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Mortality from the influenza pandemic of 1918–19 in Indonesia

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The influenza pandemic of 1918–19 was the single most lethal short-term epidemic of the twentieth century. For Indonesia, the world's fourth most populous country, the most widely used estimate of mortality from that pandemic is 1.5 million. We estimated mortality from the influenza pandemic in Java and Madura, home to the majority of Indonesia's population, using panel data methods and data from multiple quinquennial population counts and two decennial censuses. The new estimates suggest that, for Java alone, population loss was in the range of 4.26–4.37 million, or more than twice the established estimate for mortality for all of Indonesia. We conclude that the standing estimates of mortality from influenza in Java and Indonesia need to be revised upward significantly. We also present new findings on geographic patterns of population loss across Java, and pre-pandemic and post-pandemic population growth rates.

Introduction

With an estimated population of 237.6 million in 2010 (Badan Pusat Statistik 2010), Indonesia ranks as the fourth most populous country in the world. Indeed, within South East Asia, 'Indonesia is the giant of the region, both physically and demographically' (Hirschman 1994, p. 391), and within Indonesia, the island of Java, which accounts for 136.6 million people (Badan Pusat Statistik 2010), is both the most populated and the most densely populated major island in the world. For these reasons, the demographic study of Indonesia and Java is a subject of great interest. Any event with a significant demographic impact on Java is also likely to influence the global impact of the event.

The primary goal of the study presented here was to use modern statistical methods to estimate the loss of population from the influenza pandemic of 1918–19 in Java, Indonesia. The international influenza pandemic of 1918–19, dubbed the 'mother of all pandemics' (Taubenberger and Morens 2006), was the single most devastating short-term epidemic of the twentieth century. Estimates of worldwide mortality range from 24.7 to 100 million (Patterson and Pyle 1991, p. 19; Johnson and Mueller 2002,

p. 114). Emphasizing the pervasive problem of under-reporting of deaths, Johnson and Mueller (2002, pp. 107–8) discussed the considerable difficulties faced by scholars who have undertaken to estimate mortality from the pandemic in different parts of the world. Not surprisingly, '[a] recurring feature of the work on the pandemic in the last couple of decades has been the consistent upward revision of mortality figures' (Johnson and Mueller 2002, p. 108), and 'some regions reported mortality rates for the entire population as high as 5–10 percent' (ibid.).

In light of the magnitude of the pandemic as a demographic event and the sheer size of Java's population, the lack of attention paid to the pandemic in Java is surprising. Widjojo's classic treatment of the demography of Indonesia mentioned the influenza pandemic of 1918–19 in passing (1970), and Boomgaard and Gooszen's otherwise detailed documentation of the data, key phenomena, and sources of material on Indonesian demography during the colonial era also paid little attention to it (1991). The exception to this pattern is Brown (1987), who focused on the pandemic in Indonesia, lamenting that, given its sizeable impact, 'the episode has attracted remarkably little attention', and '[n]o writers have subsequently taken on the

task of describing more fully the impact of the pandemic on Indies society' (p. 235). Brown (1987) raised as many questions as he answered, attributing them to the lack of information on the subject. Hence, a second goal of this study was to use Brown (1987) as a starting point and to extend his analysis, in some cases with significant additions or revisions.

We reviewed the literature on demographic change in Indonesia and Java, paying special attention to the assessment of the impact of the pandemic in these works. We also reviewed the available demographic data, and selected for analysis those statistics that scholars agree are of relatively high quality. Using these data and panel data analysis methods, we estimated, for the first time, a population growth model for the various residencies (units of administration roughly equivalent to a county or district) of Java, allowing for a decline in population attributable to the pandemic. After producing estimates of population loss for the residencies of Java, we interpreted the estimates of the model in light of previous work on the subject. A study of this nature is of special significance because of renewed interest in recent years in influenza pandemics in general and in pandemics caused specifically by the H1N1 family of influenza viruses, of which the 1918–19 virus was one (Morens et al. 2009).

Literature review

The epidemiology of the 1918–19 influenza pandemic in Indonesia had much in common with patterns observed elsewhere. The following description draws on accounts in the *Mededeelingen van den Burgerlijken Geneeskundigen Dienst* (Journal of the Civil Medical Service or BGD; BGD 1920b), other reports of the BGD (1920a, 1922), and the *Koloniale Verslagen* (Colonial Reports, henceforth KV; Department van Zaken Oversee 1919, 1920). As in the case of a number of countries, including Scotland, England and Wales (Johnson 2006, p. 46, Figure 3.1), Portugal and Spain (Erkoreka 2010), Mexico (Chowell et al. 2010), and Peru (Chowell et al. 2011), and cities including New York City (Olson et al. 2005) and Copenhagen (Andreasen et al. 2008), at least two distinct waves of the disease were observed. In the first wave, which commenced in June and early July 1918, the disease is believed to have entered Indonesia simultaneously through Oostkust van Sumatra (now North Sumatra) from the Straits Settlements (in modern-day Malaysia) and through Java from Singapore. Additional cases, imported from Singapore, were observed in western Borneo (now Kalimantan) in the middle of July. The first wave of the pandemic primarily affected western Indonesia, leaving the islands to the east relatively unscathed, and died down by early September. The second wave was far more marked than the first in its virulence and geographic scope, and lasted from October to December 1918, with localized pockets continuing into January and even February 1919. A similar pattern was observed in other countries, including, for example, England, Scotland, and Wales (Johnson 2003, 2006), Portugal and Spain (Erkoreka 2010), and Mexico (Chowell et al. 2010, p. 569, Figure 1). Exposure to the July epidemic also protected populations from the November epidemic, a phenomenon that was also observed in the USA

Figure 1   Map of the residencies of Java in 1920
Source: Widjojo 1970, p. 66.

(Barry et al. 2008), England and Wales (Mathews et al. 2010), and Denmark (Andreasen et al. 2008).

While the records of the Netherlands East Indies provide little evidence on the age pattern of mortality and infection rates among the population as a whole, there is abundant anecdotal evidence on other aspects of the epidemic. For example, there is little doubt about its virulence. We know that in 'Paperu on Saparua (Amboina),…for some time, only 8 of the 800 inhabitants were able to do their work' (BGD 1920b, p. 145), which suggests a very high rate of infection. The same report also claimed that the disease struck 'without distinction of age, sex, or standing' (p. 149). The Colonial Reports of 1919 and 1920 also contain anecdotal evidence of the virulence of the disease. They suggest that mortality rates in at least some parts of Indonesia equalled or even exceeded 10 per cent: 6–12 per cent for the population of Ternate, 10 per cent for the island of Tobelo, and 3–4 per cent for Tapanoeli (KV 1919, column 175, Hoofdstuk K); 438 out of 4,052 coolies for a rate of 10.8 per cent in Riouw and Dependencies (KV 1919, column 69, Hoofdstuk C); 10 per cent of the population in Gorontalo (KV 1919, columns 75, 76, Hoofdstuk C); all-cause mortality of 16 per cent in 1918 compared to 0.5 per cent in 1917, for an excess all-cause mortality rate of 15.5 per cent (KV 1919, column 130, Hoofdstuk J); at least 145 out of 750 residents of Boela-baai (for a rate of 19.3 per cent), 194 out of 900 residents of Fak Fak (or 21.6 per cent), 372 out of 5,200 residents of Kokes (or 7.2 per cent), and a rate of 10 per cent that was the 'rule rather than the exception' for the population in Amahai (KV 1920, columns 64, 65, Hoofdstuk B). Elsewhere, however, the reported rates were much lower; for example, among a group of 10,300 miners in Billiton, 2,600 were struck by the disease, of whom 31 died, yielding a population mortality rate of only 0.3 per cent (KV 1919, columns 65, 66, Hoofdstuk C). Nevertheless, in general the statistics suggest that population mortality rates substantially higher than existing figures would not be inconsistent with the accounts presented in the Colonial Reports.

A number of scholars have studied the demography of Indonesia in general and Java in particular, including Breman (1963), Peper (1970), Widjojo (1970), Boomgaard and Gooszen (1991), Hirschman (1994), van der Eng (2002), and Boomgaard (2003). However, the scope of these projects or the different timeframes with which they dealt meant that the influenza pandemic was only superficially analysed, if at all. Widjojo, for example, suggested that the 'relatively small…computed rate of increase between 1905 and 1920' was probably due to the

influenza pandemic (1970, p. 67), but did not delve into the issue.

The single most influential estimate of Indonesian mortality from the pandemic comes from Brown (1987), which seems to be the only relatively recent work to deal primarily with the subject. In addressing the pandemic in Indonesia, that study raised a number of interesting questions. These include speculation about mortality from the pandemic: 'In Indonesia, it seems probable that at least 1.5 million people died' (Brown 1987, p. 235). The rationale for, or source of this estimate was not provided, but as the only relatively recent estimate of mortality in Indonesia it has entered into the recent literature on global mortality from the pandemic (e.g., Patterson and Pyle 1991, p. 14; Johnson and Mueller 2002, p. 112). Another estimate can be calculated from the Colonial Reports, which reported total deaths of 1,227,121 and 930,095 in 1918 and 1919, respectively, compared to 586,757, 673,830, 764,316, and 815,268 deaths for the years 1916, 1917, 1920, and 1921, respectively, yielding an annual average of 710,042 (Widjojo 1970, p. 102). Using a simple calculation, this suggests excess mortality for Java in 1918 and 1919 in the range of 750,000, or 2.1 per cent of the total population, which was significantly lower than the higher statistic reported by Brown (1987), though well within the range across countries reported in Johnson and Mueller (2002). As will be shown in this paper, both figures significantly undershoot the mark, though the Brown (1987) statement is technically correct in that estimated mortality was indeed in excess of his 1.5 million figure.

A second area of analysis is the geographic spread of the impact of the pandemic in Java. Brown (1987) employed death registration data at the regency (an administrative sub-unit of a residency) level to demonstrate that mortality in West Java was significantly lower than mortality in East Java, with Central Java occupying an intermediate place. Of interest here is Brown's listing of the various regencies of Java with computed flu-related mortality rates (1987, pp. 238–9, Table 11.1). As will be shown, the picture for West Java is in fact rather mixed, with some residencies conforming to the aforementioned pattern of relatively low excess mortality and others showing dramatically higher rates that paralleled rates in East and Central Java.

Data

During the period in question, the Netherlands East Indies government produced a range of population

data. Given the time period for this study, which spans the late nineteenth century and the early twentieth century, five sets of data are of possible interest. They are: (i) the 5-yearly population counts (1880–1905); (ii) the 1917 and 1927 population counts; (iii) the 1920 census (Volkstelling 1920 1922); (iv) the 1930 census (Departement van Land-bouw, Nijverheid en Handel 1933–36); and (v) the annual data produced by the Civil Medical Service or BGD from 1911 to 1940.

Because of the vastly varying quality of these different data sets, a choice had to be made about the quality threshold above which the inclusion of data was justified, and below which the benefits from additional data were outweighed by probable data inaccuracies. We used evaluations of data quality in Widjojo (1970) and Gooszen (1991a–c) to select the data for the analysis. We started by including only the data for the island of Java, because the data for the Outer Islands of Indonesia (i.e., islands other than Java and Madura) before 1905 are highly unreliable (Widjojo 1970, p. 62). Within Java, we also excluded the principalities of Jogjakarta and Surakarta, comprising approximately 10 per cent of the population, because they were governed by administrative systems that differed from the systems in place in the directly ruled residencies in the rest of Java, and data collection mechanisms in these principalities were, therefore, also different (Widjojo 1970, p. 55). Figure 1 is a map of the residencies and principalities of Java in 1920.

Of the five aforementioned sets of data, the annual reports from the BGD, which used vital registration (birth and death) statistics to compute population growth, are probably the least accurate owing to the persistent and severe problem of underreporting. In the words of recent scholars, these data 'should be regarded with a good deal of caution' (Gooszen 1991b, p. 32) and 'the quality of the results was poor ... for the system for registering deaths' (Widjojo 1970, p. 101). Gooszen (1991b, p. 30) also rejects the 1917 and 1927 population counts because they were computed from similar BGD health-registration data with the same attendant problems of undercounting. Therefore, since the 5-yearly population counts along with the two population censuses, which are regarded as having been more accurate than the BGD statistics for Java, provide a sufficient number of observations for the analysis, we focused on these three sets of data. The final data set consisted of 5-yearly population counts from 1880 to 1905 (for a total of six observations, one each for 1880, 1885, 1890, 1895, 1900, and 1905 per residency) and the two censuses (1920 and 1930,

for a total of two additional observations per residency). In sum, we used eight observations for each of 15 directly administered residencies for a sample size of 120 covering the period 1880–1930.

The 15 residencies for which data were included in the analysis comprised 90.5 per cent of the total population of Java in 1920 (Widjojo 1970, p. 6, Table 1). The residency definitions correspond to those in effect in 1920 (see the map in Figure 1), and Table 1 in Widjojo (1970) contains data that were adjusted for changes in the residencies over time. Boomgaard and Gooszen (1991, pp. 74–6) listed the boundary changes in the residencies during the time period 1880–1930 and, for the most part, these appear to have been minor, involving a handful of villages, or even a single village.

Methods

In his classic study of the demography of India, Davis (1951) used the 'population loss' method to estimate the impact of the influenza pandemic on

Table 1 Population growth models for Java (1880–1930) with estimates of population loss from the influenza pandemic of 1918–19

Estimates	Model specification	
	Unrestricted	Restricted
Intercept (γ_{00})	14.1404***	14.1405***
	0.0001	*0.0001*
Time trend (γ_{10})	0.0176***	0.0175***
	0.0001	*0.0001*
Flu dummy (γ_{20})	−0.1389***	−0.1406***
	0.0088	*0.0063*
Flu dummy * Time trend (γ_{30})	−0.0006	–
	0.8885	
Number of observations	120	
Hausman test statistic	0.00	0.00
	1.00	*1.00*
Breusch Pagan test statistic	327.52***	327.51***
	0.0001	*0.0001*
Estimates of key demographic phenomena		
Influenza population loss (millions)	4.267	4.370
Population change, 1918–19 (millions)	3.780	3.835
Annual population growth rate before pandemic (%)	1.76	1.75
Annual population growth rate after pandemic (%)	1.70	1.75

p-values for null hypothesis of 0 coefficient in italics.
***$p < 0.01$.
Source: Five-yearly population counts 1880–1905 and the censuses of 1920 and 1930 per Widjojo (1970).

the population of India and Pakistan. This method involved computing population loss as the difference between expected population given the pre-pandemic trajectory and observed population in the immediate aftermath of the pandemic. As such, it is well suited for the analysis of significant demographic events using census or other aggregate population-count data in the absence of reliable data on births and deaths. Davis used data from a number of censuses of British India (1951, p. 27, Table 7). Interestingly, while the Netherlands East Indies government had undertaken a number of population counting exercises for Indonesia, including the aforementioned series of quinquennial population counts and two censuses, these data have not been analysed using the population loss method. Therefore, this paper fills a gap in our knowledge of the impact of the influenza pandemic on Java, Indonesia, using the population loss method.

Following Chandra et al. (2012, pp. 859–60), the panel data models estimated were of the form

$$LPOP_{it} = \pi_{0i} + \pi_{1i}T_t + \pi_{2i}FLU_t + \pi_{3i}T_tFLU_t + \varepsilon_{it}$$
(1)

where $LPOP_{it}$ is the log of population in residency i in year t, T_t is a time trend, FLU_t is a dummy variable defined as

$$FLU_t = \begin{cases} 0, & t \leq 1918 \\ 1, & t > 1918 \end{cases}$$

and ε_{it} is a random error term. The parameters π_{0i}, π_{1i}, π_{2i}, and π_{3i} were modelled as random coefficients, which are the sum of fixed terms γ_{00}, γ_{10}, γ_{20}, and γ_{30}, respectively, and four corresponding random (residency-specific) terms with 0 mean. These four parameters represent the residency-specific values of the logarithm of population in 1891, the rate of population growth before the 1918–19 pandemic, the shift in the population trajectory attributable to the pandemic, and the change in the rate of population growth after the pandemic. In combination, these four estimates provide a population model for each residency.

The model was estimated using the PROC MIXED and PROC PANEL routines of the SAS software (SAS Institute 2011a, b). The Hausman specification test indicated that estimates of the random coefficients were consistent and efficient ($m = 0.00$, $p = 1.00$), and were therefore favoured over the fixed-coefficients specification. In addition, the Breusch Pagan test indicated that the random-coefficients model was also preferred to a model without district-specific coefficients (i.e., the pooled

OLS specification: ($\chi^2 = 327.51$, $p = 0.00$)). Therefore, the analysis focused on the random-coefficients estimates, with the additional observation that the results using the fixed-effects coefficients were very similar.

In the initial round of analysis, we developed a model that allowed for the rate of population growth before the pandemic to differ from the rate of growth after the pandemic (i.e., $\gamma_{30} \neq 0$). The point estimate of γ_{30} was very close to 0 and the null hypothesis that γ_{30} was 0 could not be rejected (Table 1, 'Unrestricted', Column 1). Therefore, in the final version of the model, we eliminated the γ_{30} term and restricted the growth rates before and after the pandemic to be the same (Table 1, 'Restricted', Column 2).

Results

A number of interesting findings emerged from the results (Table 1). First, the models depart significantly from the earlier literature in their estimates of population loss from the pandemic. In the directly ruled residencies *of Java and Madura alone*, the estimate of lost population is in the range of 4.26–4.37 million, which significantly exceeds the standing estimate of 1.5 million for *all of Indonesia*. Figure 2 displays the break in the population growth trajectory for Java as a consequence of the epidemic. A second finding relates to the observation that West Java escaped the brunt of the pandemic (Brown 1987, p. 237 and pp. 238–9, Table 11.1). The finding in that study is supported by data that show that, in 1918, all the regencies of West Java experienced influenza mortality rates that were below the mean rate for Java, and of these regencies, fully one-half had rates that were more than one standard deviation below the mean. The estimates in this paper suggest otherwise: both Banten and Tjirebon, residencies in West Java, are among the top five residencies in terms of population loss from influenza (see Table 2, estimates for which were computed using the restricted model of Table 1).

A third notable finding about Java, which contrasts with the Indian experience described in Mills (1986), Klein (1990), and Chandra et al. (2012), relates to the rates of population growth before and after the pandemic. There is no evidence in the data from Java (as there was in India) that annual rates of population growth differed before (1.76 per cent) and after (1.70 per cent) the pandemic.
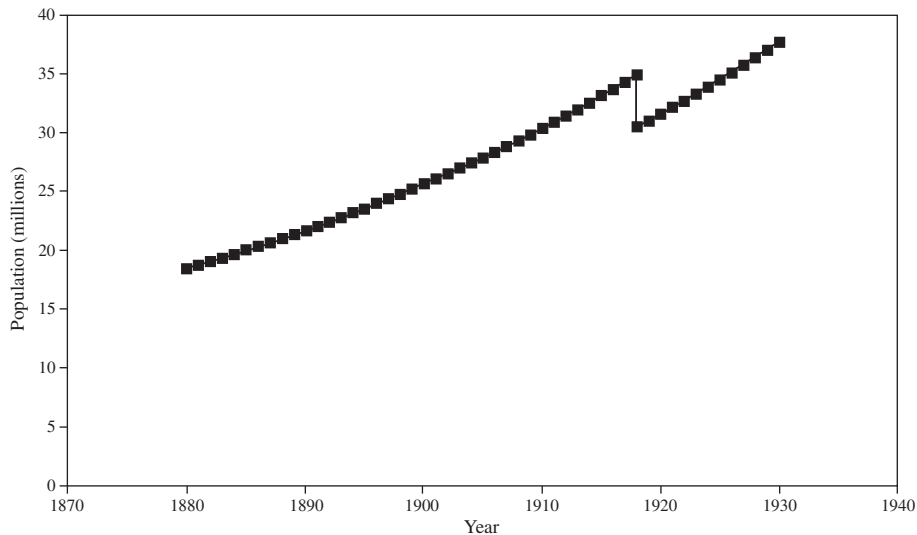
Figure 2   Population of Java, 1880–1930 (in millions)
Source: Estimates from Table 1, restricted model.

Discussion and limitations

In interpreting the results of the analysis, it should be noted that the estimate of the decline in population attributable to the influenza pandemic is the combination of the effects of mortality, fertility, and migration. Because the data reveal that migration both within and to or from Java was a minor phenomenon when compared to the size of the populations of the various residencies of Java, the estimates reflect a combination of excess mortality and depressed fertility (see Boomgaard and Gooszen 1991, pp. 51–5, especially p. 54, Table m, which puts the figure of net out-migration from Java to the Outer Islands in 1918 at 47,838 or less than one-fifth

Table 2   Estimated population losses from the influenza pandemic of 1918–19 in the regions of Java

Residency[1]	Population loss (%)	Region in Java
Madura	−23.71	East Java
Banten	−21.13	West Java
Kediri	−20.62	East Java
Surabaja	−17.54	East Java
Tjirebon	−16.62	West Java
Rembang	−14.90	Central Java
Pasuruan	−14.32	East Java
Kedu	−13.27	Central Java
Semarang	−13.18	Central Java
Pekalongan	−10.31	Central Java
Banjumas	−9.75	Central Java
Madiun	−7.31	East Java
Djakarta	−6.49	West Java
Priangan	−2.97	West Java
Besuki	−1.10	East Java

[1]Names as in Widjojo (1970, p. 6, Table 1).
Source: Estimates from Table 1.

of 1 per cent of the total population, and pp. 180–2, Table 11). Therefore, the estimate of total population loss generated by the model is an upper limit on the estimate of excess mortality. The vast difference between the estimate of 4.3 million for Java and Madura and the existing estimate in Brown (1987) of 1.5 million for all of Indonesia points to a new picture of the impact of the epidemic on Indonesia. This would remain the case even if we revised this new estimate downward to adjust for population loss from fertility declines or losses in food productivity (both of which also resulted from the epidemic) to yield a pure excess mortality figure.

Viewed in historical and comparative perspective, this new finding is not unreasonable. Numerous anecdotal accounts of mortality in the *Koloniale Verslagen*, discussed above, put the mortality rate in the vicinity of 10 per cent, which is significantly higher than the rate of 2.1 per cent for Java and Madura calculated from data obtained from the obviously flawed death registration records (see above). Even the relatively low global mortality rate of 2.5–5 per cent computed in Johnson and Mueller (2002, p. 114, Table 5) exceeds this 2.1 per cent figure. In the general geographic vicinity, we observe varying estimates of 6.1 per cent for India and 23.6 per cent for Western Samoa (Johnson and Mueller 2002, p. 112, Table 3—a review of earlier studies based in large part on published death statistics, which in many instances are known to be underestimates of the true totals). A mortality rate of even 5 per cent for Java would yield a total population loss on a population base of between 35 and 40 million of 1.75–2 million. Clearly, the estimates presented here, which are backed by

numerous anecdotal cases from Indonesia and comparative evidence from the neighbouring regions of Asia and Oceania, are consistent with upward revision.

The geographic finding that portions of western Java were as severely affected as other areas by the epidemic is also new. This may stem in part from the fact that, while most of Java experienced the worst of the pandemic in late 1918, pockets of West and West-Central Java experienced virulent 'flare-ups' as late as early 1919, which were not recorded in the reports of the BGD and KV relating to 1918 and therefore escaped the notice of a number of scholars who focused exclusively on 1918:

> In the course of 1919, especially in the first half of the year, local flare-ups of the great influenza epidemic occurred, but the illness was usually of a benign character. In only a few places was the disease lethal, including the sub-district of Cilacap, where in some *desas* [villages] for a brief period mortality per annum occurred at the rate of 600 per mille, and in the Wado sub-district of the Sumedang department. (KV 1920, deel 1, Hoofdstuk K, afd. V, p. 220; see the Appendix for original text)

In another notable finding, and in contrast to similar models for India, which demonstrate that population growth more than doubled (from 0.5 per cent per annum before the pandemic to 1.2 per cent per annum after the pandemic) (Mills 1986; Klein 1990; Chandra et al. 2012, Table 1), there was no such acceleration in population growth in Java after the pandemic. The finding of a uniform rate of 1.70–1.76 per cent is in line with observations made by demographers studying Java after adjusting for the effect of the pandemic. For example, Widjojo (1970, p. 70) stated that 'it seems plausible that the actual growth rate during most of the period up to 1918 was higher than the reported 10.0 per 1,000 persons', and Boomgaard and Gooszen (1991, p. 38) stated that '[i]n the first thirty years of the 20th century, the average rate of population growth on Java was approximately 1 per cent', which suggests there is room for upward revision for non-pandemic years once the effects of the pandemic are factored in. This finding also raises interesting questions about the comparative impact of the pandemic on fertility in India and other countries, where fertility rates apparently accelerated to make up for the lag created by the epidemic (Pool 1973; Mills 1986; Mamelund 2004; Bloom-Feshbach et al. 2011), and Indonesia, where it apparently did not. A study that attempted to investigate this issue would no doubt require the judicious use of birth registration data, which significantly underreport actual births and are therefore not explored in this paper.

This study has a number of limitations, some of which have been discussed above. The absence of reliable birth and death data means that it is difficult to cross-check the results, which have been generated using population-count data. For the same reason, it is difficult to separate the effects of depressed fertility or mortality reliably from other causes, such as the starvation and excess mortality that may have resulted from the epidemic itself. In addition, the absence of reliable age-specific population counts or mortality data before 1920 precludes any analysis using age cohorts and life tables. Finally, there is the issue of reliability of the population-count data themselves. While they are clearly more accurate than the vital registration statistics, they are not without their own flaws (Gooszen 1991a–c). The results of this study therefore need to be viewed in light of the conscious choice that has been made in favour of an acceptable but imperfect data set over an unacceptably flawed data set, with the attendant implications for the analytic methods chosen for the analyses.

In sum, this study brought fresh methods of statistical analysis to Indonesian population statistics to estimate the toll taken by the influenza pandemic of 1918–19 on the population of Java, Indonesia. Given the importance of Indonesia, the world's fourth most populous country, in world demography, the estimates, which represent a large upward revision, are a significant finding. The addition of up to 2.5 million deaths (a figure that does not even include mortality in the Outer Islands) to the estimate of known worldwide mortality of 50 million (Johnson and Mueller 2002, p. 114, Table 5) could constitute a 5 per cent upward revision of that total. It is hoped that future research will delve into the details of this phenomenon, including variations across Java and their correlates, and the reasons for the differences between the experiences of Indonesia and other countries.

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Appendix

Original text from the Colonial Report of 1920 (Department van Zaken Overzee 1920) referring to the influenza pandemic in western Java:

> In den loop van 1919, vooral in de eerste helft van het jaar, kwamen plaatselijke opflikkeringen van de groote influenza-epidemie nog verspreid voor, doch de ziekte droeg over het algemeen een goedaardig karakter. Slechts op enkele plaatsen heerschte de ziekte zeer moorddadig, o.a. in het onderdistrict Tjilatjap, waar in sommige desa's gedurende korten tijd eene sterfte optrad van 600‰ per jaar, en in het onderdistrict Wado van de afdeeling Soemedang. (KV 1920, deel 1, Hoofdstuk K, afd. V, p. 220)