

# Denominators Project

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**APPRISE**

AUSTRALIAN PARTNERSHIP FOR  
PREPAREDNESS RESEARCH ON  
INFECTIOUS DISEASE EMERGENCIES

# Background

- Access to comprehensive surveillance data is vital for interpreting disease trends and for guiding public health control measures.
- The use of different denominators in the calculation of disease rates may lead to different interpretations of the prevalence/incidence of a disease

For example...

*If the prevalence rate of a disease is calculated using the total population as the denominator and the prevalence is found to be higher than usual, the data could be interpreted as an outbreak. However, if the prevalence rate of the same disease is recalculated using testing data as the denominator, the data may show that the increased prevalence is actually a result of increased testing.*

## Current situation:

$$\text{Rate} = \frac{\text{\# Positive laboratory results}}{\text{Per 100,000 population}}$$

**Advantage:**  
obtained from  
routine surveillance  
data.

**Disadvantage:** the  
interpretation of  
disease trends may  
be biased (no info  
on testing patterns).

# \*Ideal\* solution: population prevalence survey

$$\text{Rate} = \frac{\text{\# Positive laboratory results}}{\text{Per 100,000 people from the tested population}}$$

## **Advantage:**

Accurate estimate of prevalence within the population.

## **Disadvantage:**

Expensive, resource intense, prone to sampling errors.

# Realistic solution: use of testing data

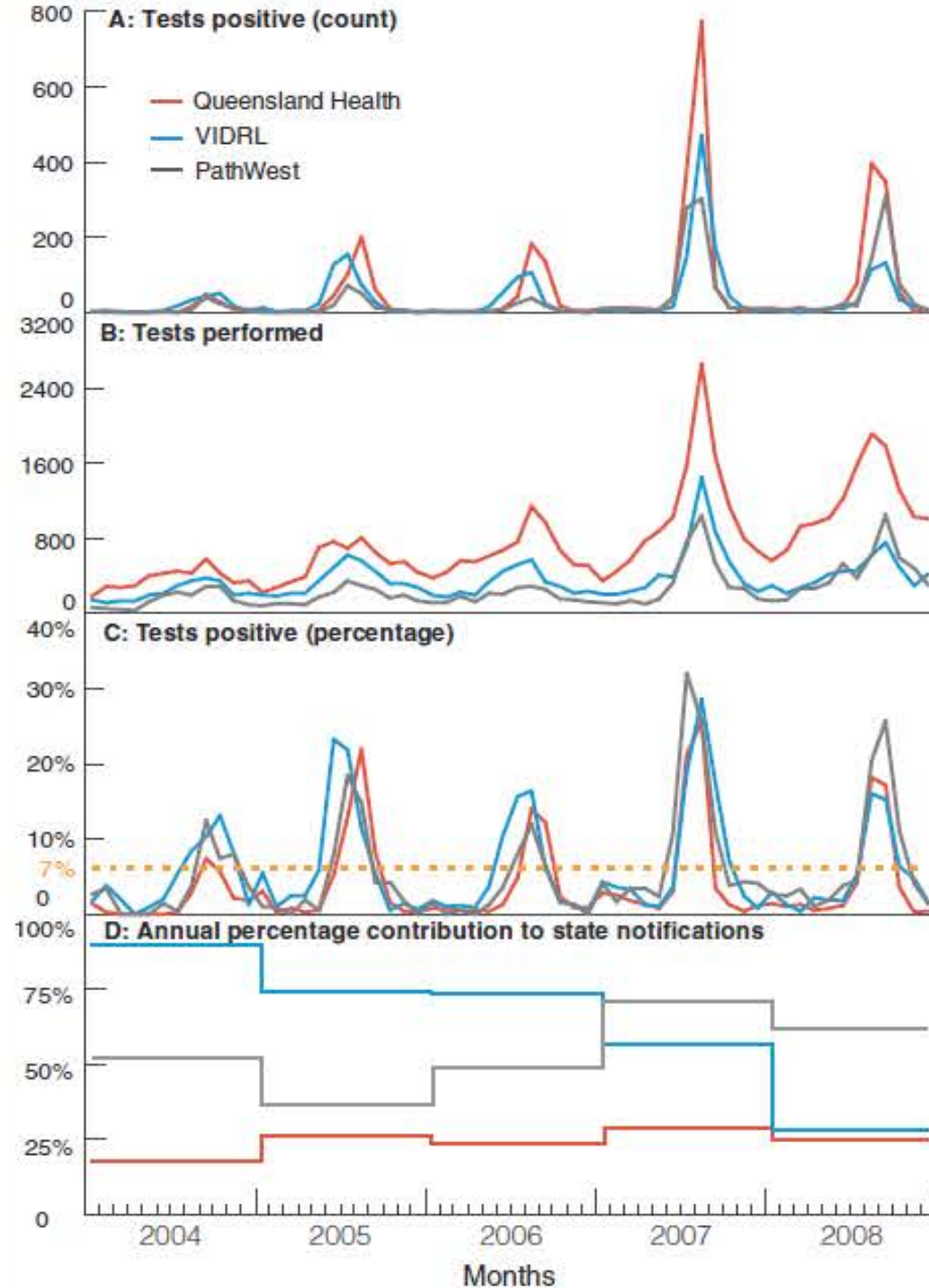
$$\text{Rate} = \frac{\text{\# Positive laboratory results}}{\text{Total \# of tests performed}}$$

**Advantage:** a significant and attainable improvement from current methods.

**Disadvantage:** May be influenced by testing patterns.

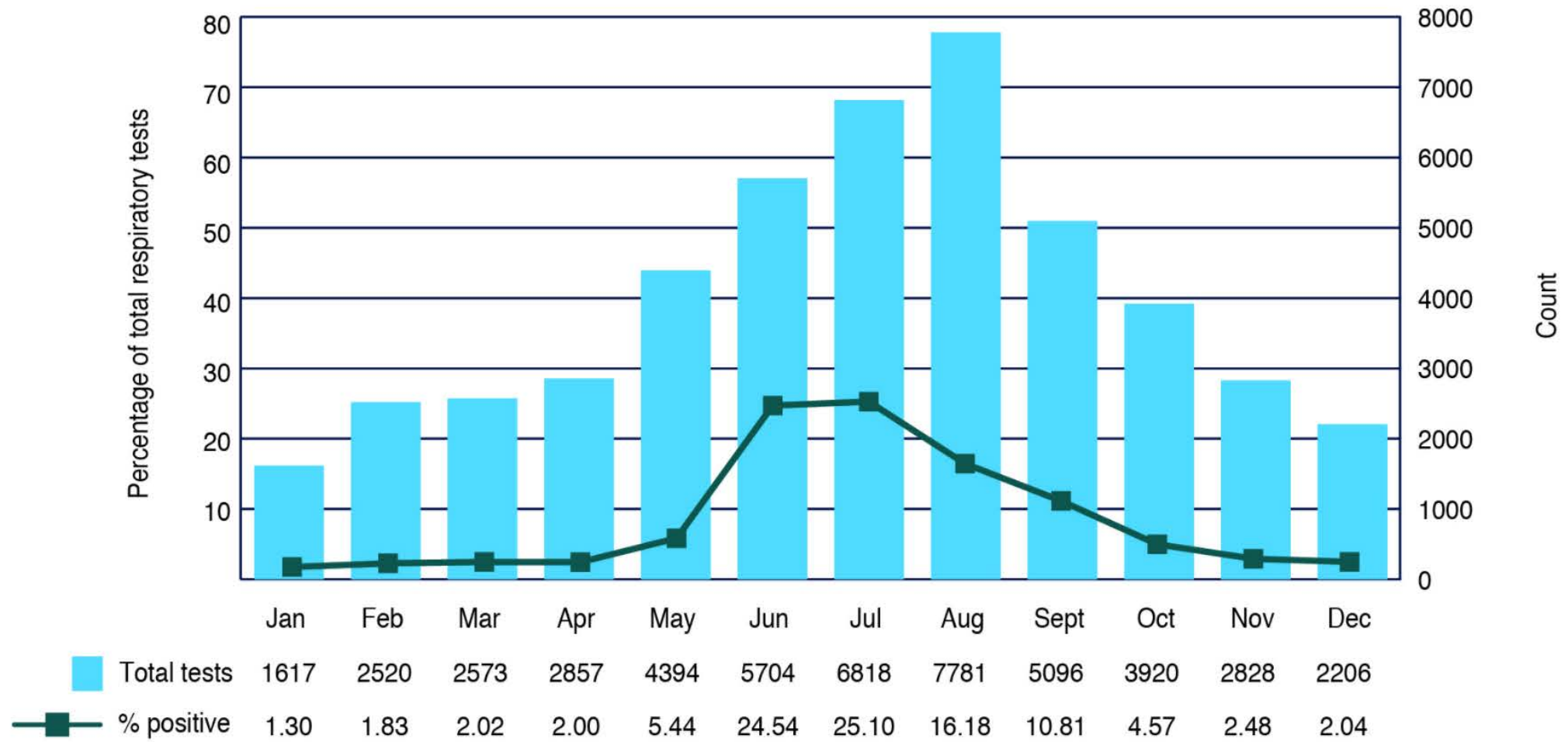
# Influenza testing by laboratory, 2004-2008.

Source: Lambert et al, *MJA*, 2010.



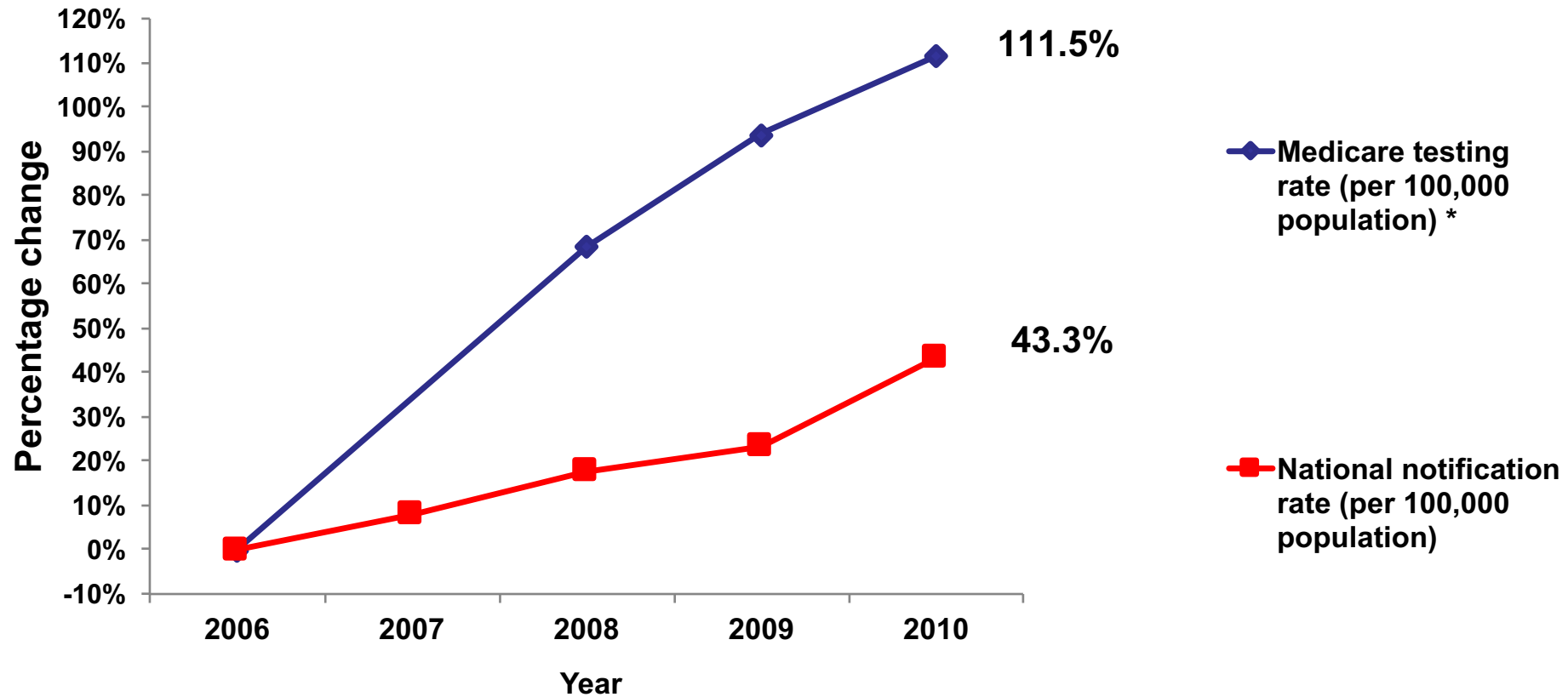
A: monthly number of positive tests; B: monthly number of tests performed; C: monthly percentage of tests performed that were positive, with 7% threshold for defining seasons,<sup>6</sup> and D: percentage contribution to total state notifications by year. (Note: use of different y-axis scale for each graph.) PathWest – PathWest Laboratory Medicine, Queen Elizabeth II Medical Centre, Western Australia. Queensland Health – Qld Department of Health laboratories. VIDRL – Victorian Infectious Diseases Reference Laboratory. ♦

# Proportion of influenza-positive respiratory tests by month, 2012



Source: Dawson et al, *Public Health Res Pract*, 2016.

# Chlamydia notifications and testing, Australia



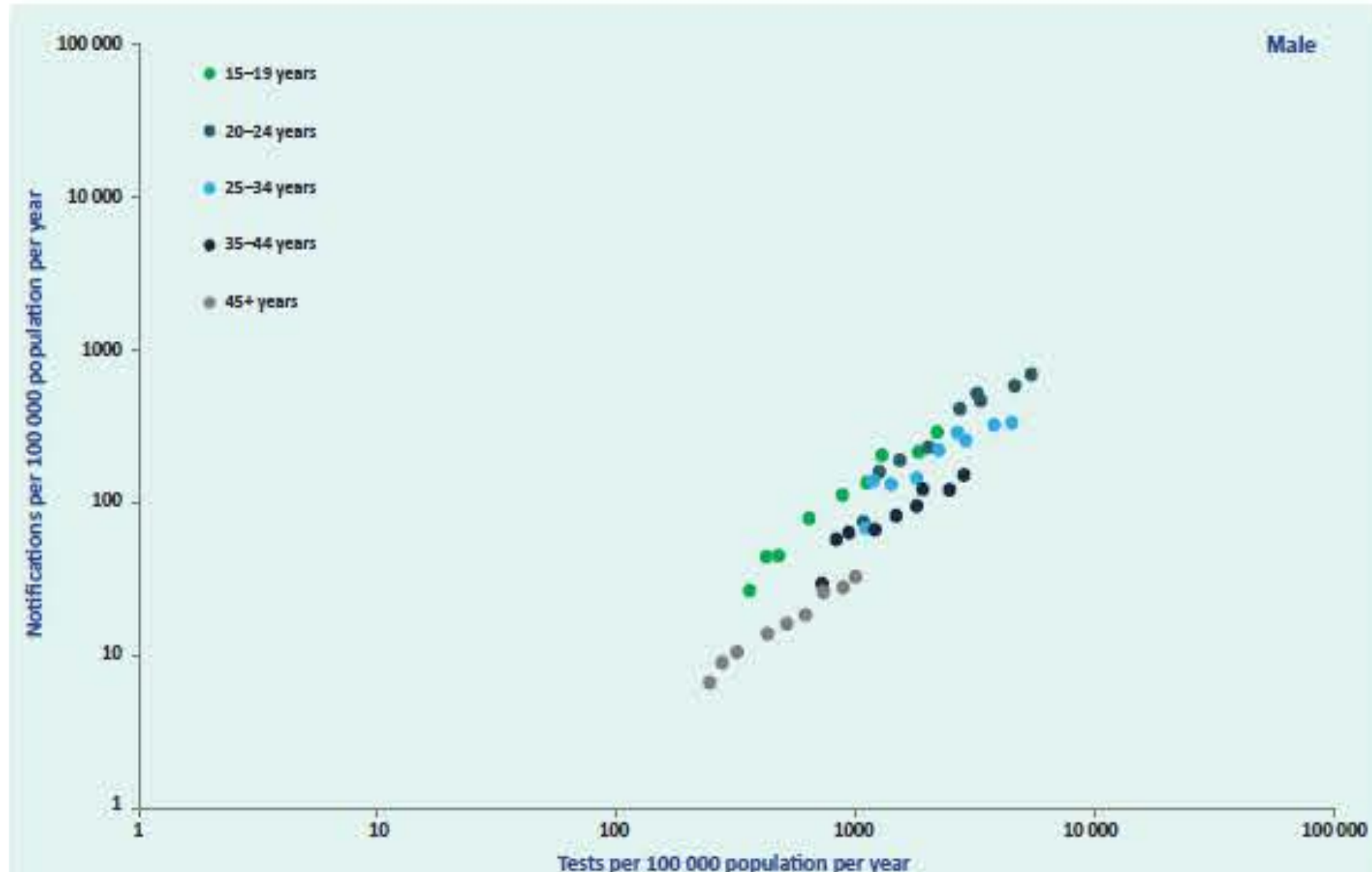
\* 2005 testing rate has been used as the starting point as 2006 and 2007 data is missing

Source: Ali, H et al, *Sex Transm Infect*, 2011.



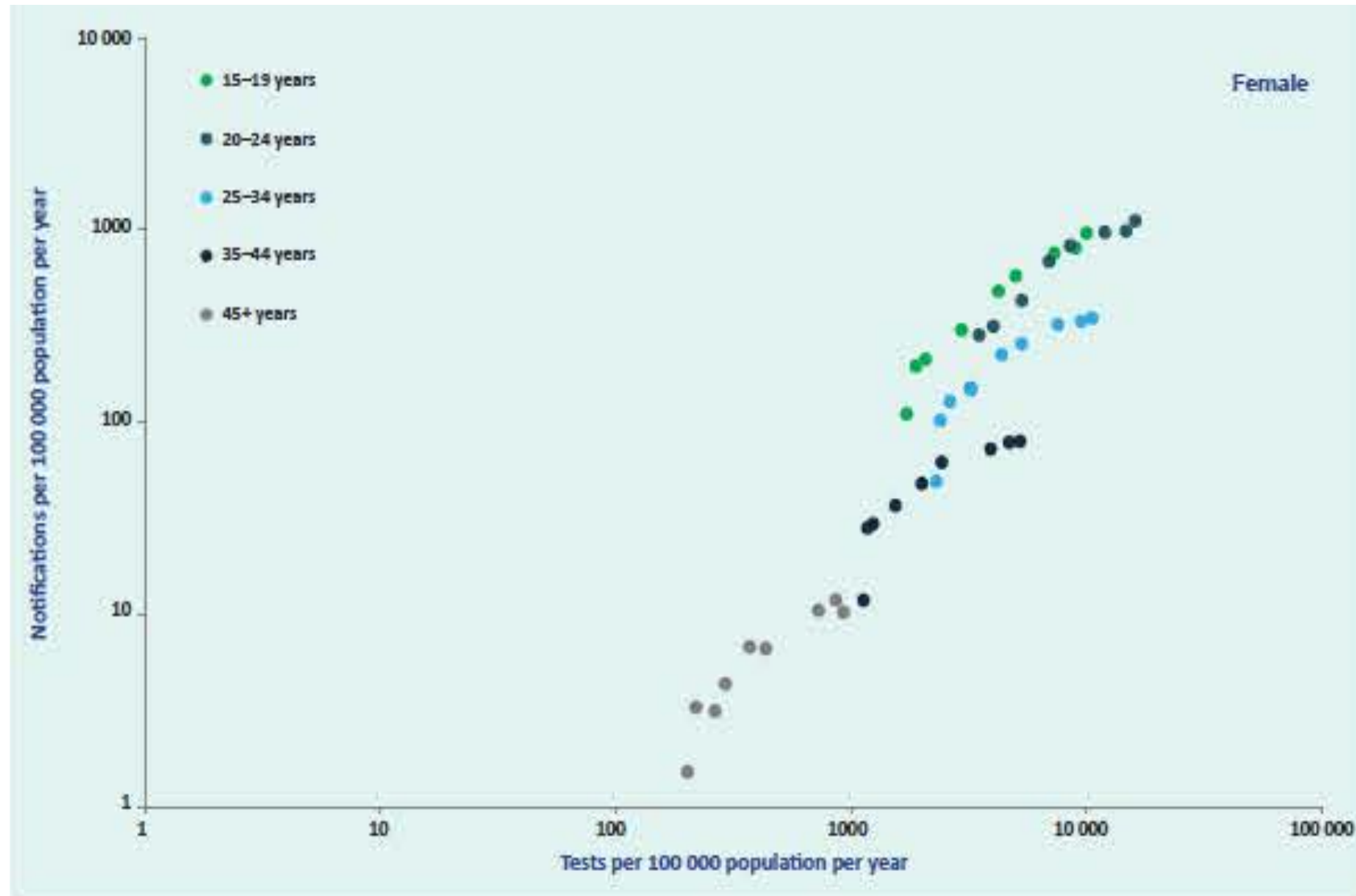
# Associations between age-specific testing and chlamydia notification rates by sex, New South Wales, Australia, 2000 to 2010 (Male)

Source: Cretikos et al, *WPSAR*, 2014.



# Associations between age-specific testing and chlamydia notification rates by sex, New South Wales, Australia, 2000 to 2010 (Female)

Source: Cretikos et al, *WPSAR*, 2014.



*How can we make diagnostic testing data more accessible and useful for the interpretation of time trends and other patterns of disease?*

# The Denominators Project

Aim: to describe and understand ways denominator data for **chlamydia** and **influenza** have been accessed, interpreted and used in **Australia**.

Why chlamydia and influenza?

- A number of papers on the collection of testing data for chlamydia and influenza exist already
- Public health importance: both diseases consistently rank in the top 5 notifiable communicable diseases in Australia.

Output: Systematic review

# So far...

1. Construct search strategy (keywords/MeSH headings/past 10 years)
2. Peer-reviewed literature search in Ovid Medline/Embase
  - 251 papers
3. Title and abstract screening
  - 29 for full review.
    - Influenza: 17 papers
    - Chlamydia: 12 papers
4. Full review of papers
5. Search reference lists of relevant papers from Step 4
6. Search SCOPUS for papers that have cited relevant papers from Step 4
7. Review extra articles found in Step 5 and 6
8. Grey literature and government report search (eg WA Health, NSW Health, Flutracking).

# Data extraction

- How the testing data were accessed
  - Source of information
  - Population coverage achieved
- How the testing data were interpreted
  - What kind of comparisons were done?
  - Eg positive notifications/testing data, compared to positive notifications/population?
- How the testing data were used
- Note differences between: disease, jurisdiction, and study type

# Discussion

- Reasons that testing data are not notifiable in Australia
- Limitations to interpretation (as cited by authors in included studies)
- Identify diseases for which the collection of denominator data would be beneficial
- Consider other variables to be collected in addition to negative test results (sex, age at onset, onset date, lab method, etc)
- Approval and funding processes for accessing denominator data

## Next steps...

- Directions for denominator data use in Australia

# Presentation References

- Ali, H et al. Understanding trends in Chlamydia trachomatis can benefit from enhanced surveillance: findings from Australia. *Sex Transm Infect* doi:10.1136/sextrans-2011-050423
- Chen MY, Fairley CK, Donovan B. 2005. Nowhere near the point of diminishing returns: correlations between chlamydia testing and notification rates in New South Wales. *Aust N Z J Public Health*. 29(3):249-53
- Cretikos M, Mayne D, Reynolds R, Spokes P, Madeddu D. 2014. Testing-adjusted chlamydia notification trends in New South Wales, Australia, 2000 to 2010. *WPSAR* 5(3) doi 10.5365/wpsar.2014.5.1.009
- Dawson G, Gilmour R, Tobin S, Travaglia J. 2016. Strengthening public health systems: assessing the attributes of the NSW influenza surveillance system. *Public Health Res Pract*. 26(2):e2621621
- Lambert SB, Faux CE, Grant KA, Williams SH, Bletchly C, Catton MG, Smith DW, Kelly HA. 2010. Influenza surveillance in Australia: we need to do more than count. *MJA* 193:43-45



# Review references so far (chlamydia)

1. Ali H, Cameron E, Drovandi CC, McCaw JM, Guy RJ, Middleton M, El-Hayek C, Hocking JS, Kaldor JM, Donovan B, Wilson DP. 2015. A new approach to estimating trends in chlamydia incidence. *Sexually Transmitted Infections* 91(7):513-519.
2. Ali H, Guy RJ, Fairley CK, Want H, Chen MY, Dickson B, O'Connor CC, Marshall L, Grulich AE, Kaldor JM, Hellard ME, Donovan B. 2012. Understanding trends in genital Chlamydia trachomatis can benefit from enhanced surveillance: Findings from Australia. *Sexually Transmitted Infections* 88(7):552-557.
3. Bowring AL, Goller JL, Gouillou M, Harvey C, Bateson D, McNamee K, Read C, Boyle D, Jordan L, Wardle R, Stephens A, Donovan B, Guy R, Hellard M. 2013. Chlamydia testing and retesting patterns at family planning clinics in Australia. *Sexual Health* 10(1):74-81.
4. Cretikos M, Mayne D, Reynolds R, Spokes P, Madeddu D. 2014. Testing-adjusted chlamydia notification trends in New South Wales, Australia, 2000 to 2010. *Western Pacific Surveillance Response Journal* 5(3):7-17.
5. Dimech W, Lim MS, Van Gemert C, Guy R, Boyle D, Donovan B, Hellard M, Access collaboration. 2014. Analysis of laboratory testing results collected in an enhanced chlamydia surveillance system in Australia, 2008-2010. *BMC Infectious Diseases* 14:325.
6. Forrest G, Boonwaat L, Douglas J, Aowfeso N. 2009. Enhanced chlamydia surveillance in New South Wales (Australia) prisons, 2005-2007. *International journal of prison health* 5(4):233-40.
7. Franklin N, O'Connor CC, Shaw M, Guy R, Grulick A, Fairley CK, Chen MY, Hellard M, Dickson B, Marshall L, Donovan B, Access Collaboration. 2010. Chlamydia at an inner metropolitan sexual health service in Sydney, NSW: Australian Collaboration for Chlamydia Enhanced Sentinel Surveillance (ACCESS) Project. *Sexual Health* 7(4):478-83.
8. Goller JL, Ward J, Saunders M, Couzos S, Kaldor J, Hellard MA, Australian Collaboration for Chlamydia Enhanced Sentinel Surveillance System. 2012. Chlamydia sentinel surveillance in Aboriginal Community Controlled Health Services finds higher testing and positivity rates among younger people. *Australian & New Zealand Journal of Public Health* 36(6):577-81.
9. Guy RJ, Want H, Franklin N, Fairley CK, Chen MY, O'Connor CC, Marshall L, Grulich AE, Kaldor JM, Hellard ME, Donovan B, Access Collaboration. 2011. Chlamydia trends in men who have sex with men attending sexual health services in Australia, 2004-2008. *Sexually Transmitted Diseases* 38(4):339-46.

10. Kong FYS, Guy R, Berger I, Boyle DJ, Hocking JS, Merritt T, Britt H, Lau P, Pirotta MV, Heal C, Brett T, Kaldor J, Donovan B, Hellard ME. 2009. Chlamydia testing rates in general practices across Australia: The Australian collaboration for chlamydia enhanced sentinel surveillance (ACCESS). *Sexual Health* 6(4):367.
11. O'Rourke KM, Fairley CK, Smaranayake A, Collignon P, Hocking JS. 2009. Trends in Chlamydia positivity over time among women in Melbourne Australia, 2003 to 2007. *Sexually Transmitted Diseases* 36\*12):763-7.
12. Reekie J, Donovan B, Buy R, Hocking JS, Kaldor JM, Mak DB, Pearson S, Preen D, Want H, Ward J, Liu B. 2017. Trends in chlamydia and gonorrhoea testing and positivity in Western Australian Aboriginal and non-Aboriginal women 2001-2013: a population-based cohort study. *Sexual Health* 26:26.

# Review references so far (influenza)

1. Ballestas T, McEvoy SP, Doyle J. 2009. Co-ordinated approach to healthcare worker influenza vaccination in an area health service. *Journal of Hospital Infection* 73(3):203-209.
2. Carlson SJ, Dalton CB, Durrheim DN, Fejsa J. 2010. Online Flutracking survey of influenza-like illness during pandemic (H1N1) 2009, Australia. *Emerging Infectious Diseases* 16(12):1960-2.
3. Carlson SJ, Dalton CB, Tuyl FA, Durrheim DN, Fejsa J, Muscatello DJ, Francis JL, d'Espaignet ET. 2009. Flutracking surveillance: comparing 2007 New South Wales results with laboratory confirmed influenza notifications. *Communicable Diseases Intelligence Quarterly Report* 33(3):323-7.
4. Carlson SJ, Durrheim DN, Dalton CB. 2010. Flutracking provides a measure of field influenza vaccine effectiveness, Australia, 2007-2009. *Vaccine* 28(42):6809-10
5. Catton M, Druce J, Papadakis G, Tran T, Birch C. 2011. Reality check of laboratory service effectiveness during pandemic (H1N1) 2009, Victoria, Australia. *Emerging Infectious Diseases* 17(6):963-8.
6. Churches T, Conaty SJ, Gilmour RE, Muscatello DJ. 2010. Reflections on public health surveillance of pandemic (H1N1) 2009 influenza in NSW. *New South Wales Public Health Bulletin* 21(1-2):19-25.
7. Coghlan B, Kelly HA, Carlson SJ, Grant KA, Leder K, Dalton CB, Cheng AC. 2016. Estimates of influenza vaccine coverage from Victorian surveillance systems based in the community, primary care and hospitals. *Communicable Diseases Intelligence Quarterly Report* 40(2):E204-6.
8. Cowie GA, Cowie BC, Fielding JE. 2017. Influenza testing trends in sentinel surveillance general practices in Victoria 2007 to 2014. *Communicable Diseases Intelligence Quarterly Report* 41(1):E4-E9.
9. Dawood FS, Hope KG, Durrheim DN, Givney R, Fry AM, Dalton CB. 2010. Estimating the disease burden of pandemic (H1N1) 2009 virus infection in Hunter New England, Northern New South Wales, Australia, 2009 *PLoS ONE* 5(3):e9880.

10. Dawson G, Gilmour R, Tobin S, Travaglia J. 2016. Strengthening public health systems: assessing the attributes of the NSW influenza surveillance system. *Public Health Research and Practice* 26(2):15.
11. Fielding J, Grant K, Franklin L, Sullivan S, Papadakis G, Kelly H, Cheng A. 2013. Epidemiology of the 2012 influenza season in Victoria, Australia. *Western Pacific Surveillance Response Journal* 4(3):42-50.
12. Fielding JE, Grant KA, Papadakis G, Kelly HA. 2011. Estimation of type and subtype specific influenza vaccine effectiveness in Victoria, Australia using a test negative case control method, 2007-2008. *BMC Infectious Diseases* 11:170.
13. Fielding JE, Regan AK, Dalton CB, Chilver MB, Sullivan SG. 2016. How severe was the 2015 influenza season in Australia? *Medical Journal of Australia* 204(2)60-1.
14. Kelly G, Carville K, Grant K, Jacoby P, Tran T, Barr I. 2009. Estimation of influenza vaccine effectiveness from routine surveillance data. *PLoS ONE* 4(3):e5079.
15. Kelly H, Grant K. 2009. Interim analysis of pandemic influenza (H1N1) 2009 in Australia: surveillance trends, age of infection and effectiveness of seasonal vaccination 14(31):06.
16. Kelly HA, Grant KA, Tay EL, Franklin L, Hurt AC. 2013. The significance of increased influenza notifications during spring and summer of 2010-11 in Australia. *Influenza and Other Respiratory Viruses* 7(6):1136-41.
17. Lambert SB, Faux CE, Grant KA, Williams SH, Bletchly C, Catton MG, Smith DW, Kelly HA. 2010. Influenza surveillance in Australia: we need to do more than count. *Medical Journal of Australia* 193(1):43-5.