

# **Trends of Hepatitis C Virus Epidemic in Australia and North America in 20th Century**

Chaturaka Rodrigo



**UNSW**  
THE UNIVERSITY OF NEW SOUTH WALES

# Hepatitis C virus

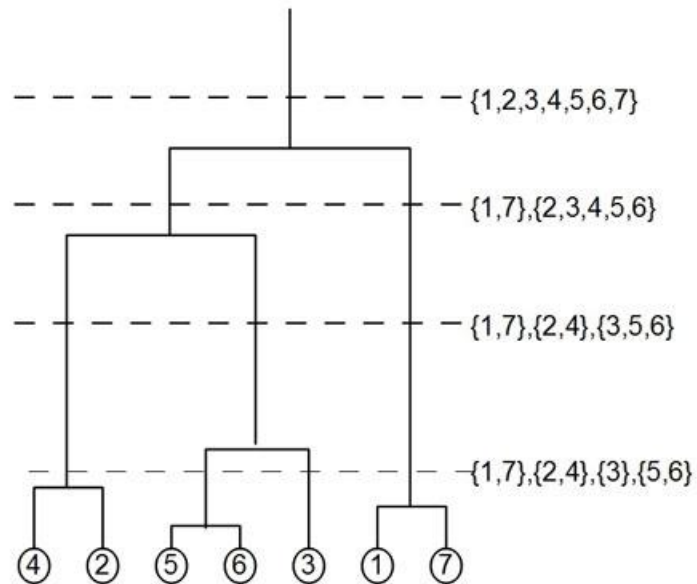
- Identified and cloned in 1989
- Time of origin is unknown
- Virus genomes have been uncovered from samples stored as far back as 1953
- Important to study the progression of the epidemic
  - Typical example of a blood borne virus spread
  - Important for epidemiological monitoring



# Objectives

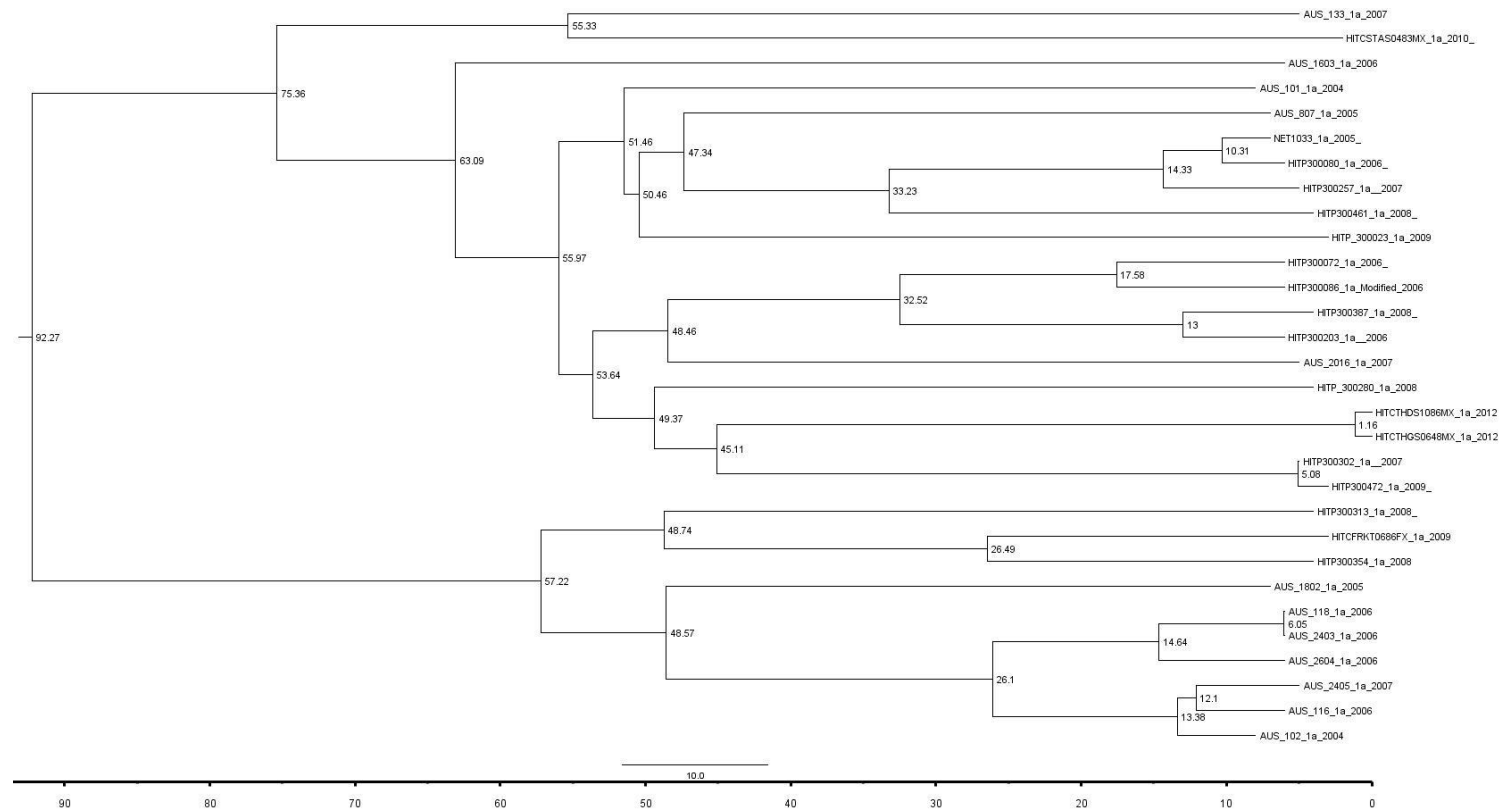
- To reconstruct the trends of the HCV epidemic in two continents using currently existing sequences

# A phylogenetic tree



**UNSW**  
THE UNIVERSITY OF NEW SOUTH WALES

# A phylogenetic tree with a timeline



**UNSW**  
THE UNIVERSITY OF NEW SOUTH WALES

# Sample selection – Full length Genomes

- For genotype 3a
  - InC3
  - Los Alamos HCV database
  - Genbank
- For genotype 1a
  - InC3
  - Los Alamos HCV database

# Methods

- Geneious
  - For alignment preparation and conversion of files
- MEGA
  - Substitution rate priors
- Path-O-Gen
  - Temporal signal of data
  - Priors for substitution rates
  - Priors for MRCA

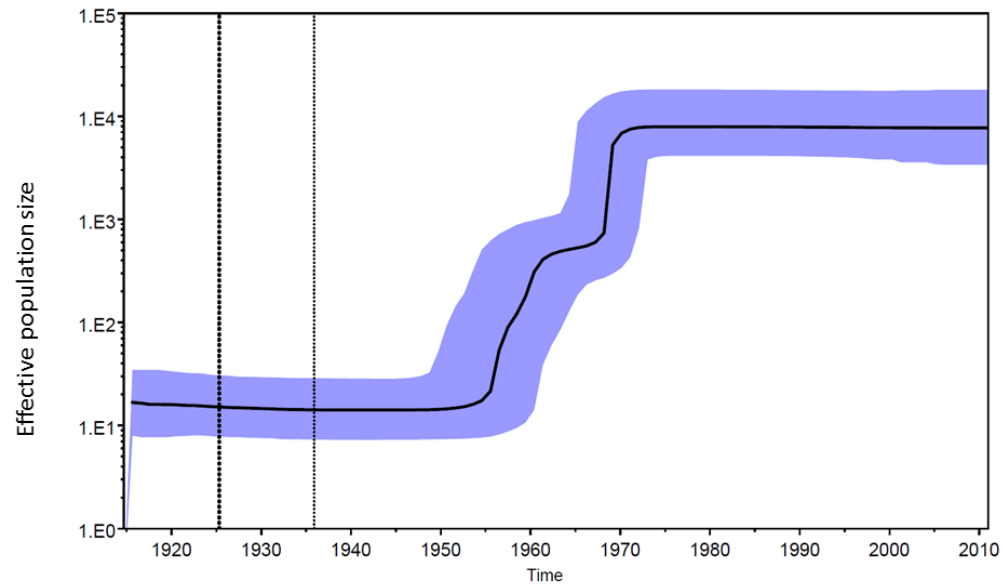
# Methods

- Beauti
  - XML file preparation
- BEAST
  - Run the analysis
- Tracer
  - Read the analysis and model comparison
  - Bayesian skyline plot
- Figtree / Geneious
  - Graphics, trees etc.





# Subtype 1a NA

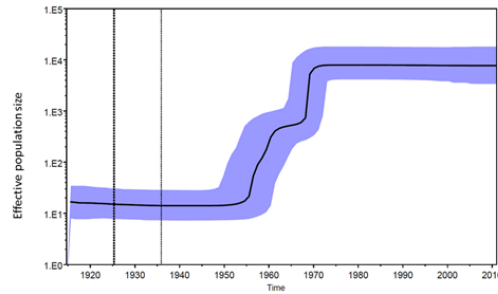


**UNSW**  
THE UNIVERSITY OF NEW SOUTH WALES

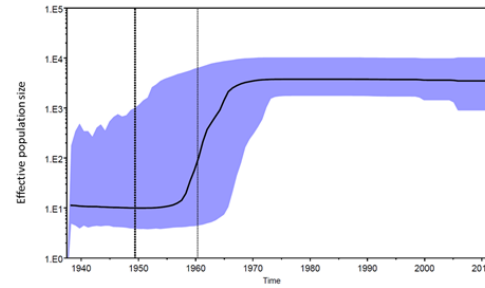
# All Projections

NA

1a



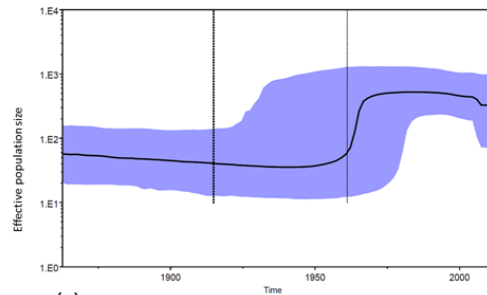
3a



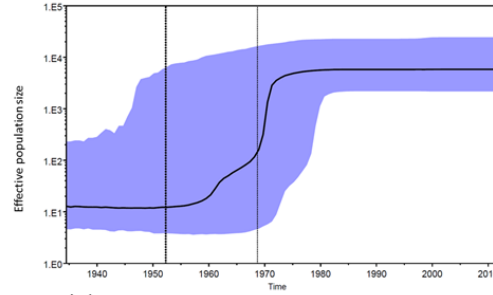
(a)

(b)

AUS



(c)



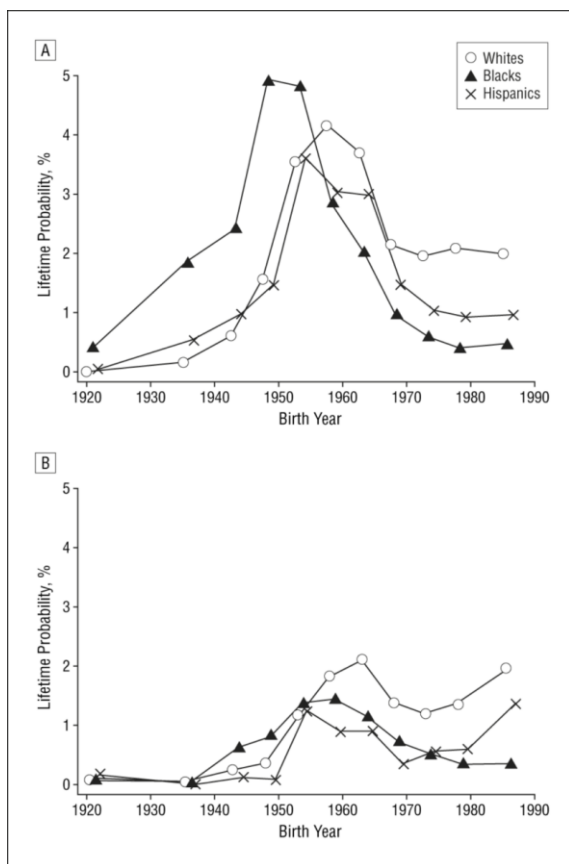
(d)



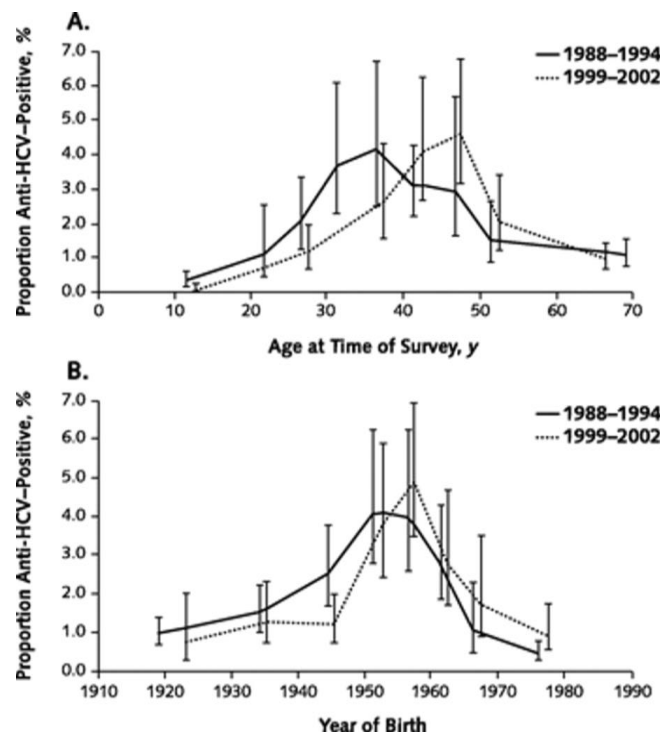
**UNSW**  
THE UNIVERSITY OF NEW SOUTH WALES

# Results

- Genotypes 1a is older (early 20<sup>th</sup> century) than 3a (mid-20<sup>th</sup> century)
- 1a probably originated at the same time in both continents. ? Source (Asia or Africa)
- There is a rapid rise in cases between 1955-1975
- All show a decline after 2000 except 3a in AUS which is stable



a) Modelled life time probability of IV drug use in US



b) HCV ab prevalence by birth year in US

Arch Intern Med. 2007;167(2):166-173. doi:10.1001/archinte.167.2.166

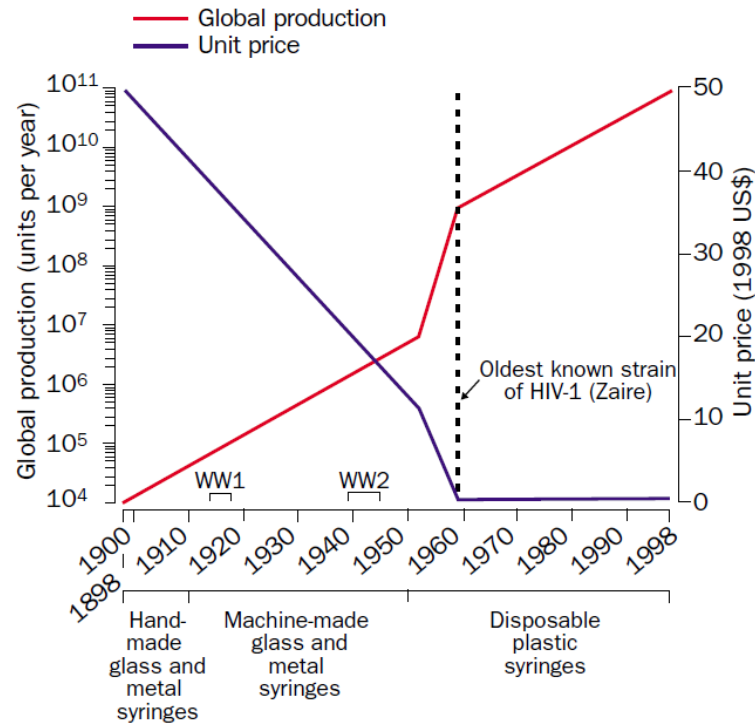


Figure 2: **Global production and unit price of injecting equipment (1898–1998)**  
 WW=World War.

Drucker E, Alcabes PG, Marx PA. The injection century: massive unsterile injections and the emergence of human pathogens. *Lancet* 2001; 358:1989-92

# Decline in number of infections

- Awareness of HIV and HCV
- Harm minimisation strategies
- Death of older people with infections
- ? Treatment effect



# Conclusions and future applications

- Bayesian evolutionary analysis is an attractive alternative to predict trends of HCV infection
- For comparison of trends in pre and post DAA era

# References

Rodrigo C, Eltahla AA, Bull RA, et al. Historical trends in the hepatitis C virus epidemics in North America and Australia. *J Infect Dis*, **2016**  
**doi:** 10.1093/infdis/jiw389

Rodrigo C, Eltahla A, Bull RA, et al. on behalf of InC3 investigators. Phylogenetic analysis of full-length, early infection, hepatitis C virus genomes among people with intravenous drug use: the InC3 Study. *J Viral Hepat*. 2016. In Press



# Acknowledgements

- Supervisors
  - Andrew Lloyd
  - Fabio Luciani
  - Rowena Bull
  - Auda Eltahla
- Fellow students and staff of VISP
- InC3 cohorts and collaborators