

# The Prevalence of Syphilis in England and Wales on the Eve of the Great War: Re-visiting the Estimates of the Royal Commission on Venereal Diseases 1913–1916

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**Summary.** Public fears of widespread venereal disease led in 1913 to the appointment of The Royal Commission on Venereal Diseases (RCVD). In 1916 its Final Report offered only a single cautious and somewhat imprecise summary statement about the likely prevalence of venereal diseases in England and Wales. Although the significance of contemporary attitudes to venereal disease has attracted a good deal of historiographic attention, no historian or demographer has since investigated this aspect of the Royal Commission's work. This article critically re-examines the most important quantitative evidence presented to the Royal Commission relating to the years immediately prior to the First World War. It utilises this evidence to produce new estimates of the probable prevalence of syphilis among adult males, both nationally and among certain geographical divisions and social groups in the national population; and also to offer a comment on the likely prevalence of gonorrhoea.

**Keywords:** venereal diseases; Royal Commission on Venereal Diseases 1913–1916; British History 1900–1920; syphilis prevalence; Wassermann Test; sensitivity and specificity; gonorrhoea

There can be no doubting the significance of venereal diseases in modern British historiography. The successful battle to repeal the Contagious Disease Acts, 1864–86, even as they were promulgated in many of the colonies, was a powerful engine of mobilization for Victorian feminism.<sup>1</sup> Other historians have shown that from the 1880s onwards linked concerns over venereal disease, white slavery and female dependence informed both the

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<sup>1</sup>J. R. Walkowitz, *Prostitution and Victorian Society: Women, Class and the State* (Cambridge: Cambridge University Press, 1980); P. McHugh, *Prostitution and Victorian Social Reform* (London: Croom Helm, 1980); F. Mort, *Dangerous Sexualities: Medico-moral Politics in England since 1850* (London: Routledge, 1987); F. B. Smith 'The Contagious Diseases Acts Reconsidered', *Social History of Medicine*, 2006, 3, 197–215; P. Baldwin, *Contagion and the State in Europe 1830–1930* (Cambridge: Cambridge University Press,

1999), ch. 5; P. Bartley, *Prostitution. Prevention and Reform in England 1860–1914* (London: Routledge, 2000) and on colonial proliferation see for instance: P. Levine, *Prostitution, Race and Politics. Policing Venereal Disease in the British Empire* (London: Routledge, 2003); P. Howell, *Geographies of Regulation: Policing Prostitution in Nineteenth-Century Britain and the Empire* (Cambridge: Cambridge University Press, 2009). For an introduction to some of the wider body of international historiography on venereal diseases in

moral purity and the female suffrage movements.<sup>2</sup> Meanwhile major scientific advances were changing medical perceptions, too.<sup>3</sup> After several failed attempts in 1913, leading feminist and medical figures successfully orchestrated an appeal to public opinion for a government enquiry, influenced as much by imperialist, eugenic and social hygienist fears of 'national deterioration' as by sympathies with feminist demands or preventive public health motives.<sup>4</sup> From the ensuing final recommendations of the Royal Commission on Venereal Diseases (RCVD) in 1916 emerged the highly significant public health and social policy innovation of a national network of clinics to provide the interwar population with free, no-blame treatment.<sup>5</sup> And in 1918 women got the vote.

Despite its increasingly well-researched and important place in the political, cultural, gender, feminist, public health and medical historiography of late Victorian and Edwardian Britain, demographic and epidemiological histories of this period do not address venereal diseases.<sup>6</sup> This is an embarrassing and unique silence for such a major disease with impacts on both mortality and fertility.

The RCVD's first terms of reference were: 'to inquire into the prevalence of Venereal Diseases in the United Kingdom'.<sup>7</sup> After 64 days of sittings; hearing evidence from 80 expert

Europe (and the British empire), see R. Davidson and L. A. Hall, eds, *Sex, Sin and Suffering. Venereal Disease and European Society since 1870* (London: Routledge, 2001).

<sup>2</sup>For instance, L. Bland, *Banishing the Beast: English Feminism and Sexual Morality, 1870–1914* (Harmondsworth: Penguin, 1995); S. K. Kent, *Sex and Suffrage in Britain 1860–1914* (London: Routledge, 1990).

<sup>3</sup>For a narrative history of venereology in Britain in relation to the principal international scientific advances, see J. D. Oriol, *The Scars of Venus: A History of Venereology* (Berlin: Springer Verlag 1998). For neurosyphilis, see J. D. Hurn, 'The History of General Paralysis of the Insane in Britain, 1830 to 1950' (PhD thesis: University of London, 1998); and Gayle Davis, *The Cruel Madness of Love: Sex, Syphilis and Psychiatry in Scotland, 1880–1930* (Amsterdam: Rodopi, 2008). On the changing context regarding germ theory, see M. Worboys, *Spreading Germs. Disease Theories and Medical Practice in Britain 1865–1900* (Cambridge: Cambridge University Press, 2000). See also Mary Spongberg, *Feminizing Venereal Disease: The Body of the Prostitute in Nineteenth-century Medical Discourse* (New York: New York University Press, 1997).

<sup>4</sup>L. A. Hall, 'Venereal Diseases and Society in Britain, from the Contagious Diseases Acts to the National Health Service', in Davidson and Hall, *Sex, Sin and Suffering*, 120–36, 122–4, 127. For helpful sketches of the appointed members of the Royal Commission, see R. Davenport-Hines, *Sex, Death and Punishment. Attitudes to Sex and Sexuality in Britain since the Renaissance*, London: William Collins and Sons, 1990), ch. 6; see also D. Evans, 'Tackling the "Hideous Scourge": The Creation of the Venereal Diseases Treatment Centres in Early Twentieth-century Britain', *Social History of Medicine*, 1992 5, 413–33, 414–16. On the

influence over the policy of 'National Efficiency' and racial deterioration fears, see: G. R. Searle, *The Quest for National Efficiency: A study in British politics and Thought 1899–1914* (Oxford: Oxford University Press, 1971).

<sup>5</sup>On the energetic public health administrative response to the recommendations of the RCVD, see J. M. Eyler, *Sir Arthur Newsholme and State Medicine 1885–1935* (Cambridge: Cambridge University Press, 1997), 277–94. The best study of the post-1918 era of venereal disease medicine and policy in Britain is: R. Davidson, *Dangerous Liaisons. A Social History of Venereal Disease in Twentieth-century Scotland* (Amsterdam: Rodopi, 2000); see also the related recent study addressing this period by J. Laite: *Common Prostitutes and Ordinary Citizens: Criminalization and Commercial Sex in London, 1885–1960* (Basingstoke: Palgrave, 2011).

<sup>6</sup>There is no mention of venereal disease in England and Wales in the standard demographic history of the period: R. Woods, *The Demography of Victorian England and Wales* (Cambridge: Cambridge University Press, 2000). Syphilis was only mentioned in passing in the influential T. McKeown, *The Modern Rise of Population* (London: Arnold, 1976); neither is venereal disease discussed in Anne Hardy's *The Epidemic Streets. Infectious Disease and the Rise of Preventive Medicine 1856–1900* (Oxford: Clarendon Press, 1993). However, A. Hardy, "'Death is the Cure of All Diseases": Using the General Register Office Cause of Death Statistics for 1837–1920', *Social History of Medicine*, 1994, 7, 472–92, 489–90, discusses the lack of reliable death certification.

<sup>7</sup>*Royal Commission on Venereal Diseases Final Report*, Cd 8190 (HMSO 1916), iii.

witnesses answering 22,296 questions transcribed in 758 pages of minutes plus 191 pages for 30 appendices, the Commissioners' response was cautiously, yet also somewhat imprecisely, stated as follows:

While we have been unable to arrive at any positive figures the evidence we have received leads us to the conclusion that the number of persons who have been infected with syphilis, acquired or congenital, cannot fall below 10 per cent of the whole population in the large cities, and the percentage with gonorrhoea must greatly exceed this proportion.<sup>8</sup>

It seems that demographic and epidemiological historians have been content to leave it at that. Consequently, this summary statement has often been repeated, but not critically re-examined.<sup>9</sup>

The purpose of this article is to re-visit the Royal Commission's enquiry, since it contains important investigative evidence about the likely prevalence of syphilis, which has not been subject to critical re-evaluation by historians. This was a propitious date to attempt to establish the disease's population prevalence. In 1906 a diagnostic test, the Wassermann complement fixation test, had been devised, so that measures of the disease's incidence had, in theory, become possible. Secondly, although effective treatment for syphilis was possible following the development during 1909–12 of the arsphenamine compounds, 606 and 914 (salvarsan and neo-salvarsan), by Ehrlich and Noguchi, the disease's overall prevalence was still unaffected by these developments as there were no government-funded clinics, while medical professionals had not yet begun to disseminate such treatment in the civil population.<sup>10</sup>

### The Official Epidemiological Evidence

The first witness called by the Royal Commission was Dr T. H. C. Stevenson, since 1908 Medical Superintendent of Statistics at the General Register Office of England and Wales, and the leading authority on the nation's official vital registration and census statistics.<sup>11</sup> Syphilis was a fatal disease for a proportion of its victims so official cause of death records, certified by trained doctors since 1874, might in theory have provided an index of its prevalence. Stevenson told the Commission, however, that certified deaths from syphilis were completely untrustworthy in this regard:

It is notorious that medical men do not—they simply cannot afford to—state such facts candidly on open certificates of cause of death handed to the relatives and copied on to public records carefully preserved for the information of any interested party. Letters

<sup>8</sup>*Ibid.*, 23.

<sup>9</sup>For instance, Walkowitz, *Prostitution*, 270, note 9; Baldwin, *Contagion*, 425; Davidson, *Dangerous Liaisons*, 36; and Hall, 'Venereal Diseases', 126.

<sup>10</sup>See A. Hanley, "'Scientific Truth into Homely Language': The Training and Practice of Midwives in Ophthalmia Neonatorum, 1895–1914', *Social History of Medicine*, 2013, doi: 10.1093/shm/hkt099. Only the medical professionals of the armed forces of several nations, including the Royal Navy, were as yet

beginning to take-up the new diagnostic tests and treatments systematically: RCVD, Q.360–1; 377; 425–7. At the end of the First World War mercury treatment was still common: J. E. Ross and S. M. Tomkins, 'The British Reception of Salvarsan', *Journal of the History of Medicine and Allied Sciences*, 1997, 52, 398–423.

<sup>11</sup>The Commission also took evidence subsequently from Dr J. C. Dunlop, the Statistical Superintendent

from medical men stating that this is the case have been preserved at the General Register Office for the past two or three years.<sup>12</sup>

Hence, most certified deaths from syphilis appeared to occur among workhouse, infirmary and asylum inmates, specifically among the illegitimate infants of single pauper mothers, where the doctor's potential income was unaffected by his certification choices.<sup>13</sup>

Stevenson did, however, offer the Commissioners a partial solution to this problem. There were three separate causes of death among adults which medical science had only recently come to realise were in fact almost exclusively due to syphilis in its tertiary stages. Quantitatively the most important was 'GPI', General Paralysis of the Insane, a degenerative condition of the brain, often certified by practitioners as 'general paralysis' or 'general paresis'.<sup>14</sup> Secondly, the related condition of, 'tabes' or 'tabes dorsalis' (also certified by its symptoms as 'locomotor ataxy'), a degeneration of the central nervous system. The third such cause of death was 'aneurysm', an arterial degeneration and rupture of the aorta.<sup>15</sup> There was as yet little professional reluctance to certify these three causes of death.<sup>16</sup> Consequently Stevenson offered the Commission a statistical analysis of these three syphilitic causes of death combined with syphilis itself, as a guide to the prevalence of venereal disease in the population of England and Wales.

However, it was Stevenson's firm (and correct) view that neither these three causes of death, nor 'syphilis' itself, either separately or in combination, could be reliably used to establish trends over time, nor as *absolute* measures of the overall prevalence of syphilis.<sup>17</sup> There was no known relationship between rates of infection and rates of death from the disease: it was only understood that an unknown fraction of those originally infected by syphilis subsequently died from one of these four causes of death.<sup>18</sup> The current incidence of these deaths could therefore only be used as approximate—but probably robust—indicators of patterns of *relative* prevalence: showing whether syphilitic disease was more or less prevalent among different sections of the populace, defined either socially or geographically.<sup>19</sup>

Even subject to these limitations, the possibilities were intriguing. Stevenson confessed that,

When I commenced ... to look into the figures, I was under the impression ... that the national statistics in regard to the diseases under the Commission's review were in large measure worthless. But the result of my study of the figures has been considerably to modify my opinion. I think that the figures probably bear some relation to the facts.<sup>20</sup>

<sup>12</sup>RCVD, Appendix 1, 71; and Q.183–197; 3231–3238.

See also Hardy, 'Death is the Cure', 389.

<sup>13</sup>RCVD, Q.17–18; 23; 27–8; 34–7; 58–61; 74–80.

<sup>14</sup>RCVD, Q.24; 42–5; 3239–54.

<sup>15</sup>RCVD, Q.51–4; 175. Whereas the other two diseases were entirely the product of tertiary syphilis, Stevenson believed this was probably true of about 80 per cent of deaths from aneurysm: RCVD, Q.3293; 3325.

<sup>16</sup>RCVD, Q.46, 3267; and Appendix 1, 72.

<sup>17</sup>RCVD, Q.3330. Both locomotor ataxy and GPI had only been classified as causes of death since 1901, while

aneurysm, though classified before 1901 had previously been less precisely defined.

<sup>18</sup>For the first empirical study, see: T. Gjestland, 'The Oslo Study of Untreated Syphilis: An epidemiological investigation of the natural course of the syphilitic infection based upon a re-study of the Boeck-Bruusgaard material', *Acta Dermatology and Venereology*, 1955, 35, Supplement 34. Gjestland found that 15 per cent of an untreated Oslo sample infected 1890–1910 subsequently developed fatal tertiary manifestations.

<sup>19</sup>RCVD, Q.29.

<sup>20</sup>RCVD, Q.20; a view repeated at Q.245.

**Table 1.** Death rates per million (age standardised) among men aged 15 and over in England and Wales in eight social classes: from causes of death certified as syphilis, locomotor ataxy, GPI and aneurism, 1911–1912

Class	Description	Death rate per million
Class I	Upper and middle class	302
Class II	Intermediate	280
Class III	Skilled working-class	264
Class IV	Intermediate	304
Class V	Unskilled working-class	429
Class VI	Textile workers	186
Class VII	Mining workers	177
Class VIII	Agricultural labourers	108
All classes		283

Source: RCVD, Appendix I, Table 3.

Note: The figures in Table 1 appear to show absolute rates per million for the eight classes of the population. However, these figures only have validity as *relative* values.

Stevenson had recently developed an official social classification scheme constructed by aggregating male occupations in five social gradings plus three others.<sup>21</sup> He used this to present an analysis of the four syphilitic causes of death, grouped together, which revealed a remarkable non-linear social pattern after age-standardisation.<sup>22</sup> As shown here in Table 1:

... syphilis is most prevalent amongst the highest and lowest of the five social classes dealt with, and the three great industries of textile manufacture, mining and agriculture are exceptionally free from the disease.<sup>23</sup>

It was well-known that venereal disease usually exhibited much lower prevalence in rural communities but regarding industrial communities engaged in textiles manufacture and coal-mining, 'It was a great surprise to us to find how free they are in comparison with the other working-class groups.'<sup>24</sup>

Stevenson judged it impossible with the official statistics at his disposal to go beyond such estimates of the *relative* prevalence of syphilis. Yet, as we have seen, the Royal Commissioners did venture a positive estimate of *absolute* prevalence, albeit expressed as a minimum figure of 10 per cent among a section of the national population, only—those in the largest cities. The Commissioners had of course also heard evidence from other witnesses and other sources of information on prevalence, such as asylum, workhouse or prison populations; those medically examined by the armed forces; or the clinical records of private practitioners or hospitals. However, the Final Report correctly recognized that virtually all such sources of evidence were fatally flawed for estimating population prevalence because they constituted unrepresentative, selected sections of the population.<sup>25</sup>

<sup>21</sup>On the origins and limitations of this classification system, see S. Szreter, *Fertility, Class and Gender in Britain 1860–1940* (Cambridge: Cambridge University Press, 1996), Part II, especially ch. 5.

<sup>22</sup>The importance for valid demographic comparisons of correcting for different age distributions of the adult

males in the eight classes was explained by Stevenson at RCVD, Q.3319.

<sup>23</sup>RCVD, Appendix 1, 75.

<sup>24</sup>RCVD, Q.3312.

<sup>25</sup>RCVD, Final Report, Section II 'Prevalence', 6–22.

Unfortunately, the Commissioners did not spell out in full the precise reasoning for the figure of 10 per cent. It seems most likely, from examination of the Commission's Reports, witnesses transcriptions and Appendices, that it was the results of two new studies specially commissioned for the official enquiry which may have encouraged them.<sup>26</sup> These two studies were each carefully designed, within the scope of the limited time and resources available, to provide reliable answers to questions about absolute prevalence which, as the Commissioners were aware, official statistics and other pre-existing evidence could not satisfactorily address.

### Wassermann Tests of Prevalence for the RCVD

The two specially commissioned studies presented the results of two sets of Wassermann Tests performed on serum extracts drawn from two quasi-random samples of urban adult males of known age and contrasting social status. The analysis was undertaken in the two leading contemporary research laboratories for Wassermann testing in England. In the London County Council's Central Pathological Laboratory (CPL), its director, Sir F. W. Mott, an appointed member of the Royal Commission, personally supervised the analysis of a series of 500 blood samples of 'the artisan class', provided by Sir John Collie (another Commissioner) from his medical practice.<sup>27</sup> Secondly, Dr Paul Fildes, working with James McIntosh, probably the leading Wassermann practitioner of his generation in Britain, in the Bacteriological Laboratory of the London Hospital, tested blood samples Fildes had collected from East Enders attending the London Hospital.<sup>28</sup> The results of these two studies can be re-interrogated today to re-evaluate the question of the prevalence of venereal disease in England and Wales on the eve of the Great War. Such re-analysis requires discussion first of the nature of the two samples and secondly the complexities of the Wassermann Test.

Sir John Collie was employed by the Metropolitan Water Board, the London County Council and other large companies to carry out medical examinations on job applicants and claimants for insurance compensation.<sup>29</sup> At short notice, he offered the Royal Commission the results of a sequence of 2,176 medical examinations from his practice over a period of 7.25 months.<sup>30</sup> Collie does not state where these men resided but there must be a virtual certainty that they were working in the London labour market where Collie practised. About half the caseload sequence related to 1,119 insurance cases; leaving 1,057 job applicants. It was this latter group, essentially a quasi-random sample of male Londoners who deemed

<sup>26</sup>RCVD, Final Report, 'Special Investigations', paras 44–47.

<sup>27</sup>Sir F. W. Mott, FRS, 1855–1926, Director of Medical Studies at the Maudsley Hospital and Director of the CPL, was the most eminent British scientist of his generation working on problems of mind and body, credited with having empirically demonstrated the syphilitic causation of GPI. See Hurn, 'The History of General Paralysis', ch. 3; S. Mathews, 'Matter of Mind: The Contributions of Neuropathologist Sir Frederick Walker Mott to British Psychiatry, c.1895–1923' (PhD thesis: University of Manchester, 2006), esp. ch. 6.

<sup>28</sup>McIntosh had been an invited researcher at the leading laboratory of Elie Metchnikoff, joint winner with Ehrlich of the 1908 Nobel prize in Medicine for pioneering immunology. McIntosh and Fildes had been chosen by Prof William Bulloch, head of the London Hospital Laboratory, to perform the first tests on the new drug for treating syphilis, Salvarsan (606), when Bulloch was sent a sample by his friend, Ehrlich: 'Paul Gordon Fildes', *Biographical Memoirs of the Fellows of the Royal Society*, 315–47, 322.

<sup>29</sup>Sir John Collie Obituary, *BMI*, 1935, April 13: 1 (3875), 807–8.

<sup>30</sup>The study was undertaken during late 1913 and the first half of 1914: RCVD, Q.17,541.

themselves fit for work, which provided the basis for the selection of 500 blood samples which Collie passed on to Mott's laboratory for Wassermann testing. Collie also provided the extremely important, ancillary 'stratifying' information: that they averaged 30–33 years of age (and all were over age 21); nearly all were married; and 'all cases belonged to the same social stratum', namely 'of a somewhat superior artizan class' [sic].<sup>31</sup>

In the second special study, Dr Fildes performed Wassermann Tests on serum samples he took from 616 male patients attending the London Hospital in Whitechapel from 11 May to 2 July 1914 for conditions entirely unrelated to venereal diseases. The majority of those tested were residents of the adjacent East End metropolitan boroughs with a few from the Essex suburbs. That these patients hailed predominantly from the more humble reaches of the working-class was confirmed by the fact that one-fifth were 'aliens', meaning the recently immigrant Jews.<sup>32</sup> The ages of the men tested were very similar to Collie's study, with most aged 19–58 and a median age of 34–38 years.

Both the Mott/Collie and the Fildes/McIntosh studies were presented to the Royal Commission as exercises to demonstrate the quantitative extent of syphilis in the ambulatory, 'healthy' general population, as a contrast to various flawed previous estimates from the early literature of Wassermann testing, which tended to be derived from highly selected groups of patients.<sup>33</sup> Consequently they each deliberately excluded all cases who, in their respective medical experience, were judged to be manifesting possible symptoms of syphilis. Fortunately, they both included enough details in their reports to form a quantitative estimate of the numbers thereby excluded, as shown below.

What follows is an exercise in the re-interpretation and technical correction of the results of these two sets of Wassermann Tests. The accuracy of the Wassermann Test has always been a matter of legitimate scientific debate.<sup>34</sup> There were high stakes involved in the science and politics of Wassermann testing, which spread rapidly and internationally after 1906. A mistaken initial belief by Wassermann that it tested specifically for antibodies

<sup>31</sup>This is Collie's own description, Appendix XIII, 141. At one point the Commission's Chairman, Lord Sydenham, described Collie's sample as 'the pick of the unskilled labour classes'. Collie immediately corrected Sydenham: 'Yes; that is to say the better class of working men'. It seems clear that Collie did mean the skilled working-class or 'artizans', characterising the class of workmen he examined, as suffering less from venereal disease than 'a wider class of the labouring population': RCVD, Qs.17,564–5.

<sup>32</sup>RCVD, Appendix XII, 139. The infection rates of Jews and Gentiles were found to be virtually identical, confounding a long-standing belief that circumcision protected Jews from syphilis. See R. Darby, "'Where Doctors Differ": The Debate on Circumcision as a Protection against Syphilis', *Social History of Medicine*, 2003, 16 57–78, 58–67.

<sup>33</sup>The reasoning behind this decision was only explicitly spelled out in a subsequent official publication of 1918, reflecting on Fildes' work for the RCVD: see Medical Research Committee, Special Report No. 21, *The Diagnostic Value of the Wassermann Test* (1918), 11. Both Fildes and Collie seem to have only

belatedly appreciated that to exclude systematically all patients with suspected syphilis in fact constituted an inverse form of selection, which biased their results towards under-statement of the incidence in the 'general population'; but they did not attempt to make the appropriate corrections to their raw results, which are now undertaken, below, in this article.

<sup>34</sup>For the clearest and most up-to-date exposition of the Wassermann Test, its practical complexities and theoretical flaws, see: H. Van den Belt, 'The Collective Construction of a Scientific Fact: A Reexamination of the Early Period of the Wassermann Reaction (1906–1912)', *Social Epistemology*, 2011, 25, 311–39, especially 317–22. See also A. M. Brandt, *No Magic Bullet: A Social History of Venereal Disease in The United States since 1880* (Oxford: Oxford University Press, 1987), ch. IV, 147–54; and I. Lowy, 'Testing for a Sexually Transmissible Disease, 1907–1970: The History of the Wassermann Reaction', in V. Berridge and P. Strong, eds, *AIDS and Contemporary History* (Cambridge: Cambridge University Press, 1993), 74–92.

to the syphilitic organism, *Treponema pallidum*, was nevertheless followed by rapid practical development by many researchers to improve the test, despite acknowledgement that it was a non-treponemal test (i.e. it did not test for a specific treponemal antibody but apparently for certain other direct consequences of the spirochete's presence within the body). During the interwar years there were a series of international efforts to standardize the Wassermann Test or to devise technically less complex alternatives with more easily interpretable results. In the UK the new MRC (Medical Research Committee, which became the Medical Research Council) was an early sponsor.<sup>35</sup> With the promise of international kudos for the scientist who could produce a truly standard test for syphilis for mass dissemination, there were intensely competitive claims and counter-claims for different methods and a series of sharply contested international trials.<sup>36</sup>

For the medical profession the propensity of the Wassermann Test—or any alternative—to produce any false positives at all was—perfectly understandably—a primary focus of concern, since its members were at the sharp end of telling individuals they had a socially-unacceptable disease.<sup>37</sup> False negatives were, of course, also a serious problem, apparently bringing into question the test's reliability for the routine work of diagnosis and evaluation of treatment.<sup>38</sup> National and international evaluations mounted during the interwar years produced inconclusive, widely varying and contested results.<sup>39</sup> They all confirmed one cardinal fact about the Wassermann Test: as a multi-stage, protracted complement fixation test involving five reagents from different animal species, its capacity to give consistent results even within a single laboratory depended critically on the training, dedication and conscientiousness of the technicians, and the highest standards of uniform laboratory conduct were hard to ensure.<sup>40</sup> Consequently, each laboratory was likely to have its

<sup>35</sup>Medical Research Committee, *The Diagnostic Value; Medical Research Council Special Report No. 78, The Serum Diagnosis of Syphilis. The Wassermann and Sigma Reactions Compared* (HMSO 1923).

<sup>36</sup>See P. Mazumdar, "'In the Silence of the Laboratory': The League of Nations Standardizes Syphilis Tests', *Social History of Medicine*, 2003, 16, 437–59.

<sup>37</sup>As Hazen put it, reporting on the evaluative work of a US Public Health service committee, '[it] feels very strongly that any test which fails to show a rating of over 99 per cent specificity [i.e. less than 1 per cent false positives] should be corrected, as it is believed that a false diagnosis of syphilis is ... "a major calamity":' H. H. Hazen, 'The Serodiagnosis of Syphilis', *The Journal of the American Medical Association*, 1937, 108, 785–88, 786.

<sup>38</sup>L.W. Harrison, *The Diagnosis and Treatment of Venereal Diseases in General Practice*, 3rd edn (London: Oxford University Press (Oxford Medical Publications), 1921; 1st edn 1918), 266–9.

<sup>39</sup>Mazumdar, "'In the Silence'", 450–2, notes that at the 1928 League of Nations conference, the Wassermann Test appeared to miss over 40 per cent of those samples known to be syphilitic and even the Kahn test missed over 30 per cent. However, the validity of

these tests was itself soon discredited. Harry Eagle, Assistant Surgeon in the US Public Health Service, subsequently stated that two major comparative testing exercises mounted by the US Public Health service in 1934 and in 1935–6 were conducted with 'the hope of introducing some order into the confusion' because: 'All three conferences [of the League in 1923, 1928 and 1930] were open to serious criticism on several grounds.' H. Eagle, *The Laboratory Diagnosis of Syphilis. The Theory, Technic and Clinical Interpretation of the Wassermann and Flocculation Tests with Serum and Spinal Fluid* (London: Henry Kimpton, 1937), 365. He was not alone in criticizing the League's tests: for instance, R. Gilbert, 'Standardisation of the Wassermann Test', *American Journal of Public Health*, 1930, 20, 47–8.

<sup>40</sup>'A Wassermann technician becomes entirely reliable and self-sufficient only after years of training', Eagle, *Laboratory*, 361; 'Wassermann Tests ... should not be left to laboratory assistants, however skilled ... the responsible pathologist, on every occasion ... should ... inspect the reactions ... and be directly and personally responsible for the reports made', National Health Insurance Special Report Series no.21 'The Wassermann Test (Interim Report)' (1918), 8.



own signature pattern of results, consistent within itself but not necessarily reproducible elsewhere.<sup>41</sup> Nevertheless, and despite his pride in his own 'Eagle' variant of the alternative flocculation test, the leading US authority, Harry Eagle, was prepared as late as 1937 to acknowledge that the Wassermann Test should, on balance, be retained since there was still no all-round superior alternative, provided it was performed in efficient laboratories.<sup>42</sup> The acknowledged shortcomings in the Wassermann Test's accuracy and comparability ensured they were never relied upon, alone, by wise physicians. These widespread and fraught debates during the interwar decades, also attracted the attention of Ludwik Fleck, whose highly influential study originally published in 1935, has resulted in the Wassermann Test acquiring an enduring reputation among historians and sociologists as the paradigm example of the socially-constructed nature of a putatively positivist scientific fact.<sup>43</sup>

However, a close reading of the critical and epidemiological literature indicates that the results of Wassermann Tests performed on ambulant, not otherwise-diseased groups of male adults mostly aged 19–58 years in Britain c. 1913–14 by these two leading research laboratories may be utilised as sources for deriving valid estimates of the absolute rates of prevalence of the disease. The central puzzle of the Wassermann Test's immunological non-specificity, emphasized by Fleck in 1935, was clarified in 1942 when Mary Pangborn was able to demonstrate that the Wassermann reaction in the serum of syphilitic patients was provoked by a phospholipid, which she named cardiolipin.<sup>44</sup> While confirming this is not part of an immune response, the intriguing and unexpected property of cardiolipin is that it is found both in the syphilis spirochete and also as a constituent of normal host tissues. This is why tissue damage by certain other diseases, notably those inducing fevers such as malaria, measles, pneumonia, but also certain transient body states (including pregnancy and even certain aspects of ageing processes in those over 60 years old) could sometimes produce 'false positive' Wassermann reactions. However, in the absence of such conditions and fevers, the reaction was more invariably due solely to the phospholipid associated with the spirochetes. Thus, following a table listing the many possible conditions that can give false positives, McFalls and McFalls nevertheless conclude, 'Normal, healthy individuals rarely (less than 0.1 per cent) give a false-positive reaction.'<sup>45</sup> It is, thus, particularly

<sup>41</sup> 'Every test for syphilis, however sensitive and however specific it may be under ideal conditions is limited in actual performance by the capacities of the individual who carries it out', Eagle, *Laboratory*, 376.

<sup>42</sup> Eagle, *Laboratory*, 361–4.

<sup>43</sup> Ludwik Fleck, *Genesis and Development of a Scientific Fact*. (Chicago: University of Chicago Press, 1979); first published in German in 1935. For an endorsement of Fleck's approach, see Lowy, 'Testing'. For a respectful but rather more critical recent account, see: van den Belt, 'The Collective Construction of a Scientific Fact'.

<sup>44</sup> On this see Van den Belt, 'The Collective Construction of a Scientific Fact', 322.

<sup>45</sup> J. A. McFalls and M. H. McFalls, *Disease and Fertility* (New York: Academic Press, 1984), 345. Their judgement is confirmed by W. J. Brown *et al.*, *Syphilis and Other Venereal Diseases* (Cambridge, MA: Harvard University Press, 1970), 32, who in fact cite figures of 0.025 per cent from empirical evaluations including

Wassermann Tests, completed in the 1940s and 1950s, such as those of J. E. Moore and C. F. Mohr, 'Biologically False Positive Serologic Tests for Syphilis', *JAMA*, 1952, 150, 467–73, 468. These conclusions appear to be at variance with Lowy, 'Testing', 84, citing both Moore and Mohr and N. J. Fiumara, 'Biologic False Positive Reaction for Syphilis', *New England Journal of Medicine*, 1963, 268, 402–5. However, the latter was a study of a highly-selected sub-set of all syphilitic cases seen in Massachusetts state between 1954 and 1961. They were 1,000 unusual problem cases for diagnosis, only one-fifth of which were confirmed by treponemal tests to be false-positives, representing, therefore, a minuscule proportion of all those originally tested, from which the 1,000 had been selected. Hence, this study's findings are in fact statistically entirely consistent with the conclusions of McFalls and McFalls and Brown *et al.*

fortunate for the exercise reported here that both Collie and Fildes performed their Wassermann Tests only on ambulant 'healthy' (non-feverish) groups of adult males aged under 60 who were rather unlikely, given the selection criteria applied in each study, to be suffering from any of the conditions which occasionally produced false positives.

Appropriate allowances do need to be made for the characteristic deficient sensitivity and specificity of these two laboratories' practices. Sensitivity and specificity were already familiar concepts when Wassermann testing commenced but had not yet acquired their probabilistic formulation in clinical epidemiology in a manner which would have enabled interwar testers to calibrate statistically the inaccuracies in their results in a more productive manner, rather than seeing them primarily as undesirable forms of 'error'. Utilising the epidemiological concepts of sensitivity and specificity as a method of correction for known inaccuracy in test results in no way discounts or sidesteps the seriousness for individual patients and medical practitioners in the past of these shortcomings of the Wassermann Test. Rather, the point is that information about the scale of those shortcomings can be used retrospectively to produce a valid, appropriately adjusted statistical measure of prevalence in the populations tested, provided there is also evidence available on the characteristic shortfalls in sensitivity and specificity occurring at these two laboratories.

A test with 100 per cent sensitivity correctly identifies all patients *with* the disease. A test with 80 per cent sensitivity detects 80 per cent of patients with the disease (true positives) but 20 per cent with the disease go undetected (false negatives). Thus, if a disease, like syphilis, is affecting approximately, say, 10 per cent of a population of 1,000 persons, then a test with a sensitivity of 80 per cent will correctly identify 80 of the 100 cases who truly have the disease while generating 20 false negatives. Conversely, a test with 100 per cent specificity correctly identifies and excludes all patients *without* the disease. A test with 80 per cent specificity correctly reports 80 per cent of patients without the disease as test negative (true negatives) but 20 per cent of patients without the disease are incorrectly identified positive (false positives). In the same hypothetical population of 1,000 in which the disease affects 10 per cent, a test with 80 per cent specificity will correctly identify 720 or the 900 people who do not have the disease but will also generate 180 false positives. As can be appreciated, since it is the case with many diseases, including syphilis, that they affect only a minority of the population, a test's deficient specificity will require a rather greater degree of quantitative correction than the same proportionate degree of deficiency in its sensitivity. The question, therefore, is what were the sensitivity and specificity characteristics of the Wassermann Tests run for the RCVD at the CPL and the London Hospital laboratories?

Through controlled trials on Salvarsan treatment McIntosh and Fildes developed a standard method for performing the Wassermann Test after evaluating various alternatives, finding that the new Sachs' method of cholesterinised human heart extract for the antigen in the reaction produced the most reliable results.<sup>46</sup> In 1913 Fildes and McIntosh published a detailed, 60-page account of their procedures including an evaluation of the results achieved with this antigen on a subset of serum samples drawn from individuals known to have 'clinically certain' syphilis. In this exercise McIntosh and Fildes could identify and measure the false negatives among their Wassermann Test results. This shows rates of sensitivity of 99 per cent and

<sup>46</sup>J. McIntosh and P. Fildes, 'An Investigation of the Value of Certain Antigens for Use in the Wassermann

Reaction, in Particular of Sachs' New Antigen', *Zeitschrift für Chemotherapie*, 1912, 1, 79–93.

97 per cent for secondary and tertiary syphilis, respectively, with an expected somewhat lower rate, 93 per cent, for primary syphilis (and 100 per cent for congenital cases).<sup>47</sup> These performance figures correspond to an average sensitivity of 97.25 per cent on samples drawn at random from adults in their mid-thirties as was the case in the Special Study of East Enders.<sup>48</sup>

Fortunately there is comparable information available on the sensitivity levels in the Wassermann Tests performed at the PLC. Taking note of McIntosh and Fildes' recent results, the superior cholesterinised heart antigen was also being used there.<sup>49</sup> Dr J. P. Candler and Sydney Mann (who had been appointed in 1901 as Mott's biochemical assistant and in 1921 became Deputy Director) reported results of tests on 186 blood serum samples from a set of certified GPI cases (which should all have tested positive). This showed that 175 cases (94.1 per cent) tested positive; a figure that increased to 97.8 per cent (182 cases) after a repetition of the test, thereby even surpassing the sensitivity rate of 97 per cent for tertiary cases reported by McIntosh and Fildes.<sup>50</sup> However it is specifically noted by Collie in his evidence that only a single Wassermann Test was performed on his sample.<sup>51</sup> If Mott's laboratory was capable of finding 94.1 per cent positive tertiary cases with a single testing process while Fildes' was finding 97 per cent, that indicates 2.99 percentage points (equating to 3 per cent) less accuracy at Mott's laboratory than at Fildes'. Accordingly, Mott's laboratory would have achieved an overall sensitivity in its Special Study for the RCVD of 94.33 per cent for its sample of men aged in their mid-thirties (i.e. 3 per cent less than the sensitivity value of 97.25 per cent calculated for Fildes' Special Study).<sup>52</sup>

There is insufficient comparable and detailed published evidence to derive a secure empirical estimate of the specificity of each of these two laboratories' testing procedures. There have, however, been recent rigorous evaluations published of the sensitivity and specificity characteristics of a range of non-treponemal tests.<sup>53</sup> This indicates that in such tests

<sup>47</sup>P. Fildes and J. McIntosh, 'The Wassermann Reaction and its Application to Neurology', *Brain*, 1913, 36, 193–254, 219. These results are also briefly discussed by the certifying clinician, Dr J. H. Sequeira, dermatologist at the London Hospital: at RCVD, Qs. 14, 343–50. It was well-known that the Wassermann Test was least effective in identifying the infection during the first two weeks of the primary stage as it was considered a test dependent on the proliferation of the syphilitic spirochaetes in the infected individual.

<sup>48</sup>These three different rates can be converted into this average figure by multiplying them by appropriate factors to represent the differing chances that an individual tested on average in their mid-thirties in 1913–14, would have been in each of the 3 stages, assuming on average most would have contracted the disease about 10 years earlier in their mid-twenties: 1 month in the primary stage; 17 months in the secondary stage; and 102 months in the latent or tertiary stages. This produces an average figure of 97.25 per cent =  $[(93 \times 1) + (99 \times 17) + (97 \times 102)] / 120$ .

<sup>49</sup>On Mann, see Mathevs, 'Matter', 130. J. P. Candler and S. A. Mann, 'The Wassermann Reaction in the Diagnosis of Mental Disorders', *Archives of Neurology and Psychiatry*, 1914, VI, 61–75, 61.

<sup>50</sup>*Ibid.*, 64.

<sup>51</sup>RCVD, Collie's 'Supplementary Note' after Q.17,611. Mott, however, stated: 'in the case of Sir John Collie's cases I saw every positive reaction myself and was repeated to be certain', RCVD, Appendix XV, 143. While this would have been an extra check reducing the number of false positives, it would not have enhanced sensitivity by diminishing the (potentially larger) number of false negatives.

<sup>52</sup>In a subsequent wartime study when Fildes was a Staff Surgeon at the Royal Naval Hospital, Haslar, his Wassermann Tests on an unselected series of 1,414 initial admissions to the hospital produced comparable sensitivity results of 72.7 per cent on primary cases, 99.7 per cent on secondary cases and 94.7 per cent on latent and tertiary cases. The lower figure for primary cases was due to the Navy's efficiency in promptly sending infected men to the hospital within the first 2–3 weeks of infection. MRC, Report No. 21 *The Diagnostic Value*, 13.

<sup>53</sup>S. Larsen, B. Steiner and A. Rudolph, 'Laboratory Diagnosis and Interpretation of Tests for Syphilis', *Clinical Microbiological Review*, 1995, 8, 1–21, 6. Treponemal tests, developed since the 1940s, directly measure the presence or absence of specific antibodies to the

specificity values tend to be about 2.93 percentage points higher than sensitivity values.<sup>54</sup> Such a differential would therefore indicate values of sensitivity and specificity of 97.25 per cent and virtually 100 per cent, respectively, for the Fildes study; and 94.33 per cent and 97.094 per cent for the Mott study. In relation to the laboratory of McIntosh and Fildes, there is confirmatory, positive evidential support for an estimate of 99.7 per cent for specificity.<sup>55</sup>

### The RCVD's two Special Studies

Collie's report details that precisely 500 serum samples from the 1,057 male job applicants were submitted to a Wassermann Test. They 'were taken consecutively as they presented themselves for examination, and no selection was made except that working-class people over 21 years of age only were chosen'; and they were 'cases of those apparently in perfect health (as evidenced by a thorough physical examination)'.<sup>56</sup> Thus, these 500 are in fact a pre-screened group. During his questioning as a witness Collie specified that the number he had removed due to suspected venereal disease was 'about 5 per cent'.<sup>57</sup> A rejection rate of 5 per cent would imply a little over 50 cases 'rejected' from the original total of 1,057 on the basis of their physical examination. Collie in fact detailed 60 cases of venereal disease that had been diagnosed by his clinical examination (those 'where clinical evidence was alone relied on').<sup>58</sup> He states that four (only) were gonorrhoea cases and the other 56 were all syphilis cases. Thus, Collie had examined 1,057 non-insurance persons, while excluding 56 (5.3 per cent) as manifest syphilitics (plus one of the four gonorrhoea cases—the other three must have come from the rather different examinations he performed on the 1,119 insurance cases). This screening effect would mean that whereas Collie reported 46/500, or 9.2 per cent, returning a positive Wassermann Test from this 'apparently healthy' group of 500 men, in fact an additional 56 of the original 1,057 (5.298 per cent) had been removed before the Wassermann testing. These syphilis cases should be returned to both numerator and denominator to produce a correct estimate of the population prevalence of syphilis (both manifest and non-manifest) among the original sample of the London artisan class. This corrected prevalence estimate is  $72.5/526.5$ : 13.77 per cent. That is 49.66 per cent higher than the raw figure of 9.2 per cent.

spirochaete itself (*Treponema pallidum*), unlike the various non-treponemal tests, which are the successors to the Wassermann Test, which detected cardioli-  
pin (see above, text between notes 44 and 45).

<sup>54</sup>*Ibid.*, Table 2. If the results reported from a range of five non-treponemal tests are adjusted for application to a set of persons in their mid-thirties, to match the typical ages of the persons tested in the two historic samples from 1913–14, following the method in footnote 48, they are found to exhibit an average sensitivity of 95.6 per cent along with an average specificity of 98.4 per cent; the specificity figure being 2.93 percentage points higher than the sensitivity value.

<sup>55</sup>After discussing the table displaying their sensitivity results in 337 adult cases, McIntosh and Fildes state that 'As regards the specificity of the reaction, we have only found one non-syphilitic individual [out of a total of 337 adult cases] giving a positive result in

recent years—a case of acute malaria twenty-fours after a rigor': 'The Wassermann', 219.

<sup>56</sup>RCVD, Appendix XIII, 141. It is not explained why only 500 of the 1,000 'clean' cases were subsequently Wassermann-tested. Most likely it was decided to complete tests on half the sample—500 cases—because of competing demands on the CPL.

<sup>57</sup>Collie was clearly talking about this total of 1,057 cases who were seeking employment (not the 1,119 accident and illness insurance cases) when he stated that, 'Those who were rejected were not submitted to the Wassermann Test naturally, I rejected about 5 per cent.' RCVD, Collie in response to Q.17,606.

<sup>58</sup>RCVD, Appendix XIII. Collie qualified the thoroughness of his physical examination under questioning, stating that 'I did not examine the genitals in such a way that one could be perfectly certain that they had or had not the disease.' (Q.17,577).

However, before we can apply this correction factor of 1.4966, it is necessary to take into account a number of further, documented biases in Collie's sample. The most important of these relates to the unusual number of men tested who had served in the armed forces. Fortunately Collie and Mott analysed the effect of this factor on their results. Out of the 500 men tested, 492 gave information on whether they had military service experience. Among these 127 (25.8 per cent) with experience in the armed services returned a positive rate of 18.89 per cent whereas the remaining 365 (74.2 per cent) returned a rate three times lower at 6.02 per cent.<sup>59</sup> Collie's sample was clearly not typical of the London artisan working-class in this important respect, requiring adjustment.

Recruits were drawn 60 per cent from the unskilled urban or rural labouring classes on enlistment, with 40 per cent from a more privileged section of the manual workforce (figures roughly proportionate to their numbers in the workforce in 1911).<sup>60</sup> Some of those unskilled on entry may well have acquired training and contacts during military service to enable movement into more skilled employment on leaving. However, even if a disproportionate number of those exiting the armed services with skills then gravitated to the London labour market, it is not plausible that they could have contributed anything like 25 per cent of the artisan class in London. Taking into account the relative size of the armed services and turnover of personnel, a much-reduced figure of 8.33 per cent, about one-third of 25 per cent, would probably be much more representative.<sup>61</sup> This would imply that the raw figure of 9.2 per cent syphilis prevalence among London artisans should be reduced to 7.09 per cent.<sup>62</sup>

The second set of possible sources of bias in Collie's results all act in the opposite direction. As they were all apparently fit and healthy men, applying for jobs in relatively large organizations, it is less likely men suffering from debilitating symptoms would have appeared before Collie in the first place, so that a certain section of the infected population were self-selected out of the pool of men he saw.<sup>63</sup> Secondly, it may have been only the more well-qualified, stable and respectable sub-section of the London artisanal class, with good references, who were accepted for employment by the larger, well-established organizations employing Collie's services (a feature which may also help to explain the unusual proportion of ex-servicemen). A final caveat is the disclosure by Collie that some had refused to take the

<sup>59</sup>RCVD, Appendix XV (Memo by Sir F.W.Mott), 145.

<sup>60</sup>Szreter, *Fertility*, 210, citing Army Medical Department statistics in the Edwardian period.

<sup>61</sup>Of those 8,325,716 men who were aged 15–44 years in England and Wales in 1911, 2.297 per cent were enlisted in the armed forces at the census, equivalent to 3 per cent of manual working-class males. Given that men in military service could leave with honourable discharge after seven years' service and many left much earlier, turnover could well be twice to three times the 3 per cent proportion, a figure that might be somewhat higher for this particular cohort due to the tens of thousands of temporary volunteers during the Boer War. Something like 6–9 per cent of working-class men in their mid-thirties could have had military experience among this cohort, probably closer to 9 per cent among those gravitating to the London labour market.

<sup>62</sup>This figure (7.093 per cent) results from the following calculations:  $(0.9167 \times 6.02) + (0.0833 \times 18.89) = 5.5185 + 1.5735 = 7.092$  per cent. Note that this correction procedure assumes that the relative risk of manifesting the clinical symptoms of syphilis (which would have been picked up by Collie in his pre-screening physical examination) among men with a history in the armed services, as compared with those without such a history, would have been the same as the relative risk between these two groups of men of being subsequently found (by the Wassermann Test) to have sub-clinical symptoms (i.e. a ratio of approximately 3:1 in both cases).

<sup>63</sup>This point was made by the Commissioners when questioning Collie about the sample: RCVD, Q.17,557; 17,566–67.

Wassermann Test. When questioned, Collie acknowledged that some of these 'very few' might have 'suspected the result'. Combined with Collie's acceptance that to publicly acknowledge having had syphilis was considered a 'moral offence' by the men he saw, this would suggest that some of the 'very few' refusers may have done so because they knew they had been infected. It is unfortunate that Collie was not pressed to divulge exactly how many had refused following his statement, 'There were a few who refused. They of course are not counted but they were very few.'<sup>64</sup> Supposing those 'very few' refusers included two or three persons who knew they had syphilis, that would have increased by about one-twentieth the numbers that Mott's Wassermann Tests subsequently revealed to be infected, resulting in an overall estimated infection rate about half a percentage point higher. Given that a substantial downward correction factor has been applied to compensate for the over-representation of ex-servicemen, the combination of these three opposed biases would indicate a moderate re-adjusting factor of at least half a percentage point in the opposite direction, revising the corrected figure of 7.09 per cent to 7.6 per cent.

As we have seen, this raw figure then needs to be inflated by a factor of 1.4966 to compensate proportionately for Collie's prior exclusion of manifest syphilitics from his 'clean' sample. This means that the triple-corrected value from the Mott–Collie study for London artisans results in an estimated syphilis prevalence rate of 11.374 per cent. This value should then, finally, be further corrected for the known specificity and sensitivity properties of the Wassermann Tests conducted in the CPL, which require a reduction factor of about 2.134 percentage points, resulting in a final, estimated value of 9.240 per cent.<sup>65</sup>

The second study also aimed to exclude all those who might be supposed to have a 'manifest' form of syphilis.<sup>66</sup> To achieve this, Fildes not only rejected those presenting with evident clinical symptoms but also all those who, in his medical opinion, might have a condition indirectly related to syphilis. All cases relating to any internal disease were uniformly excluded. Fildes *included* only those suffering from 'conditions which have never in the course of a wide experience been associated with syphilis.' Consequently most individuals in his analysis were being treated for accidents, fractures or hernias. Fildes acknowledged that whatever statistic his study showed for syphilis prevalence, 'clearly the whole sum of syphilis among the population will be somewhat greater owing to the existence in the actual population of the East End of persons with "manifest" syphilis.'

As with Collie's study, it is therefore necessary to inflate Fildes' reported finding of 10.3 per cent prevalence among 616 East End adult males to allow for all the 'manifest' and potential cases which he carefully excluded. Unfortunately, Fildes does not provide figures on the numbers excluded. The evidence from Collie's study is, therefore, highly

<sup>64</sup>RCVD, Q.17,544.

<sup>65</sup>The method for this correction is as follows. Supposing a sample of 1,000 persons drawn from a population in which there is a true rate of prevalence of syphilis infection of approximately 9 per cent. In a representative sample, 90 persons will have the disease, 910 will not. A series of Wassermann Tests with the known properties of 97.094 per cent specificity and 94.33 per cent sensitivity conducted on such a sample will have mis-identified (as 'false positives') 2.906 per cent of the 910 persons who did not have the

disease (26.44 persons) while failing to identify (as 'false negatives') 5.67 per cent of the 90 persons who did have the disease (5.10 persons). Hence there is a predictable over-estimate of 2.134 percentage points (26.44 persons over-estimated minus 5.103 persons under-estimated, equating to a net 21.34 persons out of the 1,000 tested). Thus, the raw empirical result of 11.374 per cent prevalence needs to be reduced to a value of 9.240 per cent.

<sup>66</sup>All quotations in this paragraph from RCVD, Appendix XII, 139–40.

relevant to establish what scale of inflation factor should be applied. Fildes found 64 positive Wassermann cases among 616 tested. The implication of Collie's evidence is that Fildes would have excluded an at least similar proportion of manifestly evident syphilitics to that excluded by Collie, a number of syphilitics equal to at least 5.3 per cent of an original sample. In Fildes' case these exclusions had left him with 616 remaining to test, from which he found the 64 Wassermann-positive cases. That would imply that at least 35 out of an original 651 had been excluded ( $35 = 5.3$  per cent of 651). However, the adjustment probably needs to be somewhat greater than this, since it is clear from his description of his methods that Fildes' exclusion criteria were even stricter than Collie's, embracing 'more or less obscure conditions which may have a remote connection with syphilis' (of which he detailed four specific examples, and also recorded that each of these four excluded cases did indeed test positive). If Collie excluded 5.3 per cent of the whole sample because he judged them to be syphilitics, it seems most likely that Fildes' even stricter criteria would have excluded up to about one-fifth more of those he originally saw. Using 6.3 per cent, instead of 5.3 per cent, as an estimated exclusion rate (corresponding to about six additional cases excluded—four of which were in fact detailed by Fildes, as noted above), produces an estimated prevalence rate from Fildes' study of 15.70 per cent.<sup>67</sup>

This figure of 15.70 per cent needs finally to be corrected for the known specificity and sensitivity characteristics of the laboratory procedures at the London Hospital, requiring in this case a very small upward adjustment of just 0.188 percentage points, to a final adjusted estimate of 15.89 per cent.<sup>68</sup>

With these adjusted estimates permitting us to place the findings of Collie and Fildes on an equivalent basis, we are now finally in a position to compare the findings from their two independent studies on two diverse sections of the London working-class both with each other and also with the independent source of evidence on relative rates among different 'social classes' provided by Dr T. H. C. Stevenson. Stevenson's analysis of the nation's official cause of death records, reproduced in Table 1, showed that the death rate per million (age standardised) for men above age 15 from the combination of syphilis and the three syphilitic causes of death for Social Class III was 264; and for Social Class V the equivalent rate was calculated at 429. These official figures indicated that nationally the overall prevalence of syphilis among men classified to the lower status, unskilled manual occupations (Class V) was 1.625 times higher than among men classified to the artisanal, skilled occupations (Class III). By comparison, the Wassermann Tests deployed in Collie's study of a random sample of the 'superior artisanal' or skilled working-class, corresponding to Stevenson's Social Class III, indicated a rate of 9.24 per cent, while Fildes' study indicated a rate of 15.89 per cent among the working-class of the East End, corresponding to Stevenson's Social Class V.

<sup>67</sup>To inflate the sample of 616 by 6.3 per cent requires the addition of 38.8 persons to both denominator and numerator (since it is assumed those screened-out had syphilis); the prevalence rate can then be calculated as:  $(64 + 38.8) / (616 + 38.8) = 15.70$ .

<sup>68</sup>See footnote 65 for the correction method. The steps are the same here but with application of the different values for sensitivity and specificity in the laboratory of

McIntosh and Fildes: 97.25 per cent and 99.7 per cent, respectively (see above, footnotes 48 and 55); applied to a true prevalence rate of 16 per cent. Of 1,000 tested 0.3 per cent of the 840 persons without the disease are false positives (2.52 persons) while 2.75 per cent of the 160 with the disease are false negatives (4.40 persons): a net under-estimate of 0.188 percentage points.

The two Special Studies thus indicate that among the unskilled male working-class the prevalence of syphilis (15.95 per cent) was 1.72 times higher than among the skilled working-class (9.31 per cent). Considering the extremely different sources and methods involved in producing these three different estimates of prevalence among these two distinct social groups, there is a remarkable degree of concurrence between them. This provides some confidence that the absolute prevalence rates found in the two special studies, based on the results of Wassermann Tests, can now provide the basis, suitably adapted, for calculating robust national estimates of absolute prevalence of syphilis in the adult male population, in conformity with the pattern of relative rates of mortality revealed by Stevenson's national analysis, in terms of the eight categories of his official 'class' model.

### Estimates of National Patterns of Prevalence

Two further sets of adjustments now need to be made to calculate national estimates. First, there is the small discrepancy between the two sets of ratios; and secondly the fact that both Wassermann-tested samples derive from London, an unusually high-prevalence region of the country.

Given that the ratio of 1.625 between the syphilitic mortality rates of Social Class III and Social Class V in Stevenson's model derives from the massively-based national statistics using age-standardised death rates, it would seem advisable that this figure should be most appropriately used to represent the true relationship between the values for national divisions of the skilled and unskilled sections of the male workforce. The ratio of 1.72 between the results of the two Special Studies should therefore be adjusted to conform to a ratio of 1.625, rather than vice-versa. This would imply that the figures of 9.24 per cent and 15.89 per cent should each be modified by a proportionately equal amount to produce a ratio of 1.625 between them. This is achieved by increasing the figure of 9.24 per cent and by decreasing the figure of 15.89 per cent by exactly 2.82725 per cent in each case, producing adjusted values of 9.50 per cent and 15.44 per cent, respectively, such that the latter figure is 1.625 times higher than the former.

Finally, in order to convert these absolute prevalence figures derived from samples of the London working-class into national estimates of syphilis prevalence, they need to be further modified by a factor which allows for London's relatively high incidence of venereal diseases. Fortunately, Stevenson published sufficient official information to make this adjustment on a relatively exact empirical basis. Stevenson provided the RCVD with a table showing the overall crude death rate per million from syphilis and the three other syphilitic causes of death for both sexes combined in four large divisions of the national population, distinguishing the most urban from the least urban populations (categories A–D in Table 3 in the text below).<sup>69</sup> The crude death rate for London was given as 240 per million; compared with 210

<sup>69</sup>The figures are presented in RCVD, Appendix 1, Table 1, p.78, giving death rates per million for syphilis, GPI, locomotor ataxy and aneurysm combined for both sexes. Demographically, these are less precise than the figures for the eight 'social classes' presented in Table 1 in the text above because they are not sex-specific nor age-standardised. However, they relate to four very large population aggregates, which mitigates these weaknesses. The four aggregates are: London with a

defined population here of 4,521,301; the 75 County Boroughs of England and Wales with a combined population of 10,943,658; all 'Other Urban Districts', comprising a further 12,779,790 persons; and finally the 7,919,084 people residing in the 'Rural Districts' of England and Wales. For these population numbers, see 74<sup>th</sup> Annual Report of the Registrar-General (ARRG), Table 2.



per million for all County Boroughs; 140 per million for 'Other Urban Districts'; and 97 per million for Rural Districts; with an overall national average figure for England and Wales of 164 per million. This information can be used to generate an accurate correction factor to convert the estimates from the two Special Studies into estimates for the adult male national population of England and Wales for the two contrasting sections of the skilled and unskilled working-class, Stevenson's Classes III and V.<sup>70</sup>

With appropriate weighting for their respective population sizes, the estimated crude death rate for all urban populations in England and Wales, metropolitan and non-metropolitan combined (i.e. categories A,B,C of Stevenson's four types of place, omitting only category D, 'Rural Districts'), can be calculated to be 183.13 per million.<sup>71</sup> By comparing this with the figure of 240 per million for London, this demonstrates that figures for the prevalence of syphilis calculated for London representatives of the skilled and unskilled working-classes, as in the case of the two Special Studies, need to be reduced to 76.3 per cent of their nominal values, to render them into estimates that represent the skilled and unskilled working-classes of the whole urban population of England and Wales.

Thus, Table 2 gives the values for Classes III and V, each reduced accordingly through multiplication of the values of 9.50109 and 15.4393 by a factor of 0.763042, producing adjusted values of 7.249688 and 11.78075, respectively. With this final step in the adjustment and correction processes completed, the estimated values of absolute prevalence for the other six classes in Stevenson's classification model can also now be calculated and are shown in Table 2. The estimated values for absolute prevalence shown in Table 2 are each

<sup>70</sup>The official cause of death statistics indicated that men recorded almost three times as many deaths as women from the combination of the four syphilitic causes of death. However, this does not distort the exercise of using these uncorrected, non-sex-specific rates to estimate the scale of adjustment required in specifically male rates of prevalence. While syphilitic death rates in London were much higher than in the general population, the extent to which men died more than women in the capital was hardly any greater than in the country overall (there were 2.70 times more male than female deaths in London, as against 2.685 times more male than female deaths in England and Wales, only a 0.633 per cent difference in the ratios). While London had a greater female imbalance in its sex-ratio (1127:1000), as against England and Wales (1042:1000), even taking this into account would only increase the difference in the two ratios from 0.63 per cent to 0.685 per cent, i.e. by about 1/150th, which is negligible. Consequently, the calculation in the text has been left unadjusted for this effect. Sources for numbers of deaths by sex in England and Wales and in London administrative country: 74th ARRG, Tables on pp.194-241. For sex ratios in London and England and Wales in 1911: <[http://www.visionofbritain.org.uk/text/chap\\_page.jsp;jsessionid=ACD2010F1499D88F015191DB8725CB82?t\\_id=SRC\\_P&c\\_id=4&cpub\\_id=EW1911GEN](http://www.visionofbritain.org.uk/text/chap_page.jsp;jsessionid=ACD2010F1499D88F015191DB8725CB82?t_id=SRC_P&c_id=4&cpub_id=EW1911GEN)> accessed 14 January 2014.

<sup>71</sup>Only the three 'urban' of Stevenson's four categories of place are used here because virtually all men working in the occupations represented by Class III and Class V were living in one of these three urban categories. Men working in the fourth category, 'Rural Districts', would predominantly have been allocated to Stevenson's Classes VII or VIII. Using the information given on the crude syphilitic death rates per million for the three urban categories of place in the national population just cited in the text, combined with their respective population sizes, whose values are given in footnote 69, the formula for calculating the population-weighted crude syphilitic death rate for all three categories combined together is as follows, in the sequence County Boroughs plus 'Other Urban Districts' plus London:  $(210 \times 10.944) + (140 \times 12.780) + (240 \times 4.521) / (10.944 + 12.780 + 4.521)$ . Thus,  $5172.48 / 28.245 = 183.13$  per million. From this, it follows that the crude syphilitic death rate per million for all urban populations in the UK combined is approximately 76.3 per cent of the figure for London, alone, since:  $183.13 / 240 = 0.763042$ . So, any estimates of the prevalence of syphilis derived from London samples need to be multiplied by 0.763042 (a reduction in their values by about 23.7 per cent), to render them into estimates representing all urban populations of England and Wales.

**Table 2.** Final estimates of the absolute prevalence of syphilis among men aged in their mid-thirties in England and Wales in 1911–1912 in eight official classes

Class	Description	Absolute prevalence of syphilis (%)
Class I	Upper and middle class	8.293
Class II	Intermediate	7.689
Class III	Skilled working-class	7.250
Class IV	Intermediate	8.348
Class V	Unskilled working-class	11.781
Class VI	Textile workers	5.108
Class VII	Mining workers	4.861
Class VIII	Agricultural labourers	2.966
All classes		7.771

Source: Derived from evidence presented to the RCVD, Appendices I, XII and XIII.

**Table 3.** Estimates of the absolute prevalence of syphilis among men aged in their mid-thirties in England and Wales in 1911–1912 in four categories of place

Category	Description	Absolute prevalence of syphilis (%)
A	London	11.373
B	75 County boroughs	9.951
C	Other urban districts	6.634
D	Rural districts	4.597
All places		7.771

Source: Derived from evidence presented to the RCVD, Appendices I, XII and XIII.

consistent both with the relativities between the eight classes shown in Table 1 and also with these London-corrected adjusted values for Classes III and V.<sup>72</sup>

The figures of crude death rates per million for four different types of place can also be similarly transformed into estimates of absolute prevalence of syphilis among men in their mid-thirties. As the bottom line of Table 2 shows, the absolute prevalence rate for males in their mid-thirties for the population of England and Wales has now been estimated at 7.771 per cent. This corresponds to the crude death rate (both sexes combined) of 164 per million calculated for the whole population of England and Wales by Stevenson. Absolute prevalence rates for men in their mid-thirties can therefore be estimated for each of the four categories of place and are shown in Table 3.<sup>73</sup>

<sup>72</sup>The estimates for Class III and V, of 7.249688 and 11.78075, each bear a consistent mathematical relationship (a constant with the value 0.027461) to the figures of 264 and 429 for Classes III and V in Table 1. Therefore multiplying all relative values for all eight classes listed above in Table 1 by the same constant (0.027461) converts them into the absolute prevalence values given here in Table 2.

<sup>73</sup>This is achieved by calculating a figure that bears the same relationship to the known figure for the crude death rate per million for each place as does the figure of 7.771 to the figure of 164 per million for all four categories of place combined. Dividing 164 by 7.771446 gives a value for this constant of 21.10289. Dividing the values given by Stevenson for the crude death rates per million of each of the four categories of place given above in text (after note 69)

The research reported here indicates that in 1911–12 about 7.77 per cent of all men in England and Wales aged in their mid-thirties had been infected with syphilis. This figure should of course be viewed less as a precise value and more as a central estimate within a wider band of probable values, plus or minus 10%. Thus, if the exercise reported here has some value, it now seems that we may have some confidence that the rate of prevalence of syphilis among men of average age in their mid-thirties in the whole population of England and Wales on the eve of the Great War was probably no less than 7 per cent and no more than 8.5 per cent.

### The Prevalence of Venereal Diseases and Gender Relations?

The Commission's cautiously phrased estimate that infection with syphilis 'cannot fall below 10 per cent of the whole population in the large cities', was couched as a minimum for a certain section of the population. In that form, it has been borne out as a not inaccurate statement by the critical exercise performed here, as shown in Table 3.

But there is a significant caveat on this. In using the term 'persons', the Royal Commissioners were either implying that female rates were also above 10 per cent in the largest cities or that in fact male rates might be quite significantly above 10 per cent, off-set by lower female rates; or even vice-versa. To be fair to the Commissioners, what little evidence they had on sex-differentials in prevalence was very difficult to interpret so it is no surprise that they sat on the fence with this formulation. Fildes' study suggested a female prevalence rate about half that of the males.<sup>74</sup> Stevenson's official cause of death deposition reported that the crude male death rate from the four syphilitic causes of death was 2.7 times greater than the female rate.<sup>75</sup> However, these rates were not age-standardised and it was not known if there might be a gender difference in susceptibility to death from these four causes, in which case they would not have been a faithful reflection of sex-differential infection rates during earlier adulthood.<sup>76</sup> Probably the least unsatisfactory, population-based, contemporary evidence of relevance that we can draw on today for an epidemiologically similar northern European population comes from the compulsory—but legally confidential—notification system (which was accompanied by the incentives of free treatment for patients and a fee for each recorded visit for the physician) consolidated by the Swedish 1918 VD (Prevention Act).<sup>77</sup> Returns for the two years 1918 and 1919 are most comparable

by this constant will therefore produce a consistent estimate of the absolute syphilis prevalence rate among men in their mid-30s in each category of place, A–D.

<sup>74</sup>These results cannot be subjected to the same critical scrutiny and correction factors as those applied to the males and there is no other comparable sample, as Collie did not examine females. However, the raw, unadjusted results of the Wassermann Tests performed by Fildes on his male and female samples may give an approximate indicator of the sex-differential ratio of infection among the East End working-class. The 616 males tested gave a raw, unadjusted rate of 10.3 per cent positive Wassermann Tests, while 386 similarly-aged females from the same London Hospital sample produced a raw rate of 5.1

per cent positive Wassermann Tests. RCVD, Appendix XII, 140.

<sup>75</sup>See note 70.

<sup>76</sup>In fact subsequent research, a large autopsy study in the USA, has found that, a male, once infected with untreated syphilis, is about 67 per cent more susceptible than a similarly infected female to develop the tissue damage which leads to the fatal tertiary manifestations of syphilis. Brown *et al.*, *Syphilis*, 104–5.

<sup>77</sup>R. J. M. Hallgren, 'Legislative measures against the spread of venereal diseases in Sweden', *Public Health*, 1944, 62, 96–9. The Swedish law of 1918 was the culmination of over a century of legislation starting in 1812 under which the Swedish population had become accustomed to compliance with the most rigorous venereal disease notification system in the world: Anna Lundberg, *Care and Coercion*.

to the situation prevailing earlier in the decade before 1914 in England and Wales (Sweden was non-belligerent in the First World War), since it is clear that with the wider dissemination of effective treatment a marked syphilis reduction (both absolute and relative to gonorrhoea) occurred in the Swedish statistics from 1920 onwards, as in Britain.<sup>78</sup> The administrative data generated by the Swedish system suggests that female prevalence rates were not equivalent to male rates and were more likely, overall, to have been in the range of somewhat under one-half those of male rates, as also found by Fildes in London's East End.<sup>79</sup>

Of course Christabel Pankhurst's *The Great Scourge*, published in 1911, was the most trenchant contemporaneous feminist denunciation of male responsibility for the infection of the 'innocent'—wives and children—with venereal disease, but Pankhurst focused on gonorrhoea, not syphilis.<sup>80</sup> Her polemic was as significant for its novel effort to publicise the dangers of gonorrhoea for women's health and fertility, as it was for its eye-catching and repeated claims that 75–80 per cent of all men in Britain were infected with venereal disease, mostly gonorrhoea and mostly before marriage.<sup>81</sup>

Can the effort in epidemiological reconstruction of male syphilis rates, reported here, provide any further insight into Pankhurst's claims specifically in relation to gonorrhoea? The RCVD, though not explicitly addressing Pankhurst's figures, acknowledged in its summary statement that 'the percentage with gonorrhoea must greatly exceed' the 10 per cent figure for syphilis but offered nothing more precise. Unfortunately there is no contemporary source of British evidence equivalent to that used here for syphilis with which to derive a population prevalence estimate for gonorrhoea. Pankhurst cited a number of internationally-respected medical clinicians for her claims but their statistics were not based on epidemiological, population-based studies. It is clear that gonorrhoea is more infectious than syphilis and is virtually always prevalent as a multiple of the rate of syphilitic infection in any population, especially one lacking effective treatments for either disease.<sup>82</sup>

*Medical Knowledge, Social Policy and Patients with Venereal Disease in Sweden 1785–1903* (Umea: Umea University, 1999). Reporting of VD had been legislated in 1913 and became efficient by 1918 in anticipation of the 1918 Act (Lundberg, personal communication).

<sup>78</sup>A. Newsholme, 'The decline in registered mortality from syphilis in England. To what is it due?', *Journal of Social Hygiene*, 1926, 12, 514–23.

<sup>79</sup>The Swedish notifications indicated that the incidence of male syphilis was approximately 2.5 times higher than female; and the incidence of male gonorrhoea 3.5 times higher during 1918 and 1919: G. Dahlberg, 'Venereal Diseases in Sweden 1913 to 1937', *American Journal of Hygiene*, 1941, 33, 51–63, Table 1. The RCVD was presented with similar, less comprehensive statistics from Berlin's Statistical Board for the month of December 1913, which showed 3.6 times more men than women treated for gonorrhoea and 2.0 times more men treated for syphilis: RCVD, Appendix XXVIII, 131–2. It should be borne in mind that symptomless and painless gonorrhoea is significantly less frequent in men than in women (see

note 82), which would partly explain the greater sex-differential in notifications and would suggest that the syphilis ratio is the more accurate index of gender differences in venereal infection rates: McFalls and McFalls, *Disease*, 263.

<sup>80</sup>For other feminists, see Hall, 'Venereal Disease', 123–4.

<sup>81</sup>C. Pankhurst, *The Great Scourge and How to End it* (London: E. Pankhurst, Lincoln's Inn House, 1913), vi, 10, 17, 39–44, 69, 72, 86, 99 and 125. On the wider context of changing gendered understandings of the dangers of gonorrhoea, see M. Worboys, 'Unsexing Gonorrhoea: Bacteriologists, Gynecologists and Sufferers in Britain, 1860–1920', *Social History of Medicine*, 2004, 17, 41–59.

<sup>82</sup>Unlike syphilis, infection by gonorrhoea confers no immunity to reinfection, intensifying its infectious transmission in any population; furthermore, about 70 per cent of women and 55 per cent of men are largely asymptomatic and so may be unaware of their infectious carrier status, which may last for years: McFalls and McFalls, *Disease*, 262–4.

But how big a multiple was it among the population of England and Wales before the First World War?

Probably the two most relevant published statistics for evaluating this question relate to British wartime experience and the Swedish civilian notification system. With around 400,000 military cases treated during the Great War, a ratio of about 2.75 cases of male gonorrhoea per case of syphilis was reported.<sup>83</sup> During the two years of 1918–19 the Swedish system recorded 3.97 times more visits to doctors for gonorrhoea than for syphilis among adult males.<sup>84</sup> These two figures suggest, therefore, that a judicious central estimate might be a ratio of about 3.25 for the pre-war civilian male population of England and Wales.<sup>85</sup> This would indicate that gonorrhoea infected between 23.0 per cent and 27.5 per cent of adult men in addition to the 7.0–8.5 per cent infected with syphilis. Even if a proportion as high as one-half of those infected by syphilis were also infected by gonorrhoea, this would still imply that on the eve of the Great War somewhere between 26.0 per cent and 32.0 per cent of the entire male population by their mid-thirties would have had an infection by either gonorrhoea or syphilis. Although this is well below Pankhurst's claim of 75–80 per cent, nevertheless it is a truly pervasive level of venereal disease in the population, which, given that it relates to men of prime marrying age, could be of considerable epidemiological, socio-cultural and demographic importance.

It was also of course the case that, as Table 2 shows, the prevalence of syphilis (and therefore also gonorrhoea) was about 7 per cent higher than the national average among Pankhurst's own social peers, the educated upper and middle classes. Thus, among this privileged section of society, where male age at marriage in the Edwardian years was delayed to a historical peak of 33.5 years, the epidemiological and demographic research reported here indicates that about one in three bachelors (28–34 per cent) had probably had an infection by either syphilis or gonorrhoea before or at marriage.<sup>86</sup> This provides evidence that early twentieth-century suffragettes were making a moral and political argument which, in addition to its logical claims and rhetorical force as a discourse, probably drew part of its power from the bitter personal and emotional experience of many women among the educated and governing elite—and, no doubt, the guilty regrets of many men, too.<sup>87</sup>

## Conclusion

The RCVD's Final Report offered only a single summary estimate of the prevalence of venereal disease with little explicit discussion of how it had arrived at this conclusion. This article has shown that some of the evidence presented to the Royal Commission can be profitably

<sup>83</sup>W. P. MacPherson *et al.*, *History of the Great War Based on Official Documents Medical Services: Diseases of the War*. Vol. II (London: HMSO, 1923), 118.

<sup>84</sup>Dahlberg, 'Venereal Diseases', Table 1. In the Swedish notification system many patients would have had multiple visits counted for a single episode of gonorrhoea or syphilis (Lundberg, personal communication). However, it is not known how, if at all, this might have affected the ratio between the two diseases.

<sup>85</sup>Given the asymptomatic nature of a significant proportion of gonorrhoea cases (see note 82) the British wartime statistics are likely to significantly underestimate its prevalence, relative to syphilis. Davidson

summarises interwar Scottish venereologists as believing that 'the ratio of gonorrhoea to syphilis was in the order of 3–4:1.' Davidson, *Liasions*, 165.

<sup>86</sup>Bachelor marriage ages in the professions 1901–06: Census of England and Wales, 1911, Vol. 13 *Fertility of Marriage*, Part 2, Table VII.

<sup>87</sup>See Ben Griffin, *The Politics of Gender in Victorian Britain. Masculinity, Political Culture and Struggle for Women's Rights* (Cambridge: Cambridge University Press, 2012) for a revisionist exposition of the importance of links between personal experience and social identities and the politics of gender.

re-visited today, critically re-examined and combined together to provide a somewhat fuller, more informative set of estimates of the probable prevalence of adult male syphilis infection than that offered by the RCVD. These are estimates that apply not only to the whole male population of England and Wales in 1911–12 but also to various social and geographical sections of the populace.

Table 3 shows that among males in their mid-thirties somewhat over 10 per cent had been infected not only in the metropolises of London, Manchester and Liverpool but probably in at least 20 large cities (i.e. among the larger of the 75 county boroughs, especially those with major ports). Tables 2 and 3 additionally show that the incidence of male syphilis was in fact quite evenly spread geographically across the population, with prevalence rates of about 5 per cent almost everywhere except in the most remote rural communities. At 11.4 per cent the estimate for London was higher but not massively higher than some other large cities. It is no surprise to find the highest rates of male prevalence, at nearly 12 per cent, associated with the urban poverty of the unskilled workers of Class V in Stevenson's classification scheme, a telling contrast with the low rates of just 5 per cent among proletarian men in textile and mining communities, places where social conditions and gender relations had scandalised the early Victorians but which offered relatively secure and stable employment by this period. However, probably the most intriguing figure is the estimate of 8.3 per cent among elite males of Stevenson's Class I, somewhat above—rather than below—the national average of 7.77 per cent. The wider implications of this exemplify ways in which this effort at historical epidemiological reconstruction can contribute to our understanding not only of medical and demographic history but also of the diverse historical significance of venereal diseases in British social, cultural, political and gender history in the decades before the Great War.

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