**Supplementary Document** for Variability in Published Rates of Influenza-Associated Hospitalizations: A Systematic Review, 2007–2018

**Table S1.** Search strategy used across six databases.

| Database          | Strategy                                                                                                                                 |
|-------------------|-------------------------------------------------------------------------------------------------------------------------------------------|
| **Medline (OVID)**| ^Influenza, Human/ OR (influenza* OR acute respiratory infection*).ti AND "Cost of Illness"/ OR *Incidence/ OR Hospitalization/ OR burden.kf,ti. OR hospital*.ti,kf. OR ((cost* OR burden) ADJ3 (illness OR disease OR influenza)).ti,ab. AND Limit yr="2007 – current"; Humans |
| **Embase (OVID)** | ^Influenza/ OR (influenza* OR acute respiratory infection*).ti AND "Cost of Illness"/ OR Incidence/ OR Hospitalization/ OR burden.kw,ti. OR hospital*.ti,kw. OR ((cost* OR burden) ADJ3 (illness OR disease OR influenza)).ti,ab. AND Limit yr="2007 – current"; Humans; Exclude Medline Journals |
| **CINAHL (Ebsco)**| (MJ "Influenza, Human") OR (TI (influenza* OR "acute respiratory infection*")) AND (MH "Cost of Illness") OR (MH Incidence) OR (MH Hospitalization) OR (TI (burden OR surveillance OR hospital* OR ((cost* OR burden) N3 (illness OR disease OR influenza)))) OR (MW (burden OR surveillance OR hospital* OR ((cost* OR burden) N3 (illness OR disease OR influenza)))) AND Limit yr="2007 – current"; Humans; Exclude Medline Records |
| **Cochrane Library** | [mh "Influenza, Human"] OR (influenza* OR "acute respiratory infection*").ti AND [mh "Cost of Illness"] OR [mh Incidence] OR [mh Hospitalization] OR burden.ti,ab OR hospital*.ti,ab OR ((cost* OR burden) NEAR/3 (illness OR disease OR influenza)):ti,ab AND Limit yr="2007 – current"; Humans |
| **Global Health (OVID)** | ^Influenza/ OR (influenza* OR acute respiratory infection*).ti AND disease incidence/ OR burden.ti. OR hospital*.ti. OR ((cost* OR burden) ADJ3 (illness OR disease OR influenza)).ti,ab. AND Man/ Limit yr="2007 – current"; Humans |
| **LILACS**        | Influenza AND Burden OR cost OR hospitalization OR incidence AND 2007-current |

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### Table S2. Specific case definitions reported in extracted articles by analytic case definition.

| Case Definition | Detailed Definitions Used in Extracted Articles |
|-----------------|-----------------------------------------------|
| **ARI* with fever** | • Acute respiratory illness with a history of fever or measured fever (≥38°C) and cough, with onset ≤7 days, requiring hospitalization  
  • Acute respiratory illness with a history of fever or measured fever (≥38°C) and cough, with onset ≤10 days, requiring hospitalization  
  • Hospitalized with acute illness onset (≤14 days) with reported or measured fever (≥38°C) and cough  
  • Hospitalized with measured temperature (≥38°C) or self-reported fever with symptoms of cough or sore throat, and shortness of breath or difficulty breathing with onset ≤10 days of hospital admission  
  • Hospitalized with measured temperature (≥38°C) or self-reported fever with symptoms of cough or sore throat, and shortness of breath or difficulty breathing with onset ≤7 days of hospital admission  
  • Measured temperature (≥38°C) and at least one of: new/worsening cough, sore throat, stuffy nose, runny nose  
  • Admitted to hospital for >24 hours with presence of respiratory difficulty, measured fever (≥38°C), cough, and one or more: confinement to bed, thoracic pain, polypnea, or acute respiratory distress syndrome  
  • Hospitalized with measured fever (≥37.3°C) and at least one: cough, sore throat, tachypnea, difficulty breathing, abnormal breath sounds, sputum production, hemoptysis, chest pain, or chest radiograph consistent with pneumonia  
  • Acute respiratory illness with measured fever (≥38°C) and at least one: cough, sore throat, shortness of breath, difficulty breathing, expectoration, cough blood, chest pain, or lung abnormality showed on X-ray film  
  • Hospitalized with subjective fever in previous 21 days with cough or sore throat  
  • Measured fever (≥38°C) or history of fever in previous 7 days and two or more: cough, sore throat, headache, rhinorrhea, limb or joint pain, vomiting or diarrhea |  
| **ARI, fever not required** | • ICD10†: J00-J22, J44.0  
  • ICD10: J00-J03, J40-J44, J47  
  • ICD9‡: 460-466  
  • ICD9: 460-466, 480-487, 490, 493, 786, 780.6, 381-382  
  • Hospitalized with cough or difficulty breathing with or without fever  
  • Physician diagnosed lower respiratory infection  
  • Hospitalized with any respiratory symptoms (cough, nasal congestion, coryza, dyspnea, wheezing) or nonlocalizing fever  
  • Hospitalized with cough, difficulty breathing, or pleural chest pain with onset in previous 14 days  
  • Acute upper respiratory tract infection (including colds, sinusitis, pharyngitis, tonsillitis, acute otitis media) or acute lower respiratory tract infection (including croup, tracheitis, bronchiolitis, virally induced wheezing, asthma, pneumonia)  
  • Hospitalized with clinically suspected respiratory infection  
  • Bronchitis, pharyngitis or pneumonia with or without fever  
  • Hospitalized with two or more: fever, cough, sore throat, sneezing, congestion, rhinorrhea  
  • Presenting with fever/feverishness or cough at hospital  
  • Hospitalized during defined influenza season with fever and/or ARI symptoms |  
| **Pneumonia** | • Cough or difficulty breathing AND any of following: unable to drink or breastfeed, vomits everything, convulsions, lethargy, or unconsciousness, chest indrawing or stridor in calm child  
  • Hospitalized with cough or difficulty breathing and any one of the following: tachypnea, unable to drink or breastfeed, vomits everything, convulsions, lethargic or unconscious, nasal flaring, grunting, oxygen saturation <90%, chest indrawing, or stridor in a calm child |
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### Case Definition - Detailed Definitions Used in Extracted Articles

| Case Definition                      | Detailed Definitions Used in Extracted Articles                                                                                                                                                                                                 |
|--------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Pneumonia (continued)                | - Met criteria for the clinical syndromes of severe pneumonia (cough or difficulty breathing with lower chest indrawing and no signs of very severe pneumonia) OR very severe pneumonia (severe criteria plus hypoxia (O₂<90%), inability to drink, inability to sit, and/or impaired consciousness)  
  - Acute illness with one or more of: measured fever ≥38°C, new or worsening cough, dyspnea, consistent auscultation findings [rales or diminished breath sounds], pain in the chest or abdomen when breathing, or purulent or blood-stained sputum production; and radiologic findings consistent with pneumonia |
| Influenza                            | - ICD10: J10-J11  
  - ICD10: J10  
  - ICD10: J09-J10  
  - ICD9: 487  
  - Hospitalized with laboratory confirmed influenza infection  
  - Admitted to hospital ≤14 days after or ≤3 days before positive influenza test  
  - Hospitalized for community-onset laboratory confirmed influenza infection  
  - Any patient with clinical features compatible with influenza, requiring hospitalization for clinical severity with at least one: pneumonia, septic shock, acute respiratory distress syndrome, multiple organ dysfunction syndrome, or admission to ICU |
| Pneumonia and influenza              | - ICD10: J09-J18  
  - ICD10: J10-J18  
  - ICD10: J09-J18, J20-22, J28-29, J96, G05.1F, G05.1O, H67.1B, R56.0  
  - ICD9: 480-488  
  - ICD9: 480-487 |
| Respiratory                          | - ICD10: J00-J99  
  - ICD10: J00-J99, R05-R06, A40-A41, P36  
  - ICD10: J00-J99, H65, H66, H67.1  
  - ICD9: 460-519  
  - ICD9: 460-496  
  - ICD9: 460-519, 079, 786.0-786.4, 786.7-786.9 |
| Circulatory                          | - ICD10: I00-I99  
  - ICD10: I20-I25, I30, I32, I40-43, I46, I48, I50  
  - ICD9: 380-459  
  - ICD9: 410-414, 420, 422, 425, 477.3, 427.5, 428 |
| Respiratory and circulatory         | - ICD10: I00-I99, J00-J99  
  - ICD9: 390-519 |
| Acute medical illness                | - ICD10: A00-N99, R00-R99  
  - ICD9: 001-629, 680-739, 780-799  
  - Hospitalized with a medical illness including acute exacerbations of chronic medical conditions (excludes: elective surgery, trauma, obstetrics and gynecologic, orthopedic, ophthalmologic, and psychiatric conditions) |
| All cause                            | - ICD10: A00-Y99  
  - ICD9: 001-999 |
| Sepsis                               | - ICD9: 038, 771.81 |

*ARI: Acute Respiratory Infection  
†ICD10: International Classification of Diseases, 10th Revision  
‡ICD9: International Classification of Diseases, 9th Revision
### Table S3. Description of extracted articles.

| First Author Last Name (Year) | Title                                                                 | Source                                                                 | City/State/Country | WHO Region   |
|-------------------------------|----------------------------------------------------------------------|------------------------------------------------------------------------|--------------------|--------------|
| Abdel-Hady (2018)             | Estimating the burden of influenza-associated hospitalization and deaths in Oman (2012-2015) | Influenza and Other Respiratory Viruses 12(1): 146-152.                | Oman               | Middle East  |
| Adhin (2013)                  | Trends of influenza infection in Suriname                              | Influenza Other Respir Viruses 7(5): 629-633.                          | Suriname           | Americas     |
| Ajayi-Obe (2008)              | Influenza A and respiratory syncytial virus hospital burden in young children in East London | Epidemiol Infect 136(8): 1046-1058.                                   | East London, UK    | Europe       |
| Al-Awaidy (2015)              | The Burden of Influenza-Associated Hospitalizations in Oman, January 2008-June 2013 | PLoS One 10(12): e0144186.                                           | Oman               | Middle East  |
| Ang (2014)                    | Influenza-associated hospitalizations, Singapore, 2004-2008 and 2010-2012 | Emerg Infect Dis 20(10): 1652-1660.                                   | Singapore          | Western Pacific |
| Ang (2017)                    | Influenza-Associated Hospitalizations for Cardiovascular Diseases in the Tropics | Am J Epidemiol: 1-8.                                                 | Singapore          | Western Pacific |
| Appiah (2015)                 | Influenza activity - United States, 2014-15 season and composition of the 2015-16 influenza vaccine | MMWR Morb Mortal Wkly Rep 64(21): 583-590.                            | USA                | Americas     |
| Azziz-Baumgartner (2012)      | Incidence of influenza-like illness and severe acute respiratory infection during three influenza seasons in Bangladesh, 2008-2010 | Bull World Health Organ 90(1): 12-19.                                 | Bangladesh         | South East Asia |
| Azziz-Baumgartner (2013)      | Incidence of influenza-associated mortality and hospitalizations in Argentina during 2002-2009 | Influenza Other Respir Viruses 7(5): 710-717.                         | Argentina          | Americas     |
| Berkley (2010)                | Viral etiology of severe pneumonia among Kenyan infants and children  | Jama 303(20): 2051-2057.                                             | Kenya              | Africa       |
| Blanton (2017)                | Update: Influenza Activity in the United States During the 2016-17 Season and Composition of the 2017-18 Influenza Vaccine | MMWR Morb Mortal Wkly Rep 66(25): 668-676.                            | USA                | Americas     |
| Boddington (2017)             | Developing a system to estimate the severity of influenza infection in England: findings from a hospital-based surveillance system between 2010/2011 and 2014/2015 | Epidemiol Infect 145(7): 1461-1470.                                   | England            | Europe       |
| Bolotin (2012)                | A new sentinel surveillance system for severe influenza in England shows a shift in age distribution of hospitalised cases in the post-pandemic period | PLoS One 7(1): e30279.                                               | England            | Europe       |
| Bonmarin (2015)               | Intensive care unit surveillance of influenza infection in France: the 2009/10 pandemic and the three subsequent seasons | Euro Surveill 20(46).                                                 | France             | Europe       |
| First Author Last Name              | Title                                                                 | Source                                                                 | City/State/Country          | WHO Region   |
|------------------------------------|----------------------------------------------------------------------|------------------------------------------------------------------------|-----------------------------|--------------|
| Bourgeois (2009)                   | Relative impact of influenza and respiratory syncytial virus in young children | Pediatrics 124(6): e1072-1080.                                         | Massachusetts, USA          | Americas     |
| Brammer (2013)                     | Influenza activity--United States, 2012-13 season and composition of the 2013-14 influenza vaccine | MMWR Morb Mortal Wkly Rep 62(23): 473-479.                             | USA                         | Americas     |
| Bresee (2013)                      | Estimated influenza illnesses and hospitalizations averted by influenza vaccination - United States, 2012-13 influenza season | MMWR Morb Mortal Wkly Rep 62(49): 997-1000.                            | USA                         | Americas     |
| Buda (2008)                        | Epidemiologie der Influenza bei Kindern in Deutschland               | Padiatrische Praxis 72: 105-113.                                      | Germany                     | Europe       |
| Bundy (2010)                       | Burden of influenza-related hospitalizations among children with sickle cell disease | Pediatrics 125(2): 234-243.                                           | CA, FL, MD, and NY, USA     | Americas     |
| Chadha (2013)                      | Burden of seasonal and pandemic influenza-associated hospitalization during and after 2009 A(H1N1)pdm09 pandemic in a rural community in India | PLoS One 8(5): e55918.                                               | Vadu, India                 | South East Asia |
| Chandrasekhar (2017)               | Social determinants of influenza hospitalization in the United States | Influenza Other Respir Viruses 11(6): 479-488.                          | USA                         | Americas     |
| Chaves (2013)                      | Patients hospitalized with laboratory-confirmed influenza during the 2010-2011 influenza season: exploring disease severity by virus type and subtype | J Infect Dis 208(8): 1305-1314.                                         | USA                         | Americas     |
| Chaves (2014)                      | The burden of influenza hospitalizations in infants from 2003 to 2012, United States | Pediatr Infect Dis J 33(9): 912-919.                                  | USA                         | Americas     |
| Choi (2017)                        | Disease burden of 2013-2014 seasonal influenza in adults in Korea     | PLoS One 12(3): e0172012.                                             | South Korea                 | Western Pacific |
| Cohen (2010)                       | Trends for influenza and pneumonia hospitalization in the older population: age, period, and cohort effects | Epidemiol Infect 138(8): 1135-1145.                                   | USA                         | Americas     |
| Cohen (2011)                       | Influenza vaccination in young children reduces influenza-associated hospitalizations in older adults, 2002-2006 | J Am Geriatr Soc 59(2): 327-332.                                      | USA                         | Americas     |
| Cohen (2013)                       | Severe influenza-associated respiratory infection in high HIV prevalence setting, South Africa, 2009-2011 | Emerg Infect Dis 19(11): 1766-1774.                                   | South Africa                | Africa       |
| Cromer (2014)                      | The burden of influenza in England by age and clinical risk group: a statistical analysis to inform vaccine policy | J Infect 68(4): 363-371.                                              | England                     | Europe       |
| Dao (2010)                         | Adult hospitalizations for laboratory-positive influenza during the 2005-2006 through 2007-2008 seasons in the United States | J Infect Dis 202(6): 881-888.                                         | USA                         | Americas     |
| First Author Last Name (Year) | Title                                                                 | Source                                                                 | City/State/Country                      | WHO Region     |
|-------------------------------|----------------------------------------------------------------------|----------------------------------------------------------------------|-----------------------------------------|----------------|
| Davila-Torres (2015)          | Intense seasonal A/H1N1 influenza in Mexico, winter 2013-2014         | Arch Med Res 46(1): 63-70.                                           | Mexico                                   | Americas       |
| Dawa (2018)                   | National burden of hospitalized and non-hospitalized influenza-       | Influenza and Other Respiratory Viruses 12(1): 30-37.                 | Kenya                                    | Africa         |
|                               | associated severe acute respiratory illness in Kenya, 2012-2014      |                                                                      |                                         |                |
| Dawood (2010)                 | Burden of seasonal influenza hospitalization in children, United     | J Pediatr 157(5): 808-814.                                           | USA                                      | Americas       |
|                               | States, 2003 to 2008                                                |                                                                      |                                         |                |
| D'Onise (2008)                | The burden of influenza in healthy children in South Australia       | Med J Aust 188(9): 510-513.                                          | South Australia                         | Western Pacific|
| Emukule (2014)                | The burden of influenza and RSV among inpatients and outpatients in  | PLoS One 9(8): e105543.                                               | Western Kenya                           | Africa         |
|                               | rural western Kenya, 2009-2012                                        |                                                                      |                                         |                |
| Feikin (2012)                 | The population-based burden of influenza-associated hospitalization  | Bull World Health Organ 90(4): 256-263a.                              | Western Kenya                           | Africa         |
|                               | in rural western Kenya, 2007-2009                                     |                                                                      |                                         |                |
| Feng (2014)                   | [Influenza-associated-excess-hospitalization in children, Wuxi city, | Zhonghua Liu Xing Bing Xue Za Zhi 35(6): 699-703.                      | Wuxi city, Jiangsu province, China      | Western Pacific|
|                               | Jiangsu province, 2005-2010]                                         |                                                                      |                                         |                |
| Fry (2014)                    | Modeling the effect of different vaccine effectiveness estimates on  | Clin Infect Dis 59(3): 406-409.                                       | USA                                      | Americas       |
|                               | the number of vaccine-prevented influenza-associated hospitalizations|                                                                      |                                         |                |
|                               | in older adults                                                       |                                                                      |                                         |                |
| Fuller (2013)                 | Estimation of the national disease burden of influenza-associated    | PLoS One 8(2): e56882.                                               | Kenya and Guatemala                     | Africa         |
|                               | severe acute respiratory illness in Kenya and Guatemala: a novel     |                                                                      |                                         | Americas       |
|                               | methodology                                                           |                                                                      |                                         |                |
| Ganatra (2012)                | Update: influenza activity - United States, 2011-12 season and      | MMWR Morb Mortal Wkly Rep 61(22): 414-420.                            | USA                                      | Americas       |
|                               | composition of the 2012-13 influenza vaccine                           |                                                                      |                                         |                |
| Gefenaite (2018)              | Estimating burden of influenza-associated influenza-like illness and  | Influenza and Other Respiratory Viruses 12(1): 183-192.                | Romania                                  | Europe         |
|                               | severe acute respiratory infection at public healthcare facilities in |                                                                      |                                         |                |
|                               | Romania during the 2011/12-2015/16 influenza seasons                   |                                                                      |                                         |                |
| Goldstein (2015)              | Estimating the hospitalization burden associated with influenza      | Influenza Other Respir Viruses 9(5): 225-233.                          | New York City, NY, USA                  | Americas       |
|                               | and respiratory syncytial virus in New York City, 2003-2011          |                                                                      |                                         |                |
| Gouya (2016)                  | Estimation of influenza and severe acute respiratory illness         | East Mediterr Health J 22(7): 432-439.                                | Iran                                     | Middle East    |
|                               | incidence (burden) in three provinces of the Islamic Republic of     |                                                                      |                                         |                |
|                               | Iran, 2012 and 2013                                                  |                                                                      |                                         |                |
| Grijalva (2007)               | Estimating the undetected burden of influenza hospitalizations in    | Epidemiol Infect 135(6): 951-958.                                     | USA                                      | Americas       |
|                               | children                                                             |                                                                      |                                         |                |
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| First Author Last Name (Year) | Title                                                                 | Source                                                                 | City/State/Country         | WHO Region       |
|--------------------------------|----------------------------------------------------------------------|------------------------------------------------------------------------|----------------------------|------------------|
| Hadler (2014)                  | Impact of requiring influenza vaccination for children in licensed     | MMWR Morb Mortal Wkly Rep 63(9): 181-185.                               | CT, USA                    | Americas         |
|                               | child care or preschool programs--Connecticut, 2012-13 influenza      |                                                                        |                            |                  |
|                               | season                                                              |                                                                        |                            |                  |
| Hardelid (2017)                | Risk factors for admission to hospital with laboratory-confirmed      | Eur Respir J 50(3).                                                   | Scotland, UK               | Europe           |
|                               | influenza in young children: birth cohort study                      |                                                                        |                            |                  |
| Hirve (2015)                  | Incidence of influenza-associated hospitalization in rural           | J Infect 70(2): 160-170.                                               | Ballabgarh and Vadu, India | South East Asia  |
|                               | communities in western and northern India, 2010-2012: a multi-        |                                                                        |                            |                  |
|                               | site population-based study                                         |                                                                        |                            |                  |
| Huang (2015)                  | Southern Hemisphere Influenza and Vaccine Effectiveness               | Influenza Other Respir Viruses 9(4): 179-190.                          | New Zealand                | Western Pacific  |
|                               | Research and Surveillance                                           |                                                                        |                            |                  |
| Jacks (2012)                  | Influenza-associated hospitalisations in Finland from 1996 to        | Euro Surveill 17(38).                                                  | Finland                    | Europe           |
|                               | 2010: unexpected age-specific burden during the influenza A(H1N1)pdm09 |                                                                        |                            |                  |
|                               | pandemic from 2009 to 2010                                           |                                                                        |                            |                  |
| Jules (2014)                  | Age-Specific Influenza-Related Emergency Department Visits and       | Infectious Diseases in Clinical Practice 22(5): 271-278.               | TN, USA                    | Americas         |
|                               | Hospitalizations in 2010-2011 Compared With the Pandemic Year 2009-2010 |                                                                        |                            |                  |
| Jules (2015)                  | Influenza-related hospitalization and ED visits in children less than | Pediatrics 135(1): e66-74.                                             | Davidson County, TN, USA   | Americas         |
|                               | 5 years: 2000-2011                                                   |                                                                        |                            |                  |
| Kamigaki (2017)               | Estimates of influenza and respiratory syncytial virus incidences    | Influenza Other Respir Viruses 11(4): 311-318.                         | Baguio City, the Philippines | Western Pacific  |
|                               | with fraction modeling approach in Baguio City, the Philippines,     |                                                                        |                            |                  |
|                               | 2012-2014                                                            |                                                                        |                            |                  |
| Khieu (2015)                  | Estimating the contribution of influenza to hospitalisations in      | Vaccine 33(33): 4087-4092.                                             | New Zealand                | Western Pacific  |
|                               | New Zealand from 1994 to 2008                                         |                                                                        |                            |                  |
| Kniss (2011)                  | Update: influenza activity--United States, 2010-11 season, and       | MMWR Morb Mortal Wkly Rep 60(21): 705-712.                             | USA                        | Americas         |
|                               | composition of the 2011-12 influenza vaccine                          |                                                                        |                            |                  |
| Kostova (2013)                | Influenza Illness and Hospitalizations Averted by Influenza          | PLoS One 8(6): e66312.                                                | USA                        | Americas         |
|                               | Vaccination in the United States, 2005-2011                          |                                                                        |                            |                  |
| Le (2014)                     | Impact of 2009 pandemic influenza among Vietnamese children based     | Influenza Other Respir Viruses 8(4): 389-396.                          | Nha Trang city, Vietnam    | Western Pacific  |
|                               | on a population-based prospective surveillance from 2007 to 2011      |                                                                        |                            |                  |
| Matias (2016)                 | Modelling estimates of age-specific influenza-related hospitalisation | BMC Public Health 16(1): 481.                                          | United Kingdom             | Europe           |
|                               | and mortality in the United Kingdom                                  |                                                                        |                            |                  |
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| First Author Last Name (Year) | Title                                                                 | Source                                           | City/State/Country              | WHO Region   |
|-------------------------------|----------------------------------------------------------------------|--------------------------------------------------|-------------------------------|--------------|
| Matias (2017)                 | Estimates of hospitalization attributable to influenza and RSV in the US during 1997-2009, by age and risk status | BMC Public Health 17(1): 271.                     | USA                           | Americas     |
| McMorrow (2015)               | The Unrecognized Burden of Influenza in Young Kenyan Children, 2008-2012 | PLoS One 10(9): e0138272.                         | Kenya                         | Africa       |
| Millman (2015)                | Improving Accuracy of Influenza-Associated Hospitalization Rate Estimates | Emerg Infect Dis 21(9): 1595-1601.                 | USA                           | Americas     |
| Murray (2015)                 | Determining the Provincial and National Burden of Influenza-Associated Severe Acute Respiratory Illness in South Africa Using a Rapid Assessment Methodology | PLoS One 10(7): e0132078.                        | South Africa                  | Africa       |
| Nyamusore (2018)              | The national burden of influenza-associated severe acute respiratory illness hospitalization in Rwanda, 2012-2014 | Influenza and Other Respiratory Viruses 12(1): 38-45. | Rwanda                        | Africa       |
| Oliva (2018)                  | Estimating the burden of seasonal influenza in Spain from surveillance of mild and severe influenza disease, 2010-2016 | Influenza and Other Respiratory Viruses 12(1): 161-170. | Spain                         | Europe       |
| Poehling (2013)               | The burden of influenza in young children, 2004-2009                  | Pediatrics 131(2): 207-216.                       | USA                           | Americas     |
| Preaud (2014)                 | Annual public health and economic benefits of seasonal influenza vaccination: a European estimate | BMC Public Health 14: 813.                       | France, Germany, the UK, Spain, Italy, Sweden, Poland, and Slovakia | Europe       |
| Proff (2009)                  | Case-based surveillance of influenza hospitalizations during 2004-2008, Colorado, USA | Emerg Infect Dis 15(6): 892-898.                  | Colorado, USA                 | Americas     |
| Puig-Barbera (2012)           | Effectiveness of the 2010-2011 seasonal influenza vaccine in preventing confirmed influenza hospitalizations in adults: a case-case comparison, case-control study | Vaccine 30(39): 5714-5720.                      | Valencia, Spain               | Europe       |
| Rajaram (2017)                | Impact of increased influenza vaccination in 2-3-year-old children on disease burden within the general population: A Bayesian model-based approach | PLoS One 12(12): e0186739.                      | England                       | Europe       |
| Reed (2014)                   | Estimated influenza illnesses and hospitalizations averted by vaccination--United States, 2013-14 influenza season | MMWR Morb Mortal Wkly Rep 63(49): 1151-1154.       | USA                           | Americas     |
| Reed (2015)                   | Estimating influenza disease burden from population-based surveillance data in the United States | PLoS One 10(3): e0118369.                      | USA                           | Americas     |
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| First Author Last Name (Year) | Title                                                                 | Source                                                                 | City/State/Country   | WHO Region       |
|-------------------------------|----------------------------------------------------------------------|------------------------------------------------------------------------|----------------------|------------------|
| Refaeey (2016)                | Incidence of influenza virus-associated severe acute respiratory infection in Damanhour district, Egypt, 2013 | East Mediterr Health J 22(7): 503-512.                                 | Damanhour district, Egypt | Middle East      |
| Rodrigues (2018)              | Excess pneumonia and influenza hospitalizations associated with influenza epidemics in Portugal from season 1998/1999 to 2014/2015 | Influenza and Other Respiratory Viruses 12(1): 153-160.                  | Portugal             | Europe           |
| Sakkou (2011)                 | Impact of influenza infection on children's hospital admissions during two seasons in Athens, Greece | Vaccine 29(6): 1167-1172.                                              | Athens, Greece       | Europe           |
| Schanzer (2008)               | Role of influenza and other respiratory viruses in admissions of adults to Canadian hospitals | Influenza Other Respir Viruses 2(1): 1-8.                                | Canada               | Americas         |
| Schanzer (2013)               | Statistical estimates of respiratory admissions attributable to seasonal and pandemic influenza for Canada | Influenza Other Respir Viruses 7(5): 799-808.                           | Canada               | Americas         |
| Schanzer (2018)               | Burden of influenza, respiratory syncytial virus, and other respiratory viruses and the completeness of respiratory viral identification among respiratory inpatients, Canada, 2003-2014 | Influenza and Other Respiratory Viruses 12(1): 113-121.                 | Canada               | Americas         |
| Sheu (2016)                   | Comparison of age-specific hospitalization during pandemic and seasonal influenza periods from 2009 to 2012 in Taiwan: a nationwide population-based study | BMC Infect Dis 16: 88.                                                 | Taiwan               | Western Pacific  |
| Sloan (2015)                  | Socioeconomic Disparities and Influenza Hospitalizations, Tennessee, USA | Emerg Infect Dis 21(9): 1602-1610.                                    | TN, USA              | Americas         |
| Sotomayor (2018)              | Estimating the burden of influenza-associated hospitalizations and deaths in Chile during 2012-2014 | Influenza and Other Respiratory Viruses 12(1): 138-145.                 | Chile                | Americas         |
| Stewart (2018)                | Using a hospital admission survey to estimate the burden of influenza-associated severe acute respiratory infection in one province of Cambodia—methods used and lessons learned | Influenza and Other Respiratory Viruses 12(1): 104-112.                 | Cambodia             | Western Pacific  |
| Susilarini (2018)             | Estimated incidence of influenza-associated severe acute respiratory infections in Indonesia, 2013-2016 | Influenza and Other Respiratory Viruses 12(1): 81-87.                   | Indonesia            | South East Asia  |
| Talbot (2009)                 | Influenza in older adults: impact of vaccination of school children   | Vaccine 27(13): 1923-1927.                                            | TN, USA              | Americas         |
| Tallo (2014)                  | Estimating influenza outpatients' and inpatients' incidences from 2009 to 2011 in a tropical urban setting in the Philippines | Influenza Other Respir Viruses 8(2): 159-168.                           | Philippines          | Western Pacific  |
| First Author Last Name (Year) | Title | Source | City/State/Country | WHO Region |
|-------------------------------|-------|--------|--------------------|------------|
| Tam (2014)                    | Influenza-related hospitalization of adults associated with low census tract socioeconomic status and female sex in New Haven County, Connecticut, 2007-2011 | Influenza Other Respir Viruses 8(3): 274-281. | New Haven County, CT, USA | Americas |
| Taylor (2017)                 | Respiratory viruses and influenza-like illness: Epidemiology and outcomes in children aged 6 months to 10 years in a multi-country population sample | J Infect 74(1): 29-41. | Brazil, Colombia, Costa Rica, Mexico, Philippines, Singapore, Thailand | Americas, South East Asia, Western Pacific |
| Tempia (2018)                 | The effects of the attributable fraction and the duration of symptoms on burden estimates of influenza-associated respiratory illnesses in a high HIV prevalence setting, South Africa, 2013-2015 | Influenza Other Respir Viruses 12(3): 360-373. | South Africa | Africa |
| Theo (2018)                   | The national burden of influenza-associated severe acute respiratory illness hospitalization in Zambia, 2011-2014 | Influenza and Other Respiratory Viruses 12(1): 46-53. | Zambia | Africa |
| Tinoco (2017)                 | Burden of Influenza in 4 Ecologically Distinct Regions of Peru: Household Active Surveillance of a Community Cohort, 2009-2015 | Clin Infect Dis 65(9): 1532-1541. | Peru | Americas |
| von der Beck (2017)           | Characteristics and outcomes of a cohort hospitalized for pandemic and seasonal influenza in Germany based on nationwide inpatient data | PLoS One 12(7): e0180920. | Germany | Europe |
| Widmer (2012)                 | Rates of hospitalizations for respiratory syncytial virus, human metapneumovirus, and influenza virus in older adults | J Infect Dis 206(1): 56-62. | Davidson County, TN, USA | Americas |
| Wong (2009)                   | Influenza-associated hospitalisation | Hong Kong Med J 15 Suppl 9: 35-37. | Hong Kong | Western Pacific |
| Wu (2017)                     | A joint analysis of influenza-associated hospitalizations and mortality in Hong Kong, 1998-2013 | Sci Rep 7(1): 929. | Hong Kong | Western Pacific |
| Yoshida (2010)                | Viral pathogens associated with acute respiratory infections in central vietnamese children | Pediatr Infect Dis J 29(1): 75-77. | Vietnam | Western Pacific |
| Yousey-Hindes (2011)          | Neighborhood socioeconomic status and influenza hospitalizations among children: New Haven County, Connecticut, 2003-2010 | Am J Public Health 101(9): 1785-1789. | New Haven County, CT, USA | Americas |
| Yu (2014)                     | The substantial hospitalization burden of influenza in central China: surveillance for severe, acute respiratory infection, and influenza viruses, 2010-2012 | Influenza Other Respir Viruses 8(1): 53-65. | Jingzhou, China | Western Pacific |
| Zhang (2017)                  | Pneumonia and influenza hospitalizations among children under 5 years of age in Suzhou, China, 2005-2011 | Influenza Other Respir Viruses 11(1): 15-22. | Suzhou, China | Western Pacific |
## Supplementary Document for Variability in Published Rates of Influenza-Associated Hospitalizations: A Systematic Review, 2007–2018

| First Author Last Name (Year) | Title | Source | City/State/Country | WHO Region |
|-------------------------------|-------|--------|--------------------|------------|
| Zhang (2017)                  | [Estimating the burden of influenza-associated hospitalization for cases of severe acute respiratory infection, Beijing, 2015] | Zhonghua Yu Fang Yi Xue Za Zhi 51(12): 1097-1101. | Beijing, China | Western Pacific |
| Zheng (2015)                  | [Estimation of hospitalization rate of laboratory confirmed influenza cases in Jingzhou city, Hubei province, 2010-2012] | Zhonghua Liu Xing Bing Xue Za Zhi 36(3): 222-227. | Jingzhou city, Hubei province, China | Western Pacific |
| Zhou (2012)                   | Hospitalizations associated with influenza and respiratory syncytial virus in the United States, 1993-2008 | Clin Infect Dis 54(10): 1427-1436. | USA | Americas |
Table S4. Variance attributed to study heterogeneity ($I^2$) within each study characteristic category.

| Category                                    | $I^2$   |
|---------------------------------------------|---------|
| **Age Group**                               |         |
| • All Age                                   | 99.93%  |
| • ≤ 2 Years                                 | 99.98%  |
| • 2 – 4 Years                               | 99.99%  |
| • < 5 Years                                 | 99.95%  |
| • 5 – 14 Years                              | 99.82%  |
| • 15 – 49 Years                             | 99.80%  |
| • 50 – 64 Years                             | 99.56%  |
| • ≥ 65 Years                                | 99.90%  |
| **Method**                                  |         |
| • Multiplier                                | 99.97%  |
| • Regression Modelling                      | 99.97%  |
| **Case-patient identification method**      |         |
| • Symptom-based identification              | 99.97%  |
| • Administrative database                   | 99.95%  |
| **World Bank income grouping**              |         |
| • High                                      | 99.95%  |
| • Upper-middle                              | 99.99%  |
| • Lower-middle                              | 99.17%  |
| • Low                                       | 99.92%  |
| **World Health Organization region**        |         |
| • Sub-Saharan Africa                        | 99.89%  |
| • Americas                                  | 99.77%  |
| • Eastern Mediterranean                     | 99.61%  |
| • Europe                                    | 99.99%  |
| • South-East Asia                           | 99.45%  |
| • Western Pacific                           | 99.99%  |
Figure S1. Published rates of influenza-associated hospitalization, by combined age groups and analytic method.