in this paper. This paper, therefore, aims to highlight the issues to be considered when the potential analyst evaluates their suitability for a particular analysis. Gaining insight into any historical data requires the examination of a range of issues,

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[52] BPP, 'Statistical Report of the Health of the Navy,1894.', in Navy (health) (ed.), 68.
[53] BPP, 'Return to an order of the honourable the House of Commons, dated 1 August 1872; for a Statistical Report on the Health of the Navy, for the year 1870.', in Navy (health) (ed.), 267.

and the SRHNs are no exception. Doing so is made difficult because by the incompleteness of the historical record. For this reason, where biases have been identified, it has not been possible to provide complete evaluations of these. A strength of the SRHN data is the high standard of medical education to which the MOs were exposed, suggesting a reasonable degree of validity to observations (within the nomenclature and idiosyncrasies of the day). It also suggests a high degree of uniformity to recordings in different localities and times, allowing for more comparisons across space and time. Comparability, which is arguably the most important property in longitudinal data, is further enhanced by the introduction of a uniform nomenclature in 1869 after which the data was no longer compromised by variations in encoding. Possibly the major weaknesses of the SRHN data are subclinical and asymptomatic cases, which pose a threat in terms of actual incidence and prevalence. Certain analyses will, of course, be affected by this data more than others: subclinical and asymptomatic cases do not generally affect mortality rates. Analyses investigating incidence and prevalence of disease would be most severely affected, in which non-observation of cases has a variable impact depending on the disease in question: those with very high case fatality rates (such as yellow fever or plague) would be less affected. The SRHN data were possibly less affected by these than most other 19th century databases, because of the close cooperation required on board and the constant presence of the medical officer around the men. The return of observations and compilation of reports by the Admiralty clerks appears to have been rigorous and reliable, especially by the standards of the day. A number of mechanisms were put in place in order to ensure a minimum of data error and loss and the lengths to which the Admiralty clerks went to identify and correct errors, to track missing returns and to cross reference findings ensured a good quality record. This effectiveness was no doubt enhanced by the disciplinary nature of the navy and its ability to enforce sanctions on MOs who failed in their duty to report diseases. Another major weakness of the SRHN data results from the use of the ship as the unit of analysis. Disaggregation to a finer level, within the SRHNs, is almost non-existent. While in some instances age tables are provided, more information would have been useful (e.g., rank (from which social class could be deduced); occupation; height, weight; etc.). The absence of these demographics severely restricts the questions that can be asked of the data and precludes much a finely textured epidemiological investigation. As was suggested previously, an attempt to arrive at an absolute indication of data quality in the SRHN data would be misguided. The final decision as to whether the data are of good enough quality remains with the analyst, who will have to evaluate the strengths and weaknesses in the light of their particular research question. Nonetheless, the SRHNs remain a rich source of data which is, as yet, largely untapped.

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