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Assessing the pandemic potential of emerging influenza

Accurate identification of patients’ demographic characteristics and case counts are key factors in understanding the pandemic potential of emerging influenza viruses, and the implementation of effective medical surveillance and public health response actions. A recent Editorial in The Lancet Infectious Diseases contained an error about the provenance of the first human being with H5N1 avian influenza reported in the western hemisphere, and omitted key data from recent cases of H1N8 avian influenza in human beings in China.

The first confirmed case of H5N1 detected in a human being in the Americas was in a woman, not a man—a health-care worker who died around 1 week after her return from Beijing to Canada. The woman, who was travelling with a family member, experienced the first onset of symptoms during her return flight from Beijing to Canada on Dec 27, 2013. She was admitted to hospital on Jan 1, 2014, and died 2 days later on Jan 3. Local media reported that the woman was in her 20s, the age group at highest risk of death from H5N1.

The Editorial cited a fatal case of H1N8 in December, 2013, in a man aged 75 years from China’s Jiangxi Province. However, two more cases, including a fatality, were reported from China’s Jiangxi Province between Jan 29, and Feb 13, 2013. The first additional case that ended in a fatality was in a woman aged 73 years, and the second case was a 55-year-old woman. These cases were detected through intensive ongoing surveillance for H7N9 cases in China, which have been most common in elderly people.

The emergence and spread of new viruses should be tracked, and their pandemic potential predicted and countered more readily by the early identification of key, at-risk populations. The high variability of age and sex differences in morbidity and mortality rates from emerging zoonotic viruses, such as new coronaviruses and influenza viruses, can provide important indices of populations at highest risk of infection and death, and insights into potential mechanisms for transmission of these viruses to human beings, and between people. This information,
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Table: Expected number of visitors and dengue cases for each of the Brazilian cities hosting the World Cup games

| City        | Expected number of visitors* | $p_{\text{plow}}$ | $p_{\text{pmedium}}$ | $p_{\text{phigh}}$ | Minimum expected number of dengue cases† | Expected number of dengue cases‡ | Expected number of dengue cases per 100 000 visitors§ |
|-------------|-----------------------------|-------------------|----------------------|-------------------|------------------------------------------|-------------------------------|-------------------------------------------------|
| Natal       | 44 952                      | 32%               | 20%                  | 48%               | >74                                      | 6 (2–9)                       | 13 (3–20)                                      |
| Fortaleza   | 58 195                      | 34%               | 20%                  | 46%               | >92                                      | 10 (1–14)                     | 17 (2–24)                                     |
| Rio de Janeiro | 101 910                  | 62%               | 25%                  | 13%               | >66                                      | 11 (0–22)                     | 10 (0–21.6)                                   |
| Belo Horizonte | 36 788                   | 65%               | 24%                  | 11%               | >21                                      | 3 (0–8)                       | 8.2 (0–21.7)                                  |
| Recife      | 37 693                      | 57%               | 24%                  | 19%               | >31                                      | 0 (0–1)                       | 0 (0–2.7)                                     |
| Cuiabá      | 20 740                      | 71%               | 22%                  | 7%                | >9                                       | 2 (0–4)                       | 9.6 (0–19.3)                                  |
| Brasília    | 34 391                      | 73%               | 20%                  | 7%                | >14                                      | 1 (0–1)                       | 2.9 (0–2.9)                                   |
| Salvador    | 57 855                      | 56%               | 27%                  | 17%               | >45                                      | 0                            | 0                                               |
| Manaus      | 26 252                      | 63%               | 25%                  | 12%               | >16                                      | 0                            | 0                                               |
| São Paulo   | 101 150                     | 99%               | 1%                   | 0%                | >2                                       | 0                            | 0                                               |
| Cuiabá      | 34 782                      | 100%              | 0%                   | 0%                | 0                                        | 0                            | 0                                               |
| Porto Alegre | 35 343                    | 100%              | 0%                   | 0%                | 0                                        | 0                            | 0                                               |
| Total       | 607 051                     |                    |                     |                   | >370                                     | 33 (3–59)                     | 5.4 (0–9.7)                                   |

$p_{\text{plow}}$=incidence lower than 100 per 100 000. $p_{\text{pmedium}}$=incidence between 100 and 300 per 100 000. $p_{\text{phigh}}$=incidence higher than 300 per 100 000.

†Minimum number of expected cases (weighted mean) $= 1 \times p_{\text{plow}} + 100 \times p_{\text{pmedium}} + 300 \times p_{\text{phigh}}$.
‡Average (best–worst) scenarios.

Table: Expected number of days that visitors will spend in each city, depending on each of the 32 possible schedules of the games. By multiplying these individual risks by the proportion of the expected number of visitors with respect to each stadium capacity, we estimated the expected number of dengue cases in each of these 12 cities. Our estimations are, on average, more than ten-times lower than those from Lowe and colleagues (table). We estimated the minimum expected number of dengue cases by taking the weighted mean considering the lower bounds of Lowe and colleagues’ estimated incidences ($p_{\text{plow}}, p_{\text{pmedium}}, p_{\text{phigh}}$).

We estimate 33 cases (range 3–59) among the projected 600 000 visitors. The strength of our analysis is that it includes correlations with the exact FIFA match schedule, and best-to-worst case scenarios. Our results support a low dengue risk for visitors to the World Cup, which is consistent with data recently published by GeoSentinel, a network of travel medicine providers.1,4

Predictions are still merely predictions and depend on assumptions from past experiences. Of course, the incidence of dengue in 2014 might be ten-times higher than ever, it is just unlikely to be so (in fact, the number of cases reported so far in 2014 are 43% fewer in Natal and 35% fewer in Fortaleza, than in 2013). However, health-care providers in countries where World Cup visitors will return should be at high alert for dengue, and report cases immediately to authorities. In doing so, timely surveillance can be established and provide the true number of dengue cases during the World Cup.

The research was partially funded by LIM01-HCFMUSP, FAPESP, CNPq (EM, MBN, RX, MA), the Brazilian Ministry of Health (MNB), and Dengue Tools under the Seventh Framework Programme of the European Community (EM, AWS). We declare no competing interests.

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Dengue outlook for the World Cup in Brazil

Because the 2014 FIFA World Cup in Brazil is approaching soon, estimation of the dengue risk for this period in Brazil is important. We therefore commend Rachel Lowe and colleagues1 on their Article in which they discuss how they developed an early warning system for dengue, based on a spatiotemporal Bayesian hierarchical model framework driven by climate and non-climate information.1 They identified optimum trigger alert thresholds for scenarios of medium-risk and high-risk of dengue, thus enabling public health practitioners to implement early interventions. The paper correctly concludes that there is a higher risk of dengue in the cities of Fortaleza and Natal during the time of the World Cup. However, we disagree with the order of magnitude described in their paper.

We calculated the risk of dengue for foreign visitors to the World Cup on the basis of past daily (not monthly) incidence in the 12 cities that will host the games.2 Our calculations also included estimates of the expected number of visitors in each city, and the expected number of days that visitors will spend in each city, depending on each of the 32 possible schedules of the games. By multiplying these individual risks by the proportion of the expected number of visitors with respect to each stadium capacity, we estimated the expected number of dengue cases in each of these 12 cities. Our estimations are, on average, more than ten-times lower than those from Lowe and colleagues (table). We estimated the minimum expected number of dengue cases by taking the weighted mean considering the lower bounds of Lowe and colleagues’ estimated incidences ($p_{\text{plow}}, p_{\text{pmedium}}, p_{\text{phigh}}$).

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In turn, can help to develop public health strategies for the most efficient and effective use of scarce diagnostic, medical care, and treatment resources. I declare no competing interests.

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