Predicting Dengue Outbreaks in Cambodia

Appendix

Appendix Table 1. Magnitudes, timing of the peak and number of probable dengue cases reported in February, March, April, February-March, March-April and February to April to the National Dengue Surveillance System in Cambodia for seasonal dengue outbreaks between 2004 and 2016.

| Year | Magnitude | Timing of the peak | Reported cases in February | Reported cases in March | Reported cases in April | Reported cases in February-April | Reported cases in March-April | Reported cases in February to April |
|------|-----------|--------------------|----------------------------|-------------------------|-------------------------|----------------------------------|-----------------------------|---------------------------------|
| 2004 | 2,530     | July               | 162                        | 191                     | 220                     | 353                              | 411                         | 573                             |
| 2005 | 2,403     | July               | 113                        | 180                     | 195                     | 293                              | 375                         | 488                             |
| 2006 | 3,566     | August             | 122                        | 254                     | 475                     | 376                              | 729                         | 851                             |
| 2007 | 11,726    | June               | 416                        | 756                     | 1,917                   | 1,172                            | 2,673                       | 3,089                           |
| 2008 | 1,594     | July               | 89                         | 145                     | 330                     | 234                              | 475                         | 564                             |
| 2009 | 2,451     | July               | 172                        | 284                     | 544                     | 456                              | 828                         | 1,000                           |
| 2010 | 3,176     | July               | 123                        | 209                     | 198                     | 332                              | 407                         | 530                             |
| 2011 | 3,628     | July               | 90                         | 112                     | 234                     | 202                              | 346                         | 436                             |
| 2012 | 9,125     | July               | 362                        | 773                     | 1,455                   | 1,135                            | 2,228                       | 2,590                           |
| 2013 | 4,483     | July               | 340                        | 545                     | 646                     | 885                              | 1,191                       | 1,531                           |
| 2014 | 667       | August             | 54                         | 85                      | 134                     | 139                              | 219                         | 273                             |
| 2015 | 3,631     | August             | 97                         | 133                     | 196                     | 230                              | 329                         | 426                             |
| 2016 | 2,835     | August             | 333                        | 389                     | 346                     | 722                              | 735                         | 1,068                           |

Appendix Table 2. Predicted magnitudes using the linear model $M = \alpha + \beta N$, with $M$ the magnitude of the peak and $N$ the number of reported probable dengue cases in either February, March, April, February-March, March-April and February to April. The last six columns present the results for the “leave-one-out” procedure, i.e., when the current season of the learning sample is excluded.

| Year | in February | in March | in April | in February-March | in March-April | in February to April |
|------|-------------|----------|----------|-------------------|----------------|---------------------|
| 2004 | 3,446       | 2,599    | 2,322    | 2,886             | 2,353          | 3,527               |
| 2005 | 2,509       | 2,473    | 2,187    | 2,444             | 2,217          | 2,752               |
| 2006 | 2,681       | 3,321    | 3,691    | 3,056             | 3,558          | 3,759               |
| 2007 | 8,303       | 9,074    | 11,432   | 8,920             | 10,921         | 10,737              |
| 2008 | 2,050       | 2,072    | 2,912    | 2,010             | 2,586          | 2,449               |
| 2009 | 3,637       | 3,665    | 4,061    | 3,645             | 3,933          | 3,738               |
| 2010 | 2,700       | 2,805    | 2,203    | 2,732             | 2,338          | 2,647               |
| 2011 | 2,069       | 1,694    | 2,397    | 1,774             | 2,107          | 2,029               |
| 2012 | 7,271       | 9,269    | 8,951    | 8,647             | 9,236          | 9,099               |
| 2013 | 6,850       | 6,656    | 4,608    | 6,806             | 5,308          | 5,623               |
| 2014 | 1,381       | 1,384    | 1,860    | 1,310             | 1,626          | 1,493               |
| 2015 | 2,203       | 1,935    | 2,193    | 1,980             | 2,043          | 2,196               |
| 2016 | 6,716       | 4,868    | 2,998    | 5,605             | 3,580          | 4,103               |

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Appendix Table 3. Estimated parameters (and 95% confidence intervals) for the linear model \( M = \alpha + \beta N \), with \( M \) the magnitude of the peak and \( N \) the number of probable dengue cases reported to NDSS in either February, March or April, and the corresponding proportion of the variance of \( M \) explained.

| Description | Estimates for the model \( M = \alpha + \beta N \), with \( M \) the magnitude and \( N \) the number of cases | February | March | April | February-March | March-April | February-April |
|-------------|-------------------------------------------------|---------|-------|-------|----------------|-------------|---------------|
| \( \alpha \) | | 348.0 | 410.4 | 1140.56 | 285.9 | 796.4 | 597.3 |
| | | [-1,948.8; -1,153.7; 288.8; -1,501.3; -156.7; -466.7; 2,644.8] | | | | | |
| \( \beta \) | | 19.1 | 11.5 | 5.39 | 7.4 | 3.8 | 3.3 |
| | | [8.9; 29.3] | [7.4; 15.5] | [4.2; 6.5] | [4.4; 10.3] | [2.9; 4.6] | [2.5; 4.1] |
| Variance explained by the model* | | 61% | 78% | 91% | 73% | 90% | 88% |
| Variance explained, leave-one-out procedure† | | 42% | 69% | 90% | 63% | 87% | 85% |

*Corresponding to the squared correlation coefficient \( r^2 \).
†Corresponding to the predictive squared correlation coefficient \( q_{CV}^2 \) obtained in the “leave-one-out” cross validation procedure.

Appendix Table 4. Month with >5% of the total number of cases observed for 5 countries in Southeast Asia. Monthly data for the number of case reported in each dengue national surveillance system (excluding Cambodia) are publicly available in (1–4).

| Country | Month with >5% of the total number of cases observed (%) |
|---------|---------------------------------------------------------|
| Cambodia | April (6.1%) |
| Thailand | February (7.3%) |
| Vietnam | March (6.0%) |
| Laos | March (5.6%) |
| Philippines | May (8.9%) |

Appendix Table 5. Estimated parameters (and 95% confidence intervals) for the linear model \( M = \alpha + \beta N \), with \( M \) the magnitude of the peak and \( N \) the number of probable dengue cases reported in national dengue surveillance systems (1–4), when 5% of the total number of cases have been observed, and the corresponding proportion of the variance of \( M \) explained.

| Description | Estimates for the model \( M = \alpha + \beta N \), with \( M \) the magnitude and \( N \) the number of cases | Cambodia | Thailand | Vietnam | Laos | Philippines |
|-------------|-------------------------------------------------|---------|---------|-------|-------|-------------|
| \( \alpha \) | | 1140.6 [288.8; 1992.3] | 5590.1 [1963.2; 9217.1] | -4875.4 [-10889.1; -1138.4] | 3228.3 [250; 6706.6] | -4327.1 [-10142.8; 1488.5] |
| \( \beta \) | | 5.4 [4.2; 6.5] | 2 [0.8; 3.2] | 8.1 [5.6; 10.7] | -3.1 [-28.5; 22.3] | 10.2 [6.2; 14.2] |
| Variance explained by the model* | | 90.6 | 42.8 | 76.2 | 0.6 | 74.2 |
| Variance explained, leave-one-out procedure† | | 89.8 | 33.4 | 64.3 | -53.5 | 45.8 |

*Corresponding to the squared correlation coefficient \( r^2 \).
†Corresponding to the predictive squared correlation coefficient \( q_{CV}^2 \).

References

1. Van Panhuis W, Cross A, Burke D, Choisy M. Counts of Dengue reported in Philippines: 1955–2010: Project Tycho dataset. University of Pittsburgh; 2018 [cited 2019 Sep 13].
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   https://www.tycho.pitt.edu/dataset/TH.38362002
Appendix Figure 1. Observed versus predicted magnitude of the peak for each season using a simple linear regression model $M = \alpha + \beta N$, with $M$ the magnitude of the peak and $N$ the number of probable dengue cases reported to NDSS in April. The black line represents the expected results with perfect prediction. The figure on the right represents the results for the “leave-one-out” procedure.
Appendix Figure 2. Observed versus predicted magnitude of the peak for each season using a simple linear regression model $M = \alpha + \beta N$, with $M$ the magnitude of the peak and $N$ the number of probable dengue cases reported to NDSS in April. The black line represents the expected results with perfect prediction. The figure on the left represents the results when we left 2007 and 2012 out of the learning sample and tried to predict the magnitude of the peak for these 2 years. Conversely, the figure on the right represent the results when we kept only 2007 and 2012 in the learning sample to predict the magnitude of the peak for the 11 other seasons.

Appendix Figure 3. Observed vs. predicted magnitude of the peak for each season using a simple linear regression model $M = \alpha + \beta N$, with $M$ the magnitude of the peak and $N$ the number of reported dengue like cases in Thailand in February. The black line represents the expected results with perfect prediction. The figure on the right represents the results for the “leave-one-out” procedure.
Appendix Figure 4. Observed vs. predicted magnitude of the peak for each season using a simple linear regression model \( M = \alpha + \beta N \), with \( M \) the magnitude of the peak and \( N \) the number of reported dengue like cases in Vietnam in March. The black line represents the expected results with perfect prediction. The figure on the right represents the results for the “leave-one-out” procedure.

Appendix Figure 5. Observed vs. predicted magnitude of the peak for each season using a simple linear regression model \( M = \alpha + \beta N \), with \( M \) the magnitude of the peak and \( N \) the number of reported dengue like cases in Laos in March. The black line represents the expected results with perfect prediction. The figure on the right represents the results for the “leave-one-out” procedure.
Appendix Figure 6. Observed vs. predicted magnitude of the peak for each season using a simple linear regression model $M = \alpha + \beta N$, with $M$ the magnitude of the peak and $N$ the number of reported dengue like cases in Philippines in May. The black line represents the expected results with perfect prediction. The figure on the right represents the results for the "leave-one-out" procedure.