Disease surveillance based on internet-based linear models: an Australian case study of previously unmodeled infection diseases

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The following section lists all search terms analysed in this study and provides tables for each disease indicating the correlation (Spearman rho) between disease notification data and search metrics for the period 2009-14. Blank cells indicate that there was insufficient data to determine the degree of correlation.

**Unique Terms**: "Barmah forest"; "Chicken pox"; "hep a"; "hep b"; "hep c"; "Ross River"; a cough; alphamox; amoxil; barmah forest; barmah forest virus; biaxsig; blood in mucus; blood in phlegm; blood test; botulism; bromhexine; bronchiolitis; bronchitis; bronchitis contagious; bruise; bruise easily; bruised; cairns flood; ceclor; cervical mucus; chest infection; chest infections; chesty; chesty cough; Chikungunya; chilblains; Chlamydia; clarithromycin; codeine linctus; coddal; coddal cold and flu; cold and flu; cold and flu tablets; cold flu; cold hands; cold hands and feet; cold symptoms; colds; conjunctivitis; conjunctivitis contagious; cough; cough medicine; cough remedies; cough remedy; cough suppressant; coughs; cramping; cramps; Cryptosporidiosis; Cryptosporidium; cymbalta; decongestant; demazin; Dengue; dengue fever; dengue fever symptoms; dengue mosquito; dengue symptoms; dextromethorphan; dextromethorphan hydrobromide; diarrhea; difflam; dimetapp; discharge; dry cough; duro tuss; expectorant; flash floods; flood; flood australia; flood damage; flood damaged cars; flood recovery; Flu; flu and pregnancy; flu contagious; flu cough; flu incubation; flu incubation period; flu injection; flu injections; flu pregnancy; flu shots; flu symptoms; flu tablets; flu treatment; flu vaccinations; fluvax; foot and; foot and mouth; foot and mouth disease; gonococcal; gonorrhoea; h1n1 flu; h1n1 vaccine; hand foot; hand foot and mouth; hep; hepatitis; Hepatitis A; Hepatitis B; Hepatitis C; hives rash; hooping; human temperature; impetigo; Influenza; influenza a; influenza a virus; influenza symptoms; influenza vaccine; influvac; is pneumonia; is pneumonia contagious; kalixocin; laryngitis; legionella; Legionellosis; legionnaires; lemsip; leptospirosis; linctus; listeria; listeriosis; lozenges; measles; measles outbreak; meningitis; meningococcal; mouth disease; Murray Valley; Murray Valley encephalitis; myxomatosis; nasal congestion; neomycin; neuritis; night sweats; optic neuritis; panvax; pathology; Pertussis; phenomia; phenylephrine; phenylephrine hydrochloride; pholcodine; pleurisy; pneumococcal; pneumonia; pristiq; red cheeks; rheumatology; rikodeine; robitussin; ross river; ross river fever; ross river fever symptoms; ross river virus; ross river virus symptoms; roxar; roxithromycin; rulide; school sores; senega; senega and ammonia; shingles; sinus; sinusitis; staph infection; strepsils; sudafed; swine flu symptoms; symptom checker; symptoms of
dengue; symptoms of dengue fever; symptoms of pneumonia; symptoms of swine; symptoms of swine flu; tamiflu; tamiflu side effects; townsville flood; Varicella; vicks; water flood; white creamy discharge; white discharge; whooping; whooping cough; whooping cough in adults; whooping cough treatment

**Barmah Forest virus infection:** "Barmah forest"; barmah forest; barmah forest virus; flood australia; flood damage; flood damaged cars; flood recovery; myxomatosis; ross river; ross river fever; ross river virus; water flood

| Term                          | ACT | NSW | NT | Qld | SA | Tas | Vic | WA | Aus  |
|-------------------------------|-----|-----|----|-----|----|-----|-----|----|------|
| ross river virus              |     |     |    |     |    |     |     |    | 0.539|
| ross river                   | 0.358 | 0.251 |     |     |    |     |     |    | 0.414|
| ross river fever             |     |     |    |     |    |     |     |    | 0.399|
| flood australia              | -0.016 |     | 0.194 |     |    |     |     |    | 0.250|
| water flood                  |     | 0.112 |     |     |    |     |     |    | 0.237|
| flood damaged cars           |     |     |    |     |    |     |     |    | 0.082|
| "barmah forest"             |     |     |    |     |    |     |     |    |      |
| barmah forest                |     |     |    |     |    |     |     |    |      |
| barmah forest virus          |     |     |    |     |    |     |     |    |      |
| flood damage                 |     |     |    |     |    |     |     |    | 0.182|
| flood recovery               | 0.096 |     | 0.204 |     |    |     |     |    |      |
| myxomatosis                  |     |     |    |     |    |     |     |    |      |

**Botulism:** botulism; hives rash

| Term    | ACT | NSW | NT | Qld | SA | Tas | Vic | WA | Aus  |
|---------|-----|-----|----|-----|----|-----|-----|----|------|
| botulism|     |     |    |     |    |     |     |    | 0.053|
| hives rash |     |     |    |     |    |     |     |    |      |

**Chikungunya virus infection:** Chikungunya; Dengue
### Dengue

| Term              | ACT   | NSW | NT  | Qld  | SA   | Tas  | Vic  | WA   | Aus  |
|-------------------|-------|-----|-----|------|------|------|------|------|------|
| dengue            | -0.023| 0.104| 0.140| 0.194|      |      |      |      |      |
| chikungunya       | -0.033|      | 0.016| 0.056| 0.167|      |      |      |      |

### Chlamydial infection: blood test; Chlamydia; pathology

| Term          | ACT  | NSW  | NT  | Qld  | SA  | Tas  | Vic  | WA  | Aus  |
|---------------|------|------|-----|------|-----|------|------|-----|------|
| blood test    | 0.540| 0.038| 0.208| 0.433| 0.390| 0.557| 0.634|     |      |
| pathology     | 0.163| 0.484| 0.253| 0.129| 0.181| -0.008| 0.572|     |      |
| chlamydia     | 0.458| 0.213|      |      | 0.295| 0.493| 0.516|     |      |

### Cryptosporidiosis: Cryptosporidiosis; Cryptosporidium; dengue mosquito; ross river virus

| Term            | ACT | NSW | NT  | Qld  | SA | Tas  | Vic  | WA  | Aus  |
|-----------------|-----|-----|-----|------|----|------|------|-----|------|
| ross river virus|     |     |     |      |    |      | 0.569|     |      |
| cryptosporidiosis|   |     |     |      |    |      | 0.147|     |      |
| cryptosporidium |     |     |     |      |    |      | 0.213|     |      |
| dengue mosquito |     |     |     |      |    |      |       |     |      |

### Dengue virus infection: bruise; bruise easily; bruised; Dengue; dengue fever; dengue fever symptoms; dengue mosquito; dengue symptoms; symptom checker; symptoms of dengue; symptoms of dengue fever

| Term            | ACT  | NSW | NT  | Qld  | SA  | Tas  | Vic  | WA  | Aus  |
|-----------------|------|-----|-----|------|-----|------|------|-----|------|
| dengue          | -0.036| 0.337| 0.508| 0.569| 0.507|      |      |     |      |
| dengue fever    | -0.036| 0.477|      | 0.562| 0.499|      |      |     |      |
| bruise          |     | 0.289| 0.260| 0.441| 0.441|      |      |     |      |
| bruised         |     | 0.285| 0.161| 0.495| 0.401|      |      |     |      |
| symptom checker |     |     |     |      |     |      |      |     | 0.355|
bruise easily
dengue fever symptoms
dengue mosquito
dengue symptoms
symptoms of dengue
symptoms of dengue fever

**Gonococcal infection:** cervical mucus; discharge; gonococcal; gonorrhea; gonorrhoea; pristiq; staph infection; white discharge

| Term                  | ACT  | NSW  | NT   | Qld  | SA   | Tas  | Vic  | WA   | Aus  |
|-----------------------|------|------|------|------|------|------|------|------|------|
| discharge             | 0.795| -0.028| 0.298| 0.205| 0.556| 0.265| 0.786|
| white discharge       | 0.742| 0.228 | 0.643|       | 0.762|
| pristiq               | 0.642| 0.273 | 0.513|       | 0.594|
| cervical mucus        |      |      |      |      |      |      | 0.591|
| staph infection       | 0.659|      |      |      | 0.544|      | 0.524|
| gonorrhea             | 0.477|      |      |      | 0.437|      | 0.422|
| gonococcal            |      |      |      |      |      |      |      |
| gonorrhoea            |      |      |      |      |      |      |      |

**Hepatitis A:** "hep a"; h1n1 vaccine; hep; hepatitis; Hepatitis A; panvax

| Term                  | ACT  | NSW  | NT   | Qld  | SA   | Tas  | Vic  | WA   | Aus  |
|-----------------------|------|------|------|------|------|------|------|------|------|
| hepatitis a           | -0.167|      |      |      |      |      |      |      | 0.293|
| panvax                |      |      |      |      |      |      |      |      | 0.256|
| hepatitis             | -0.021| -0.008| -0.191|      | 0.196| -0.198|      | 0.146|
| hep                   | -0.026| -0.092|      |      | -0.246|      |      | -0.191|
| "hep a"               |      |      |      |      |      |      |      |      | -0.302|
| h1n1 vaccine          | 0.119|      |      |      |      |      |      |      |      |
**Hepatitis B (newly acquired):** "hep b"; hep; hepatitis; Hepatitis B; rheumatology

| Term         | ACT  | NSW  | NT   | Qld | SA   | Tas  | Vic  | WA   | Aus  |
|--------------|------|------|------|-----|------|------|------|------|------|
| hepatitis    | -0.116 | -0.014 | -0.064 | 0.157 | -0.037 | 0.123 |
| hepatitis b  | -0.002 |       |       |      | -0.263 |      | 0.034 |
| "hep b"      |       |       |       |      |        |      | 0.029 |
| rheumatology |       |       |       |      |        |      | -0.072 |
| hep          | -0.055 | -0.041 |       | -0.184 |      | -0.089 |

**Hepatitis B (unspecified):** "hep b"; hep; hepatitis; Hepatitis B; rheumatology

| Term         | ACT  | NSW  | NT   | Qld | SA   | Tas  | Vic  | WA   | Aus  |
|--------------|------|------|------|-----|------|------|------|------|------|
| hepatitis    | 0.183 | 0.097 | -0.060 | 0.067 | -0.007 | 0.230 |
| hepatitis b  | 0.005 |       |       |      | -0.008 |      | 0.166 |
| hep          | -0.023 | -0.167 |       | -0.014 |      | 0.117 |
| "hep b"      |       |       |       |      |        |      | 0.105 |
| rheumatology |       |       |       |      |        |      | -0.056 |

**Hepatitis C (unspecified):** Hepatitis C; hepatitis; hep; "hep c"

| Term         | ACT  | NSW  | NT   | Qld | SA   | Tas  | Vic  | WA   | Aus  |
|--------------|------|------|------|-----|------|------|------|------|------|
| hepatitis    | 0.193 | 0.116 | -0.149 | 0.142 | -0.035 | 0.297 |
| hepatitis c  | 0.064 |       |       |      | -0.104 |      | 0.266 |
| "hep c"      | -0.152 |       |       |      |        |      | 0.189 |
| hep          | 0.105 | -0.052 |       | -0.010 |      | 0.027 |

**Influenza (laboratory confirmed):** Flu; flu and pregnancy; flu contagious; flu cough; flu incubation; flu incubation period; flu pregnancy; flu symptoms; flu treatment; h1n1 flu; human temperature; Influenza; influenza a; influenza a virus; influenza symptoms; swine flu symptoms; symptoms of swine; symptoms of swine flu; tamiflu; tamiflu side effects
| Term                               | ACT  | NSW  | NT   | Qld  | SA   | Tas  | Vic  | WA   | Aus  |
|-----------------------------------|------|------|------|------|------|------|------|------|------|
| flu symptoms                      | 0.344| 0.290| 0.589|      | 0.485|      |      |      | 0.423|
| influenza                         | 0.364| 0.615|      |      | 0.287|      |      |      | 0.383|
| flu incubation period             | 0.105|      |      |      |      |      |      |      | 0.362|
| human temperature                |      |      |      |      |      |      |      |      | 0.321|
| flu                               | 0.265| 0.095| 0.276| 0.386| 0.239| 0.280| 0.313|      |      |
| flu incubation                    | 0.150|      |      |      |      |      |      |      | 0.308|
| tamiflu side effects              |      |      |      |      |      |      |      |      | 0.212|
| swine flu symptoms                | 0.342| 0.150| 0.322| 0.118| 0.305| 0.107|      |      |      |
| flu and pregnancy                 |      |      |      |      |      |      |      |      |      |
| flu contagious                    |      |      |      |      |      |      |      |      |      |
| flu cough                         |      |      |      |      |      |      |      |      |      |
| flu pregnancy                     |      |      |      |      |      |      |      |      |      |
| flu treatment                     |      |      |      |      |      |      |      |      |      |
| h1n1 flu                          | 0.260|      |      |      |      | 0.151|      |      |      |
| influenza a                       |      |      |      |      |      |      |      |      | 0.151|
| influenza a virus                 |      |      |      |      |      |      |      |      |      |
| influenza symptoms                |      |      |      |      | 0.099|      |      |      | 0.100|
| symptoms of swine                 | 0.322| 0.227| 0.079| 0.267| 0.134|      |      |      |      |
| symptoms of swine flu             | 0.334| 0.224| 0.266|      |      |      |      |      |      |
| tamiflu                           |      |      |      |      |      |      |      | -0.021| -0.016|

**Legionellosis:** legionella; Legionellosis; legionnaires

| Term   | ACT | NSW | NT | Qld | SA | Tas | Vic | WA | Aus |
|--------|-----|-----|----|-----|----|-----|-----|----|-----|
| legionnaires |    |     |    |     |    |     |     |    | 0.108 | 0.237 |
**Legionella**

**Legionellosis**

**Leptospirosis**: barmah forest virus; cairns flood; flash floods; flood; flood damaged cars; leptospirosis; ross river; townsville flood

| Term                        | ACT  | NSW  | NT   | Qld  | SA   | Tas  | Vic  | WA   | Aus  |
|-----------------------------|------|------|------|------|------|------|------|------|------|
| ross river                  | 0.110| 0.059|      |      |      |      |      |      | 0.405|
| cairns flood                | 0.074| 0.182|      |      |      |      |      |      | 0.288|
| flood damaged cars          |      |      |      |      |      |      |      | 0.102|      |
| barmah forest virus         |      |      |      |      |      |      |      |      |      |
| flash floods                | 0.052| 0.108| 0.094|     |      |      |      |      |      |
| flood                       | 0.193| -0.014| 0.014| 1.23 | 0.078|      |      |      |      |
| leptospirosis               |      |      |      |      |      |      |      |      |      |
| townsville flood            | 0.116| 0.165|      |      |      |      |      |      |      |

**Listeriosis**: listeria; listeriosis; neuritis; optic neuritis

| Term                | ACT   | NSW  | NT  | Qld  | SA  | Tas  | Vic  | WA   | Aus  |
|---------------------|-------|------|-----|------|-----|------|------|------|------|
| listeria            | -0.010|      |     |      |     |      |      |      | 0.091|
| neuritis            |       |      |     |      |     |      |      |      | -0.075|
| listeriosis         |       |      |     |      |     |      |      |      |      |
| optic neuritis      | -0.050|      |     |      |     |      |      | 0.064|      |

**Measles**: dengue symptoms; measles; measles outbreak

| Term                | ACT  | NSW  | NT  | Qld  | SA  | Tas  | Vic  | WA   | Aus  |
|---------------------|------|------|-----|------|-----|------|------|------|------|
| measles             | 0.198| 0.263| 0.119| 0.367|     |      |      |      |      |
| dengue symptoms     |      |      |     |      |     |      |      | -0.028|      |
measles outbreak | 0.059 | | | 0.050 |

**Meningococcal disease (invasive):** alhamox; amoxil; biaxsig; ceclor; cilamox; meningitis; meningococcal; roxar; rulide

| Term          | ACT  | NSW | NT | Qld | SA  | Tas | Vic | WA | Aus  |
|---------------|------|-----|----|-----|-----|-----|-----|----|------|
| rulide        |      |     |    |     |     |     |     |    | 0.222|
| meningococcal | 0.018|     |    |     |     |     |     |    | 0.180|
| meningitis    | -0.059| -0.011| -0.010|     |     |     |     |    | 0.025|
| amoxil        |      |     |    |     |     |     |     |    | -0.066|
| alhamox       |      |     |    |     |     |     |     |    |      |
| biaxsig       |      |     |    |     |     |     |     |    |      |
| ceclor        |      |     |    |     |     |     |     |    |      |
| cilamox       |      |     |    |     |     |     |     |    |      |
| roxar         |      |     |    |     |     |     |     |    |      |

**Murray Valley encephalitis virus infection:** Murray Valley; Murray Valley encephalitis

| Term                          | ACT  | NSW | NT | Qld | SA  | Tas | Vic | WA | Aus  |
|-------------------------------|------|-----|----|-----|-----|-----|-----|----|------|
| murray valley encephalitis    |      |     |    |     |     |     |     |    | 0.265|
| murray valley                 |      |     |    |     |     |     |     |    | -0.012|

**Pertussis:** hooping; Pertussis; whooping; whooping cough; whooping cough in adults; whooping cough treatment

| Term                      | ACT  | NSW | NT | Qld | SA  | Tas | Vic | WA  | Aus  |
|---------------------------|------|-----|----|-----|-----|-----|-----|-----|------|
| whooping                  | 0.661| 0.489| 0.525| 0.700| 0.651|
| whooping cough             | 0.695| 0.443| 0.503| 0.679| 0.649|
| whooping cough in          |      |     |    |     |     |     |     |     | 0.413|
Pneumococcal disease (invasive): a cough; alphamox; amoxil; blood in mucus; blood in phlegm; bromhexine; bronchiolitis; bronchitis; bronchitis contagious; chest infection; chest infections; chesty; chesty cough; chilblains; clarithromycin; codeine linctus; codral; codral cold and flu; cold and flu; cold and flu tablets; cold flu; cold hands; cold hands and feet; cold symptoms; colds; cough; cough medicine; cough remedies; cough remedy; cough suppressant; coughs; decongestant; demazin; dextromethorphan; dextromethorphan hydrobromide; difflam; dimetapp; dry cough; duro tuss; expectorant; flu tablets; is pneumonia; is pneumonia contagious; laryngitis; lemsip; linctus; lozenges; nasal congestion; night sweats; phenomia; phenylephrine; phenylephrine hydrochloride; pholcodine; pleurisy; pneumococcal; pneumonia; red cheeks; rikodeine; robitussin; roxithromycin; rulide; senega; senega and ammonia; sinus; sinusitis; strepsils; sudafed; symptoms of pneumonia; vicks

| Term            | ACT | NSW | NT  | Qld | SA  | Tas | Vic | WA  | Aus |
|-----------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| bronchitis      | 0.558 |     | 0.338 |     | 0.402 |     |     | 0.753 |     |
| pneumonia       | 0.611 | 0.043 | 0.479 | 0.186 |     | 0.578 | 0.371 | 0.747 |     |
| cold flu        | 0.550 |     | 0.387 |     | 0.276 |     |     | 0.715 |     |
| codral          |     |     |     |     |     |     |     | 0.663 |     |
| colds           | 0.406 |     |     |     | 0.338 |     |     | 0.654 |     |
| cold and flu    | 0.493 |     |     |     | 0.259 |     |     | 0.653 |     |
| cough           | 0.497 | 0.060 | 0.479 | 0.176 |     | 0.541 | 0.384 | 0.652 |     |
| pleurisy        |     |     |     |     |     |     |     | 0.644 |     |
| cold symptoms   | 0.401 |     |     |     | 0.327 |     |     | 0.631 |     |
| chest infection | 0.389 |     |     |     | 0.268 |     |     | 0.628 |     |
| sudafed         |     |     |     |     |     |     |     | 0.605 |     |
| laryngitis      | 0.324 |     |     |     |     |     |     | 0.586 |     |
| Condition                  | Probability |           |           |           |           |
|----------------------------|-------------|-----------|-----------|-----------|-----------|
| night sweats               | 0.402       |           |           | 0.168     | 0.568     |
| vicks                      | 0.336       |           |           | 0.320     | 0.557     |
| sinus                      | 0.413       | 0.043     | 0.356     | 0.104     | 0.357     | 0.201     | 0.555     |
| chesty                     |             |           |           |           | 0.552     |
| bronchiolitis              |             |           |           |           | 0.542     |
| dry cough                  | 0.343       |           |           | 0.280     | 0.542     |
| a cough                    | 0.306       | 0.214     |           | 0.213     | 0.534     |
| cold hands                 |             |           |           |           | 0.530     |
| rulide                     |             |           |           |           | 0.525     |
| roxithromycin              |             |           |           |           | 0.521     |
| is pneumonia               |             |           |           |           | 0.492     |
| phenylephrine              |             |           |           |           | 0.462     |
| sinusitis                  | 0.270       |           |           | 0.237     | 0.460     |
| cold and flu tablets       |             |           |           |           | 0.448     |
| cough medicine             |             |           |           |           | 0.443     |
| flu tablets                |             |           |           |           | 0.397     |
| chesty cough               |             |           |           |           | 0.396     |
| cough remedies             |             |           |           |           | 0.391     |
| amoxil                     |             |           |           |           | 0.323     |
| clarithromycin             |             |           |           |           | 0.306     |
| red cheeks                 |             |           |           |           | 0.292     |
| lozenges                   |             |           |           |           | 0.249     |
| alphamox                   |             |           |           |           |           |
| blood in mucus             |             |           |           |           |           |
| blood in phlegm            |             |           |           |           |           |
| Term                              |
|----------------------------------|
| bromhexine                       |
| bronchitis contagious            |
| chest infections                 |
| chilblains                       |
| codeine linctus                  |
| codral cold and flu              |
| cold hands and feet              |
| cough remedy                     |
| cough suppressant                |
| coughs                           |
| decongestant                     |
| demazin                          |
| dextromethorphan                 |
| dextromethorphan hydrobromide    |
| difflam                          |
| dimetapp                         |
| duro tuss                        |
| expectorant                      |
| is pneumonia contagious          |
| lemsip                           |
| linctus                          |
| nasal congestion                 |
| phenomia                         |
| phenylephrine                    |
**Ross River virus infection**: "Ross River"; barmah forest; barmah forest virus; flu injection; flu injections; flu shots; flu vaccinations; fluvax; impetigo; influenza vaccine; influvac; myxomatosis; neomycin; ross river; ross river fever; ross river fever symptoms; ross river virus; ross river virus symptoms; school sores

| Term                              | ACT | NSW | NT | Qld | SA | Tas | Vic | WA | Aus |
|-----------------------------------|-----|-----|----|-----|----|-----|-----|-----|-----|
| "ross river"                      | 0.456 | 0.082 |    |     |    |     |     |     | 0.742 |
| ross river                        | 0.467 | 0.016 |    |     |    |     |     |     | 0.732 |
| ross river fever                  |     |     |    |     |    |     |     |     | 0.626 |
| ross river virus                  |     |     |    |     |    |     |     |     | 0.623 |
| school sores                      |     |     |    |     |    |     |     | 0.250 | 0.608 |
| impetigo                          | 0.211 |     |    |     |    |     |     |     | 0.452 |
| barmah forest                     |     |     |    |     |    |     |     |     | 0.452 |
| barmah forest virus               |     |     |    |     |    |     |     |     | 0.452 |
| flu injection                     |     |     |    |     |    |     |     |     | 0.452 |
| flu injections                    |     |     |    |     |    |     |     |     | 0.452 |
| flu shots                         |     |     |    |     |    |     |     | -0.014 |  |
Asian flu vaccinations
flu vaccinations
fluvax
influenza vaccine
influvac
myxomatosis
neomycin
ross river fever symptoms
ross river virus symptoms

Varicella zoster (Chickenpox): "Chicken pox"; clarithromycin; conjunctivitis; conjunctivitis contagious; cymbalta; foot and; foot and mouth; foot and mouth disease; hand foot; hand foot and mouth; kalixocin; mouth disease; pristiq; shingles; Varicella

| Term                        | ACT | NSW | NT | Qld | SA | Tas | Vic | WA | Aus |
|-----------------------------|-----|-----|----|-----|----|-----|-----|-----|-----|
| conjunctivitis              |     | 0.071 |    | 0.380 |    | 0.624 |     |     |     |
| hand foot and mouth         |     | 0.021 |    | 0.369 |    | 0.433 |     |     |     |
| foot and mouth              |     | 0.022 |    | 0.395 |    | 0.423 |     |     |     |
| hand foot                   |     | -0.026 |   | 0.330 |    | 0.420 |     |     |     |
| clarithromycin              |     |      |    |       |    |      |     | 0.400 |     |
| foot and                    |     | 0.085 |    | 0.013 |    | 0.009 | 0.326 | 0.363 | 0.375 |
| foot and mouth disease      |     | -0.006 |   |       |    |      | 0.381 |    | 0.364 |
| mouth disease               |     | -0.026 |   |       |    |      | 0.314 |    | 0.360 |
| "chicken pox"               |     | -0.047 |   |       |    |      | 0.083 | 0.131 | 0.273 |
| pristiq                     |     | -0.008 |   |       |    |      | 0.367 |    | 0.201 |
| varicella                   |     |      |    |       |    |      |      |     | 0.185 |
**Varicella zoster (Shingles):** "Chicken pox"; clarithromycin; conjunctivitis; conjunctivitis contagious; cramping; cramps; diarrhea; discharge; kalixocin; pristiq; shingles; Varicella; white creamy discharge; white discharge

| Term                  | ACT | NSW  | NT | Qld | SA  | Tas | Vic | WA  | Aus  |
|-----------------------|-----|------|----|-----|-----|-----|-----|-----|------|
| diarrhea              |     | -0.400 | 0.546 |   | 0.578 | 0.633 | 0.762 |
| cramps                |     | -0.340 | 0.619 |   | 0.506 | 0.608 | 0.744 |
| white discharge       |     | -0.240 |       |   | 0.511 |       | 0.734 |
| discharge             | 0.091 |     | -0.290 | 0.461 |   | 0.489 | 0.359 | 0.731 |
| cramping              |     | -0.305 |       |   | 0.563 |       | 0.633 |
| varicella             |     |       |       |   |       |       | 0.590 |
| pristiq               |     | -0.263 |       |   | 0.496 |       | 0.549 |
| clarithromycin        |     |       |       |   |       |       | 0.444 |
| shingles              |     | -0.178 | 0.569 |   | -0.008 | 0.546 | 0.312 |
| conjunctivitis        |     | -0.317 |       |   | 0.296 |       | 0.225 |
| "chicken pox"         |     | -0.409 |       |   | 0.111 | 0.521 | 0.097 |
| conjunctivitis contagious |   |       |       |   |       |       |      |
| kalixocin             |     |       |       |   |       |       |      |
| white creamy discharge |   |       |       |   |       |       |      |
**Varicella zoster (unspecified):** blood test; "Chicken pox"; clarithromycin; conjunctivitis; conjunctivitis contagious; kalixocin; pristiq; shingles; Varicella

| Term                  | ACT | NSW  | NT  | Qld | SA  | Tas | Vic | WA  | Aus |
|-----------------------|-----|------|-----|-----|-----|-----|-----|-----|-----|
| blood test            |     | -0.023 | 0.297 | -0.404 |     | 0.316 | 0.400 | 0.628 |     |
| pristiq               |     | 0.521 |      |      | 0.487 |      |      | 0.551 |     |
| clarithromycin        |     |      |      |      |     |      |      | 0.447 |     |
| varicella             |     |      |      |      |     |      |      |      | 0.421 |
| conjunctivitis        |     | 0.438 |      |      | 0.404 |      |      | 0.380 |     |
| shingles              |     | 0.095 | -0.424 |      | 0.000 | 0.374 |      | 0.323 |     |
| "chicken pox"         |     | 0.332 |      |      | 0.224 |      | 0.340 |      | 0.146 |
| conjunctivitis contagious |   |      |      |      |      |      |      |      |     |
| kalixocin             |     |      |      |      |      |      |      |      |     |
Google Trends download script

```
list_of_disease = [  
    // "INSERT SEARCH TERM 1",  
    // "INSERT SEARCH TERM 2",  
    // "INSERT SEARCH TERM 3",  
]

australian_states = [  
    "AU-ACT",  
    "AU-NSW",  
    "AU-NT",  
    "AU-QLD",  
    "AU-SA",  
    "AU-TAS",  
    "AU-VIC",  
    "AU-WA",  
    "AU"
]

var disease_helper = {};  
DISEASE_WINDOWS_LOADED = 'windows_loaded';  
DISEASE_CSV = 'csv';

// Initializing a dictionary helper for each  
// disease to remember the number of states (1 state = 1 window)  
// and the csv report

var CSV_DELIMITER = ',';  
var CSV_CARRIAGE = '
';

var no_data = new Array();

var windows_loaded_callback = function(windows, disease) {  
    default_state = australian_states.length - 1; // last state: the one most likely to have data
    chartDataLength = windows[default_state].chartData.rows.length;
    for (var rowID = 0; rowID < chartDataLength; rowID++) {
        for (var k = 0; k < windows.length + 1; k++) {
            if (k === 0) {
                disease_helper[disease][DISEASE_CSV] += windows[default_state].chartData.rows[rowID][0].f + CSV_DELIMITER;
            } else {
                var temp_k = k - 1;
                try {
                    disease_helper[disease][DISEASE_CSV] += windows[temp_k].chartData.rows[rowID][3];
                } catch (err) {
                    disease_helper[disease][DISEASE_CSV] += windows[temp_k].chartData.rows[rowID][3];
                }
            }
        }
    }
}
```
if (temp_k !== (windows.length - 1)) {
    disease_helper[disease][DISEASE_CSV] += CSV_DELIMITER; // we dont want a , for the last value
} 
} catch(e) {
    //console.log('Exception for temp_k:' + temp_k + ' and rowID ' + rowID);
    disease_helper[disease][DISEASE_CSV] += 'No Data';
    if (temp_k !== (windows.length - 1)) {
        disease_helper[disease][DISEASE_CSV] += CSV_DELIMITER;
    }
}
}
}
disease_helper[disease][DISEASE_CSV] += CSV_CARRIAGE;
}
}
var encodedUri = encodeURI(disease_helper[disease][DISEASE_CSV]);
var link = document.createElement("a");
link.setAttribute("href", 'data:text/csv;charset=utf-8,' + encodedUri);
link.setAttribute("download", disease + ".csv");
link.click(); // This will download the data file named "my_data.csv".
}
var open_window = function(windows, current_state, current_disease, j) {
    var my_window = window.open(window.location.origin + '/trends/trendsReport?q=' + current_disease + '&geo=' + current_state + '&content=1');
    if (!my_window) {
        throw new Error('POP ups are blocked');
    }
    //TODO: if google quota exceeded, retry
    my_window.addEventListener('load', function() {
        disease_helper[current_disease][DISEASE_WINDOWS_LOADED] += 1;
        if (!this.chartData) {
            /*
            We cant find the data
            2 options here.
            - Either there is no data from google.
            - Or we have exceeded our quota
            */
            if (this.document.getElementById('report').getElementsByTagName('errorTitle')[0].innerHTML.indexOf('Not enough search volume') !== -1) {
                //console.log('No data for ' + current_state + ' ' + current_disease);
            }
        }
    });
}
if (disease_helper[current_disease][DISEASE_WINDOWS_LOADED] !==
australian_states.length) {
    windows_loaded_callback(windows, current_disease);
}
}

function generate() {
    disease_helper = {};
    for (var index in list_of_disease) {
        var disease = list_of_disease[index]
        disease_helper[disease] = {};
        disease_helper[disease][DISEASE_WINDOWS_LOADED] = 0;
        disease_helper[disease][DISEASE_CSV] = "",
    }

    var i = 0;
    for (var current_disease in disease_helper) {
        disease_helper[current_disease][DISEASE_CSV] += current_disease + CSV_DELIMITER;
        console.log('Processing ' + current_disease);
        for (var state_index = 0; state_index < australian_states.length; state_index++)
        {
            var current_state = australian_states[state_index];
            disease_helper[current_disease][DISEASE_CSV] += current_state + CSV_DELIMITER;
        }
        disease_helper[current_disease][DISEASE_CSV] += CSV_CARRIAGE;
    }

    var windows = new Array(australian_states.length);

    for (var j = 0; j < australian_states.length; j++) {
        var current_state = australian_states[j];

        setTimeout(function(windows, current_state, current_disease, j) {
            return (function() {
                no_data.push('No data for ' + current_state + ' ' + current_disease);
                this.close();
            } else {
                //PROBLEM, we ran out of quota
                //NEED A RETRY MECHANISM
                console.log('WARNING: LOOKS like you exceeded your quota for the data at ' + current_state + ' ' + current_disease);
            } else {
                windows[j] = this;
            }
            this.close();
            if (disease_helper[current_disease][DISEASE_WINDOWS_LOADED] ===
australian_states.length) {
                windows_loaded_callback(windows, current_disease);
            }
        }(windows, current_state, current_disease, j));
    }
}
open_window(windows, current_state, current_disease, j);
    }
}

//slowing down
i++;
}
**Model construction**

In this section we describe the four models that used a 52-week training period; the approach to producing the other eight models was identical but for a training period of either 104- or 156-weeks. The first model for the 52-week period was denoted 52RC (52-week model; Raw data; Continuous keyword selection). This model was built upon disease notification and search metrics data covering 52 weeks. An additional two weeks search metrics data was provided to the model upon which one and two week predictions of disease notification were made. Search metrics data used in the 52RC model were raw as they were in the format provided by Google Trends. However, the time-series for these search metrics were shifted in accordance with the 52-week cross-correlation results described above. Keyword selection was performed using a robust feature selection method based on multiple hypotheses testing and prediction from the mht R package (45). Once the predictions were recorded an additional data point was made available for each time series and the 52-week window was then shifted forward by one week. The process was then repeated using only 52-weeks data. This process allowed generation of one and two-week predictions with the linear model rebuilt for each predictions while including the most appropriate search metrics at each step.

The second model, denoted 52WC (52 week model; Wavelet transformed data; Continuous keyword selection) used an identical process to the 52RC model, except that data were denoised using wavelet transforms to be input in the linear models. The DaubLeAsymm family of wavelets from the wavethresh R package was used (46). Since the denoising is data-dependent, the wavelet-transformed data were recalculated each time the window was shifting one week because of an additional data point.

The other two models for the 52-week period (52RS: 52 week model, Raw data, Set keywords and 52WS: 52 week model, Wavelet-transformed data, Set keywords) were similarly fitted as to 52RC/52WC, except that the keyword selection in the linear models was not performed at each time point for the validation period (2012-2013). Rather, the terms selected over the training period (2009-2011) were maintained through the entire validation period. Keyword selection for these models was performed using the same process as described above for 52RC/52WC using the 2009-2011 training data. Using the 104 iterations obtained from successive shifts of the 52-week period over 2009-2011, we calculated the frequency of each selected search term in a model. The search terms selected in at least 50% of these models fitted in the training period were used for the construction of the 52RS and 52WS models.
Linear models were built on a 52-week period using the selected search terms. Prediction was obtained as described previously and the prediction accuracy was assessed based on the Mean Square Error of Prediction (provided in the supplementary material) as well as with Spearman correlation between notifications and the resulting prediction.

Models using state level Google Trends and disease notification data were also fitted using the workflow described above. Owing to the loss of Google Trends data when analysing smaller geographical areas, only models that performed well at national level were produced. Models were produced for pneumococcal disease and Ross River virus infection for Queensland, New South Wales and Victoria only.
Wavelet Transform

The search term data collected from Google Trends were pre-processed by wavelet transform. The process depends on the model, either 52WC/52WS, 104WC/WS or 156WC/WS. Since our models were tasked to predict the two following point of the disease notification, the wavelet transforms were performed on 54/106 or 158 data points, for each search term, and each time the window was moved forward one week.

Each 54/106 or 158-week period was written as the sum of weighted elementary functions, describing hierarchically the signal from a rough tendency to the finest details, in a finite number of resolution levels. Here, each signal was decomposed onto the Daubechies basis made of smooth trimodal elementary functions. The corresponding wavelet coefficients were thresholded with a soft-thresholding method (see Mallat, 1999, for details) to reduce signal noise by applying low smoothing. The original signal was then rebuilt based on the denoised wavelet coefficients.

There are several levels of decomposition of an initial spectrum from level N-1, high resolution, to level 0, rough tendency. The number of these levels depends on the number of data point; a 54-week period has N=6 levels because 54 lies between $2^5=32$ and $2^6=64$, a 106-week period has N=7 levels and a 158-week period has N=8 levels. The initial signal $f(t)$ is decomposed as the sum of a detail signal $D_{N-1}(t)$ and an approximation $A_{N-1}(t)$. Then the approximated signal $A_{N-1}(t)$ is decomposed into a further detail signal $D_{N-2}$ and a further approximation $A_{N-2}$. Each approximated signal is decomposed sequentially as the sum of a detail signal and of an approximation signal (residual), as illustrated in Supplementary Figure 1 for the Daubechies basis. The detail signal of level $j$ is obtained as:

$$D_j(t) = \sum_{k \in \mathbb{Z}} b_{j,k} \psi_{j,k}(t)$$

where each $\psi_{j,k}$ is a translation and a dilation of a so-called mother wavelet $\psi(t)$ (Daubechies trimodal function here). In practice, the index $k$ is in a finite support. The coefficients $b$ are called the (detailed) coefficients and are equal to $b_{j,k} = \int f(t) \psi_{j,k}(t) dt$. An empirical estimator of these coefficients is used, from the values of the discretised signal at points $t_i$. Some of the numerous wavelet coefficients are close to 0, so thresholding is made to reduce the number of non-null coefficients.

Similarly, the approximated signal of level $j$ is obtained as:

$$A_j(t) = \sum_{k \in \mathbb{Z}} a_{j,k} \phi_{j,k}(t)$$

where each $\phi_{j,k}$ is a translation and a dilatation of a so-called father wavelet $\phi(t)$. The coefficients $a$ are called the approximated coefficients.

The initial signal $f(t)$ can be entirely reconstructed from all detail signal and the approximation $A_0$ at the lowest resolution level:
\[ f(t) = A_{N-1}(t) + D_{N-1}(t) = A_0(t) + D_{N-1}(t) + D_{N-2}(t) + \cdots + D_0(t) \]

since \( A_j(t) = A_{j-1}(t) + D_{j-1}(t) \) for \( j \in \{ N - 1, N - 2, \ldots, 1 \} \).

The (detailed) wavelet coefficients \( b \) estimated from the data in Supplementary Figure 1 are plotted in Supplementary Figure 2 for all resolution levels.
Supplementary Figure 1. Pneumococcal disease, Pneumonia search term, 106-week period starting at the tenth week of 2009 (weeks 10 to 114 to learn the model, weeks 115/116 to predict the notification).
Supplementary Figure 2. Pneumococcal disease, Pneumonia search term, 106-week period starting at the tenth week of 2009 (weeks 10 to 114 to learn the model, weeks 115/116 to predict the notification).

Wavelet Decomposition Coefficients
Frequency of search term selection in model training

The three tables below indicate the frequency at which each search term was selected for use in training models for pneumococcal disease, Ross River virus infection and pertussis. All values presented are proportions.

| Pneumococcal disease | 52RC | 52WC | 52RS | 52WS | 104RC | 104WC | 104RS | 104WS | 156RC | 156WC | 156RS | 156WS |
|-----------------------|------|------|------|------|-------|-------|-------|-------|-------|-------|-------|-------|
| a cough               | 0.18 | 0.21 | 0     | 0    | 0.15  | 0     | 0     | 0     | 0     | 0     | 0     | 0     |
| amoxil                | 0.27 | 0.25 | 0     | 0    | 0.1   | 0.02  | 0     | 0     | 0     | 0     | 0     | 0     |
| bronchiolitis         | 0.02 | 0.05 | 0     | 0    | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     |
| bronchitis            | 0    | 0    | 0     | 0    | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     |
| chest infection       | 0.02 | 0.03 | 0     | 0    | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     |
| chesty               | 0.02 | 0.04 | 0     | 0    | 0.1   | 0.02  | 0     | 0     | 0     | 0     | 0     | 0     |
| chesty cough         | 0    | 0.02 | 0     | 0    | 0.05  | 0.05  | 0     | 0     | 0     | 0     | 0     | 0     |
| clarithromycin       | 0.22 | 0.24 | 0     | 0    | 0.02  | 0.02  | 0     | 0     | 1     | 1     | 1     | 1     |
| codral               | 0.78 | 0.77 | 1     | 1    | 1     | 1     | 1     | 1     | 1     | 1     | 1     | 1     |
| cold and flu         | 0.01 | 0.05 | 0     | 0    | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     |
| cold and flu tablets | 0.2  | 0.14 | 0     | 0    | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     |
| cold flu             | 0.09 | 0.08 | 0     | 0    | 0     | 0.08  | 0     | 0     | 1     | 1     | 1     | 1     |
| cold hands           | 0.05 | 0.07 | 0     | 0    | 0.05  | 0.05  | 0     | 0     | 0     | 0     | 0     | 0     |
| cold symptoms        | 0.28 | 0.27 | 0     | 0    | 0.95  | 0.88  | 1     | 1     | 1     | 1     | 1     | 1     |
| colds               | 0.11 | 0.11 | 0     | 0    | 0.1   | 0     | 0     | 0     | 0     | 0     | 0     | 0     |
| cough               | 0.21 | 0.16 | 0     | 0    | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     |
| cough medicine       | 0.03 | 0.04 | 0     | 0    | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     |
| cough remedies       | 0.01 | 0.03 | 0     | 0    | 0.15  | 0.05  | 0     | 0     | 0     | 0     | 0     | 0     |
| dry cough           | 0.2  | 0.17 | 0     | 0    | 0     | 0.02  | 0     | 0     | 0     | 0     | 0     | 0     |
| flu tablets         | 0.02 | 0.04 | 0     | 0    | 0.45  | 0.35  | 0     | 0     | 0     | 0     | 0     | 0     |
| Condition          | 52RC | 52WC | 52RS | 52WS | 104RC | 104WC | 104RS | 104WS | 156RC | 156WC | 156RS | 156WS |
|--------------------|------|------|------|------|-------|-------|-------|-------|-------|-------|-------|-------|
| Pneumonia          | 0.04 | 0.07 | 0    | 0    | 0.05  | 0.05  | 0     | 0     | 0     | 0     | 0     | 0     |
| Laryngitis         | 0.01 | 0.02 | 0    | 0    | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     |
| Lozenges           | 0.09 | 0.14 | 0    | 0    | 0.12  | 0.05  | 0     | 0     | 0     | 0     | 0     | 0     |
| Night Sweats       | 0    | 0    | 0    | 0    | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     |
| Phenylephrine      | 0.36 | 0.32 | 0    | 0    | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     |
| Pleurisy           | 0    | 0    | 0    | 0    | 0.02  | 0     | 0     | 0     | 0     | 0     | 0     | 0     |
| Pneumonia          | 0.02 | 0.03 | 0    | 0    | 0.05  | 0.8   | 0     | 1     | 1     | 1     | 1     | 1     |
| Red Cheeks         | 0.02 | 0.03 | 0    | 0    | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     |
| Roxithromycin      | 0.01 | 0.01 | 0    | 0    | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     |
| Rulide             | 0.08 | 0.04 | 0    | 0    | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     |
| Sinus              | 0.05 | 0.02 | 0    | 0    | 0.15  | 0.02  | 0     | 0     | 0     | 0     | 0     | 0     |
| Sinusitis          | 0    | 0.01 | 0    | 0    | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     |
| Sudafed            | 0.35 | 0.15 | 0    | 0    | 0.02  | 0.02  | 0     | 0     | 0     | 0     | 0     | 0     |
| Vicks              | 0.07 | 0.03 | 0    | 0    | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     |

**Ross River Virus Infection**

| Condition          | 52RC | 52WC | 52RS | 52WS | 104RC | 104WC | 104RS | 104WS | 156RC | 156WC | 156RS | 156WS |
|--------------------|------|------|------|------|-------|-------|-------|-------|-------|-------|-------|-------|
| "Ross River"       | 0.41 | 0.36 | 0    | 0    | 0.98  | 0.98  | 1     | 1     | 1     | 1     | 1     | 1     |
| Flu Injections     | 0    | 0    | 0    | 0    | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     |
| Impetigo           | 0.24 | 0.26 | 0    | 0    | 0.15  | 0.32  | 0     | 0     | 1     | 1     | 1     | 1     |
| Ross River         | 0.11 | 0.16 | 0    | 0    | 0.8   | 0.78  | 1     | 1     | 1     | 1     | 1     | 1     |
| Ross River Fever   | 0.42 | 0.41 | 0    | 0    | 0.18  | 0.38  | 0     | 0     | 0     | 0     | 0     | 0     |
| Ross River Virus   | 0.7  | 0.65 | 1    | 1    | 0.15  | 0.15  | 0     | 0     | 0     | 0     | 0     | 0     |
| School Sores       | 0.53 | 0.42 | 0    | 0    | 0.02  | 0     | 0     | 0     | 0     | 0     | 0     | 0     |
| Pertussis          | 52RC | 52WC | 52RS | 52WS | 104RC | 104WC | 104RS | 104WS | 156RC | 156WC | 156RS | 156WS |
|-------------------|------|------|------|------|-------|-------|-------|-------|-------|-------|-------|-------|
| Pertussis         | 0.43 | 0.43 | 0    | 0    | 0.9   | 0.5   | 1     | 1     | 1     | 1     | 1     | 1     |
| whooping          | 0.03 | 0.02 | 0    | 0    | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     |
| whooping cough    | 0    | 0.02 | 0    | 0    | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     |
| whooping cough in | 0.64 | 0.63 | 1    | 1    | 1     | 1     | 1     | 1     | 1     | 1     | 1     | 1     |
| adults            |      |      |      |      |       |       |       |       |       |       |       |       |
# Frequency of search term selection in predictive models

The three tables below indicate the frequency at which each search term was selected for use in predictive models for pneumococcal disease, Ross River virus infection and pertussis. All values presented are proportions.

| Pneumococcal disease | 52RC | 52WC | 52RS | 52WS | 104RC | 104WC | 104RS | 104WS | 156RC | 156WC | 156RS | 156WS |
|----------------------|------|------|------|------|-------|-------|-------|-------|-------|-------|-------|-------|
| a cough              | 0.19 | 0.24 | 0     | 0     | 0.01  | 0.01  | 0     | 0     | 0.02  | 0     | 0     | 0     |
| amoxil               | 0    | 0.04 | 0     | 0     | 0.01  | 0.02  | 0     | 0     | 0     | 0     | 0     | 0     |
| bronchiolitis        | 0.09 | 0.12 | 0     | 0     | 0.01  | 0     | 0     | 0     | 0     | 0     | 0     | 0     |
| bronchitis           | 0    | 0    | 0     | 0     | 0     | 0     | 0     | 0     | 0.19  | 0.22  | 0     | 0     |
| chest infection      | 0    | 0.02 | 0     | 0     | 0     | 0     | 0     | 0     | 0.4   | 0.31  | 0     | 0     |
| chesty               | 0.35 | 0.18 | 0     | 0     | 0.05  | 0.07  | 0     | 0     | 0     | 0.01  | 0     | 0     |
| chesty cough         | 0.3  | 0.18 | 0     | 0     | 0.04  | 0.05  | 0     | 0     | 0.15  | 0.14  | 0     | 0     |
| clarithromycin       | 0.07 | 0.05 | 0     | 0     | 0.03  | 0     | 0     | 0.15  | 0.16  | 1     | 1     | 1     |
| codral               | 0.06 | 0.04 | 1     | 1     | 0.16  | 0.13  | 1     | 1     | 0.33  | 0.33  | 1     | 1     |
| cold and flu         | 0.02 | 0.04 | 0     | 0     | 0.02  | 0     | 0     | 0.01  | 0.04  | 0     | 0     | 0     |
| cold and flu tablets | 0.03 | 0.13 | 0     | 0     | 0     | 0     | 0     | 0.01  | 0     | 0     | 0     | 0     |
| cold flu             | 0.01 | 0.05 | 0     | 0     | 0.03  | 0.15  | 0     | 0     | 0.13  | 0.15  | 1     | 1     |
| cold hands           | 0.09 | 0.03 | 0     | 0     | 0.04  | 0.05  | 0     | 0     | 0.18  | 0.19  | 0     | 0     |
| cold symptoms        | 0.07 | 0.09 | 0     | 0     | 0.18  | 0.1   | 1     | 1     | 0.45  | 0.41  | 1     | 1     |
| colds                | 0.18 | 0.27 | 0     | 0     | 0.05  | 0.01  | 0     | 0     | 0.01  | 0     | 0     | 0     |
| cough                | 0.35 | 0.19 | 0     | 0     | 0.3   | 0.27  | 0     | 0     | 0.01  | 0.02  | 0     | 0     |
| cough medicine       | 0.11 | 0.03 | 0     | 0     | 0.02  | 0     | 0     | 0     | 0.02  | 0     | 0     | 0     |
| cough remedies       | 0.07 | 0.04 | 0     | 0     | 0.03  | 0     | 0     | 0.03  | 0.06  | 0     | 0     | 0     |
| dry cough            | 0.26 | 0.15 | 0     | 0     | 0     | 0     | 0     | 0.02  | 0.02  | 0     | 0     | 0     |
| flu tablets          | 0.17 | 0.09 | 0     | 0     | 0     | 0     | 0     | 0.01  | 0     | 0     | 0     | 0     |
| Condition          | 52RC | 52WC | 52RS | 52WS | 104RC | 104WC | 104RS | 104WS | 156RC | 156WC | 156RS | 156WS |
|--------------------|------|------|------|------|-------|-------|-------|-------|-------|-------|-------|-------|
| is pneumonia       | 0.02 | 0.1  | 0    | 0    | 0.34  | 0.15  | 0     | 0     | 0     | 0.01  | 0     | 0     |
| laryngitis         | 0.05 | 0.05 | 0    | 0    | 0.04  | 0.01  | 0     | 0     | 0.03  | 0.01  | 0     | 0     |
| lozenges           | 0.25 | 0.31 | 0    | 0    | 0.04  | 0.03  | 0     | 0     | 0     | 0     | 0     | 0     |
| night sweats       | 0.05 | 0.06 | 0    | 0    | 0.04  | 0     | 0     | 0.11  | 0.14  | 0     | 0     | 0     |
| phenylephrine      | 0.05 | 0.03 | 0    | 0    | 0.1   | 0.08  | 0     | 0     | 0.44  | 0.27  | 0     | 0     |
| pleurisy           | 0.27 | 0.05 | 0    | 0    | 0.26  | 0.1   | 0     | 0     | 0     | 0     | 0     | 0     |
| pneumonia           | 0    | 0.12 | 0    | 0    | 0.76  | 0.77  | 0     | 1     | 0.93  | 0.94  | 1     | 1     |
| red cheeks          | 0.06 | 0.06 | 0    | 0    | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     |
| roxithromycin      | 0.07 | 0.15 | 0    | 0    | 0     | 0.01  | 0     | 0     | 0.04  | 0.04  | 0     | 0     |
| rulide             | 0.04 | 0.05 | 0    | 0    | 0.4   | 0.22  | 0     | 0     | 0.2   | 0.17  | 0     | 0     |
| sinus              | 0.02 | 0.13 | 0    | 0    | 0.2   | 0.09  | 0     | 0     | 0.04  | 0.05  | 0     | 0     |
| sinusitis          | 0.07 | 0.1  | 0    | 0    | 0     | 0     | 0     | 0.04  | 0.01  | 0     | 0     | 0     |
| sudafed            | 0.77 | 0.54 | 0    | 0    | 0.77  | 0.65  | 0     | 0     | 0.79  | 0.76  | 0     | 0     |
| vicks              | 0    | 0.04 | 0    | 0    | 0     | 0     | 0.07  | 0.14  | 0.08  | 0     | 0     | 0     |

| Ross River Virus Infection | 52RC | 52WC | 52RS | 52WS | 104RC | 104WC | 104RS | 104WS | 156RC | 156WC | 156RS | 156WS |
|----------------------------|------|------|------|------|-------|-------|-------|-------|-------|-------|-------|-------|
| "Ross River"              | 0.94 | 0.75 | 0    | 0    | 1     | 0.95  | 1     | 1     | 1     | 1     | 1     | 1     |
| flu injections            | 0    | 0    | 0    | 0    | 0     | 0     | 0     | 0     | 0     | 0     | 0     | 0     |
| impetigo                  | 0.06 | 0.13 | 0    | 0    | 0.15  | 0.25  | 0     | 0     | 1     | 1     | 1     | 1     |
| ross river                | 0.03 | 0.28 | 0    | 0    | 1     | 1     | 1     | 1     | 1     | 1     | 1     | 1     |
| ross river fever          | 0.13 | 0.1  | 0    | 0    | 0.12  | 0.12  | 0     | 0.12  | 0.1   | 0     | 0     | 0     |
| ross river virus          | 0.74 | 0.7  | 1    | 1    | 0.01  | 0.04  | 0     | 0     | 0     | 0     | 0     | 0     |
| school sores             | 0.34 | 0.23 | 0    | 0    | 0.43  | 0.12  | 0     | 0     | 0     | 0     | 0     | 0     |
| Pertussis                  | 52RC | 52WC | 52RS | 52WS | 104RC | 104WC | 104RS | 104WS | 156RC | 156WC | 156RS | 156WS |
|---------------------------|------|------|------|------|-------|-------|-------|-------|-------|-------|-------|-------|
| Pertussis                 | 0.39 | 0.39 | 0    | 0    | 0.35  | 0.2   | 1     | 1     | 0.01  | 0.01  | 1     | 1     |
| whooping                  | 0.03 | 0.02 | 0    | 0    | 0    | 0     | 0     | 0     | 0     | 0     | 0     | 0     |
| whooping cough            | 0    | 0.02 | 0    | 0    | 0    | 0     | 0     | 0     | 0     | 0     | 0     | 0     |
| whooping cough in adults  | 0.58 | 0.57 | 1    | 1    | 0.39  | 0.39  | 1     | 1     | 0.01  | 0.01  | 1     | 1     |
National model performance – Spearman’s correlation

National model performance for 1 week (top) and 2 week estimates (bottom), as assessed by Spearman’s correlation. The highest performing models for each disease are indicated in bold.

| Disease                        | 1 Week estimate | 2 Week estimate |
|--------------------------------|-----------------|-----------------|
| Gonococcal infection           | 0.088           | 0.064           |
| Varicella zoster (Shingles)    | 0.110           | 0.088           |
| Pneumococcal disease (invasive)| 0.742           | 0.693           |
| Ross River virus infection     | 0.071           | 0.126           |
| Pertussis                      | 0.099           | 0.100           |
| Chlamydial infection           | 0.119           | 0.120           |
| Varicella zoster (unspecified) | 0.297           | 0.340           |
| Varicella zoster (Chickenpox)  | 0.097           | 0.100           |
| Cryptosporidiosis              | 0.251           | 0.251           |
| Barmah Forest virus infection  | 0.174           | 0.161           |
| Dengue virus infection         | 0.000           | 0.000           |
| Influenza (laboratory confirmed)| 0.000           | 0.000           |
| Influenza (laboratory confirmed)| 0.401           | 0.316           |
National model performance – Mean Square Error of Prediction

National model performance for 1 week (top) and 2 week estimates (bottom), as assessed by Mean Square Error of Prediction. The highest performing models for each disease are indicated in bold.

| Disease                     | 1 Week estimate | 2 Week estimate |
|-----------------------------|-----------------|-----------------|
|                             | 2012RC 2012WC 2012RS 2012WS | 2014RC 2014WC 2014RS 2014WS | 2016RC 2016WC 2016RS 2016WS |
| Gonococcal infection        | 1.183 1.237 1.212 1.229 | 1.181 1.301 1.274 1.368 | 1.268 1.34 1.356 1.358 |
| Varicella zoster (Shingles) | 0.97 1.105 0.84 0.85   | 0.907 0.964 0.946 0.937 | 0.954 1.008 0.967 0.976 |
| Pneumococcal disease (invasive) | 0.478 0.51 0.523 0.548 | 0.278 0.347 0.564 0.376 | 0.42 0.396 0.435 0.437 |
| Ross River virus infection  | 0.394 0.542 0.465 0.514 | 0.365 0.537 0.351 0.478 | 0.289 0.288 0.29 0.288 |
| Pertussis                   | 1.418 1.394 1.447 1.416 | 2.053 1.659 2.206 2.118 | 2.299 2.265 2.24 2.189 |
| Chlamydial infection        | 1.089 1.019 0.983 0.968 | 0.832 0.789 0.832 0.789 | 0.847 0.826 0.847 0.826 |
| Varicella zoster (unspecified) | 0.771 0.764 0.83 0.845 | 0.892 0.942 0.883 0.909 | 0.994 0.957 1.014 1.014 |
| Varicella zoster (Chickenpox) | 0.862 0.879 0.746 0.758 | 0.773 0.805 0.76 0.76  | 0.875 0.926 0.884 0.861 |
| Cryptosporidiosis           | 1.031 1.05 1.071 1.089 | 1.188 1.214 1.201 1.267 | 1.18 1.189 1.197 1.203 |
| Barmah Forest virus infection | 1.527 1.52 1.072 1.249 | 1.22 1.263 1.149 1.177 | 1.101 1.11 1.334 1.342 |
| Dengue virus infection      | 1.362 1.748 1.355 1.417 | 0.461 0.485 0.461 0.49  | 0.718 0.681 0.915 0.922 |
| Influenza (laboratory confirmed) | 0.425 0.463 0.406 0.438 | 0.461 0.485 0.461 0.49  | 0.718 0.681 0.915 0.922 |
State model performance

State model performance for 1 week (top) and 2 week estimates (bottom), as assessed by Spearman’s rank correlation. The highest performing models for each disease are indicated in bold. All values presented are Spearman rho.

|                   | 1 Week estimate          | 2 Week estimate          |
|-------------------|--------------------------|--------------------------|
| **Pneumococcal disease (invasive)** | 52RC 52WC 52RS 52WS | 52RC 52WC 52RS 52WS |
|                   | 104RC 104WC 104RS 104WS | 104RC 104WC 104RS 104WS |
|                   | 156RC 156WC 156RS 156WS | 156RC 156WC 156RS 156WS |
| Australia         | 0.602 0.592 0.567 0.493 | 0.742 0.693 0.671 0.689 |
| New South Wales   | 0.345 0.196 0.342 0.348 | 0.440 0.362 0.381 0.423 |
| Queensland        | 0.306 0.320 0.310 0.233 | 0.286 0.263 0.304 0.294 |
| Victoria          | 0.402 0.309 0.039 0.039 | 0.342 0.341 0.401 0.288 |
|                   |                          | 0.409 0.416 0.362 0.383 |
| Ross River virus infection | 52RC 52WC 52RS 52WS | 52RC 52WC 52RS 52WS |
|                   | 104RC 104WC 104RS 104WS | 104RC 104WC 104RS 104WS |
|                   | 156RC 156WC 156RS 156WS | 156RC 156WC 156RS 156WS |
| Australia         | 0.700 0.680 0.648 0.687 | 0.741 0.684 0.720 0.703 |
| New South Wales   | 0.162 0.126              | 0.214 0.209             |
| Queensland        | 0.298 0.362              | 0.264 0.197             |
| Victoria          |                          | 0.200 0.197             |

|                   |                          |                          |
| **Pneumococcal disease (invasive)** | 52RC 52WC 52RS 52WS | 52RC 52WC 52RS 52WS |
|                   | 104RC 104WC 104RS 104WS | 104RC 104WC 104RS 104WS |
|                   | 156RC 156WC 156RS 156WS | 156RC 156WC 156RS 156WS |
| Australia         | 0.674 0.617 0.571 0.542 | 0.734 0.711 0.673 0.705 |
| New South Wales   | 0.289 0.259 0.333 0.358 | 0.407 0.459 0.376 0.427 |
| Queensland        | 0.232 0.235 0.307 0.258 | 0.266 0.253 0.309 0.315 |
| Victoria          | 0.342 0.367 0.055 0.055 | 0.319 0.318 0.389 0.309 |
|                   |                          | 0.386 0.370 0.354 0.369 |
| Ross River virus infection | 52RC 52WC 52RS 52WS | 52RC 52WC 52RS 52WS |
|                   | 104RC 104WC 104RS 104WS | 104RC 104WC 104RS 104WS |
|                   | 156RC 156WC 156RS 156WS | 156RC 156WC 156RS 156WS |
| Australia         | 0.680 0.705 0.669 0.693 | 0.736 0.718 0.719 0.749 |
| New South Wales   | 0.173 0.135              | 0.236 0.237             |
| Queensland        | 0.288 0.363              | 0.219 0.152             |
| Victoria          |                          | 0.141 0.142             |
National model performance - Mean Square Error of Prediction

National model performance for 1 week (top) and 2 week estimates (bottom), as assessed by Mean Square Error of Prediction. The highest performing models for each disease are indicated in bold.

| Disease                                    | 1 Week estimate | 2 Week estimate |
|--------------------------------------------|-----------------|-----------------|
|                | 52RC | 52WC | 52RS | 52WS | 104RC | 104WC | 104RS | 104WS | 156RC | 156WC | 156RS | 156WS |
| Gonococcal infection                       | 1.183 | 1.237 | 1.212 | 1.229 | **1.181** | 1.301 | 1.274 | 1.368 | 1.268 | 1.340 | 1.356 | 1.358 |
| Varicella zoster (Shingles)                | 0.970 | 1.105 | **0.840** | 0.850 | 0.907 | 0.964 | 0.946 | 0.937 | 0.954 | 1.008 | 0.967 | 0.976 |
| Pneumococcal disease (invasive)            | 0.478 | 0.510 | 0.523 | 0.548 | **0.278** | 0.347 | 0.564 | 0.376 | 0.420 | 0.396 | 0.435 | 0.437 |
| Ross River virus infection                  | 0.394 | 0.542 | 0.465 | 0.514 | 0.365 | 0.537 | 0.351 | 0.478 | 0.289 | **0.288** | 0.290 | **0.288** |
| Pertussis                                  | **2.053** | 1.659 | 2.206 | 2.118 | 2.299 | 2.265 | 2.240 | 2.189 | 2.053 | 1.659 | 2.206 | 2.118 |
| Chlamydial infection                       | 1.089 | 1.019 | 0.983 | 0.968 | 0.832 | **0.789** | 0.832 | **0.789** | 0.847 | 0.826 | 0.847 | 0.826 |
| Varicella zoster (unspecified)              | 0.771 | **0.764** | 0.830 | 0.845 | 0.892 | 0.942 | 0.883 | 0.909 | 0.994 | 0.957 | 1.014 | 1.014 |
| Varicella zoster (Chickenpox)               | 0.862 | 0.879 | **0.746** | 0.758 | 0.773 | 0.805 | 0.760 | 0.760 | 0.875 | 0.926 | 0.884 | 0.861 |
| Cryptosporidiosis                          | **1.031** | 1.050 | 1.071 | 1.089 | 1.048 | 1.048 | 1.048 | 1.048 | 1.048 | 1.048 | 1.048 | 1.048 |
| Barmah Forest virus infection               | 1.527 | 1.520 | **1.072** | 1.249 | 1.188 | 1.214 | 1.201 | 1.267 | 1.180 | 1.189 | 1.197 | 1.203 |
| Dengue virus infection                      | 1.362 | 1.748 | 1.355 | 1.417 | **1.220** | 1.263 | 1.149 | 1.177 | **1.101** | 1.110 | 1.334 | 1.342 |
| Influenza (laboratory confirmed)           | 0.425 | 0.463 | **0.406** | 0.438 | 0.461 | 0.485 | 0.461 | 0.490 | 0.718 | 0.681 | 0.915 | 0.922 |
| Disease                          | Week 1 | Week 2 | Week 3 | Week 4 | Week 5 | Week 6 | Week 7 | Week 8 | Week 9 | Week 10 |
|---------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|---------|
| Varicella zoster (Chickenpox)    | 0.862  | 0.771  | **0.768** | 0.789 | 0.832  | 0.930  | 0.769  | 0.781  | 0.969  | 1.060   | 0.923   | 0.908   |
| Cryptosporidiosis                | 1.092  | 1.098  | 1.089  | 1.096  |        |        |        |        |        | **1.058** | **1.058** |        |
| Barmah Forest virus infection    | 1.643  | 1.677  | **1.129** | 1.257 | 1.202  | 1.265  | 1.221  | 1.249  | 1.204  | 1.200   | 1.221   | 1.222   |
| Dengue virus infection           | 1.373  | 1.527  | 1.335  | 1.344  | 1.269  | 1.277  | 1.178  | 1.175  | 1.172  | **1.147** | 1.341   | 1.309   |
| Influenza (laboratory confirmed) | 0.473  | 0.464  | 0.428  | **0.420** | 0.490  | 0.473  | 0.501  | 0.481  | 0.769  | 0.734   | 0.966   | 0.966   |