Modelling HCV elimination

Is it achievable and what role would a vaccine play?

Nick Scott

What is elimination?

- The World Health Organization have set some global HCV ‘elimination’ targets:
  - 80% reduction in HCV incidence by 2030 (30% by 2020)
  - 65% reduction in HCV-related deaths by 2030 (10% by 2020)

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Where did these targets come from?

- Informed from modelling by the World Health Organization
- The WHO suggest that the elimination targets could be achieved (*globally*) if five synergistic service coverage targets are reached:

Service coverage targets	Current	2020	2030
Blood safety	89% o sc	donations eened	100% of donations screened
Safe injections: percentage of injections administered with safety engineered devices in and out of health facilities		50%	90%
Harm reduction: number of sterile needles and syringes provided per PWID per year	20	200	300
HCV diagnosis	<5% diagnosed	30%	90%
HCV treatment	<1% rec treatm		80% of people with HCV treated

Australia has already attained:

The challenging area

Source: WHO draft global health sector strategies viral hepatitis, 2016–2021

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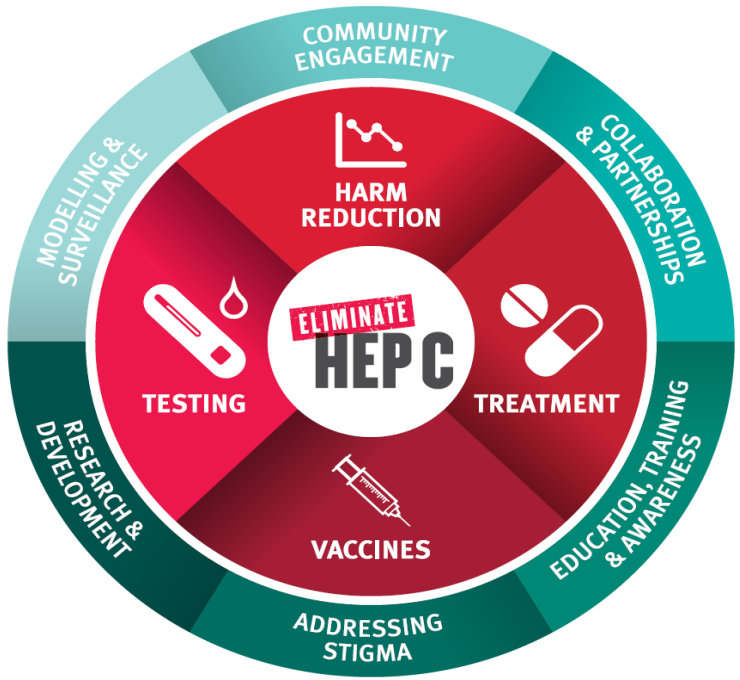
Core components for Australia

- Treatment
  - Direct-acting antivirals
- Testing
  - Antibody testing, RNA testing
- Harm reduction
  - Needle and syringe distribution, opioid substitution therapy
- Vaccines

Modelling can determine the interplay between these, and how they can best work together



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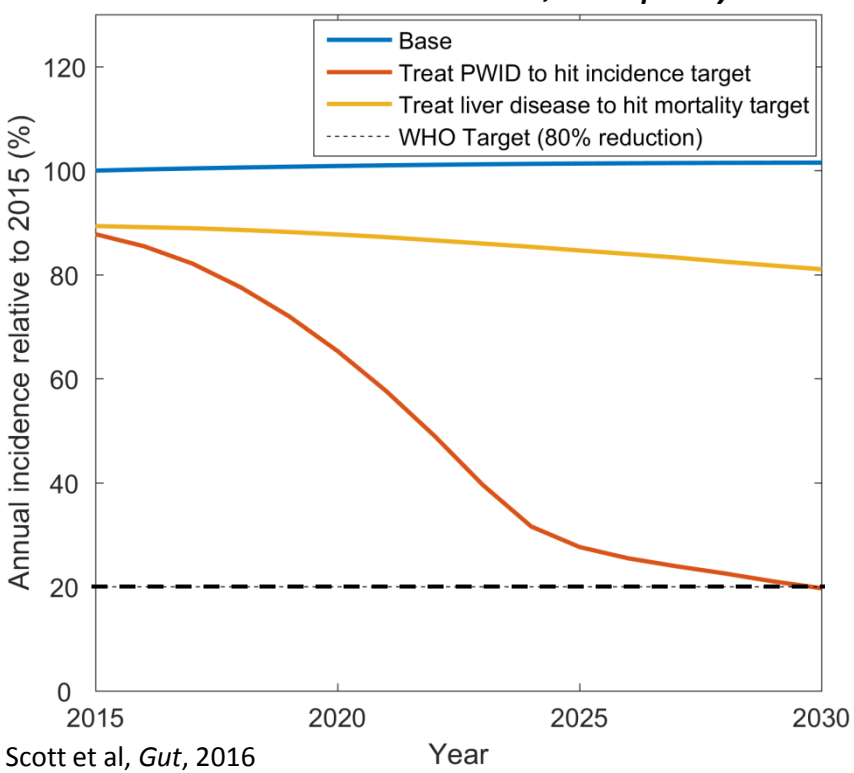
HCV incidence target in Australia

Annual incidence

Treatment numbers: 4,700 per year



Scott et al, *Gut*, 2016

- In Australia, treatment scale-up must be among PWID to reach the WHO's incidence target.
- Targeting treatments is necessary.

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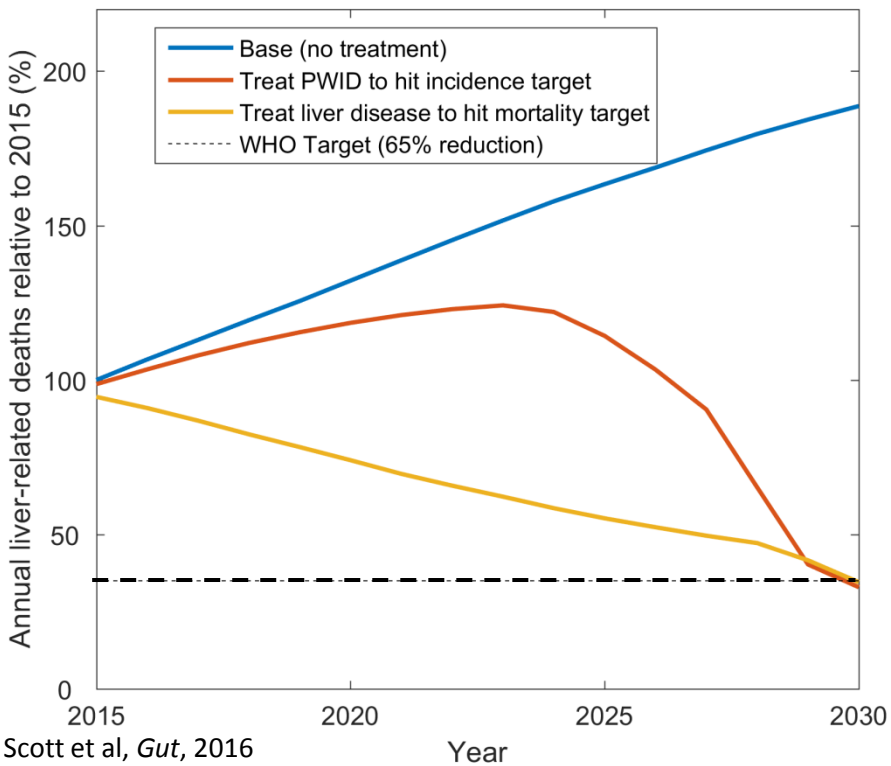
HCV mortality target in Australia

Annual HCV-related deaths

Treatment numbers: 5,700 per year



Scott et al, *Gut*, 2016

- Need to also target people with late stage liver disease.
- Treating PWID also achieves the WHO mortality target because of the cases that are prevented.
  - ***This can save on countries' treatment budgets.***

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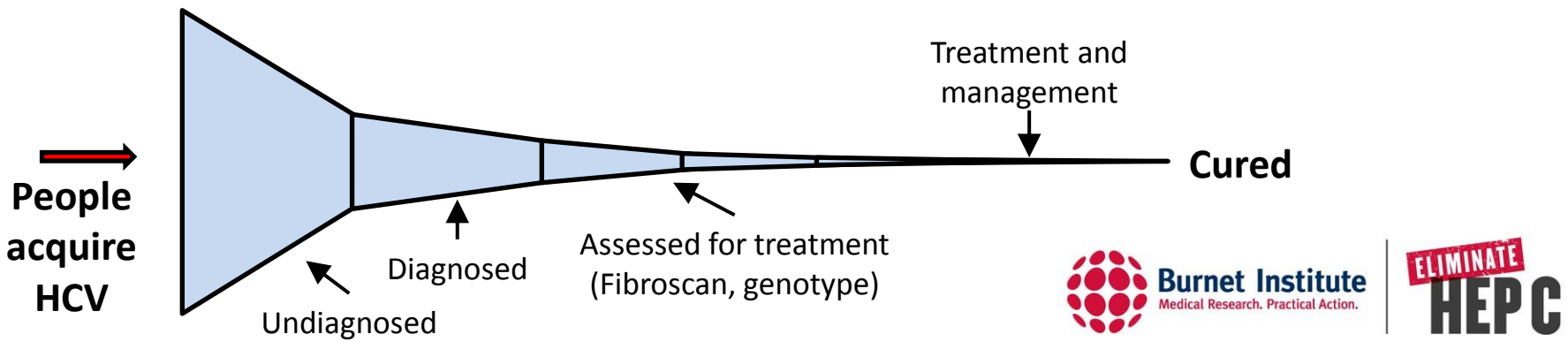
HCV cascade of care

Treatment scale-up models suggest it will be difficult but possible BUT, treatment can not be scaled up unless patients are in care.

- Consider programs to improve the cascade of care, e.g. screening programs to improve diagnosis.
- ***Identify and remove bottlenecks from the cascade.***
  - How do we get the most people on treatment?
  - Which modalities of which programs are required, e.g. nurse-led models of care.



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Current cascade of care

- Once infected, people require:
  - Antibody test (to determine Ab+)
  - PCR test (to determine RNA+, i.e. active infection)
  - Genotype test (to determine treatment protocol)
  - Liver disease test (to assess risks)

Not required in future?
- Rapid RNA tests being developed
- Increasing number of people with Ab+ but no infection

Not required in future?

Not required in future for people with APRI test < 1?

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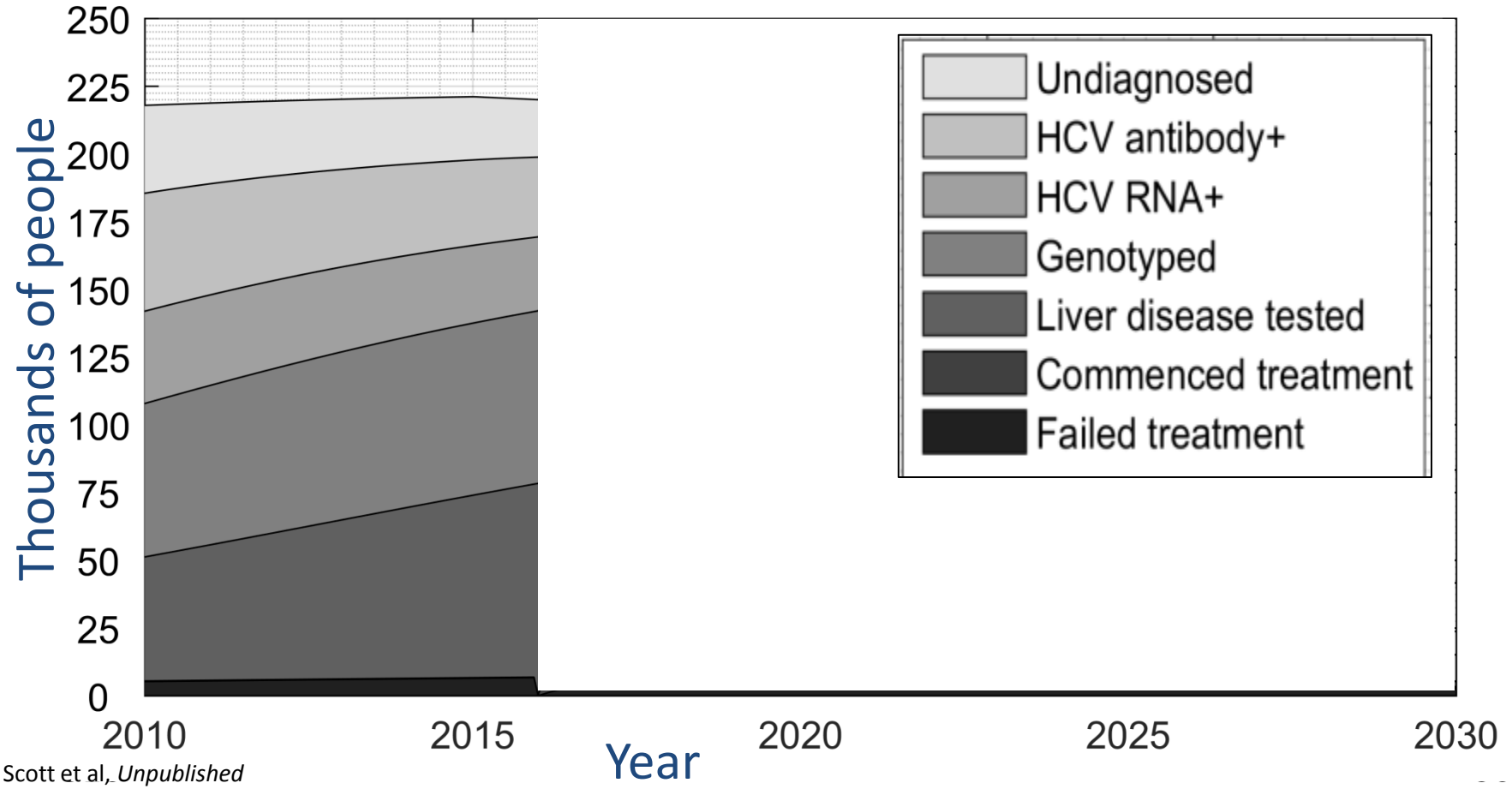
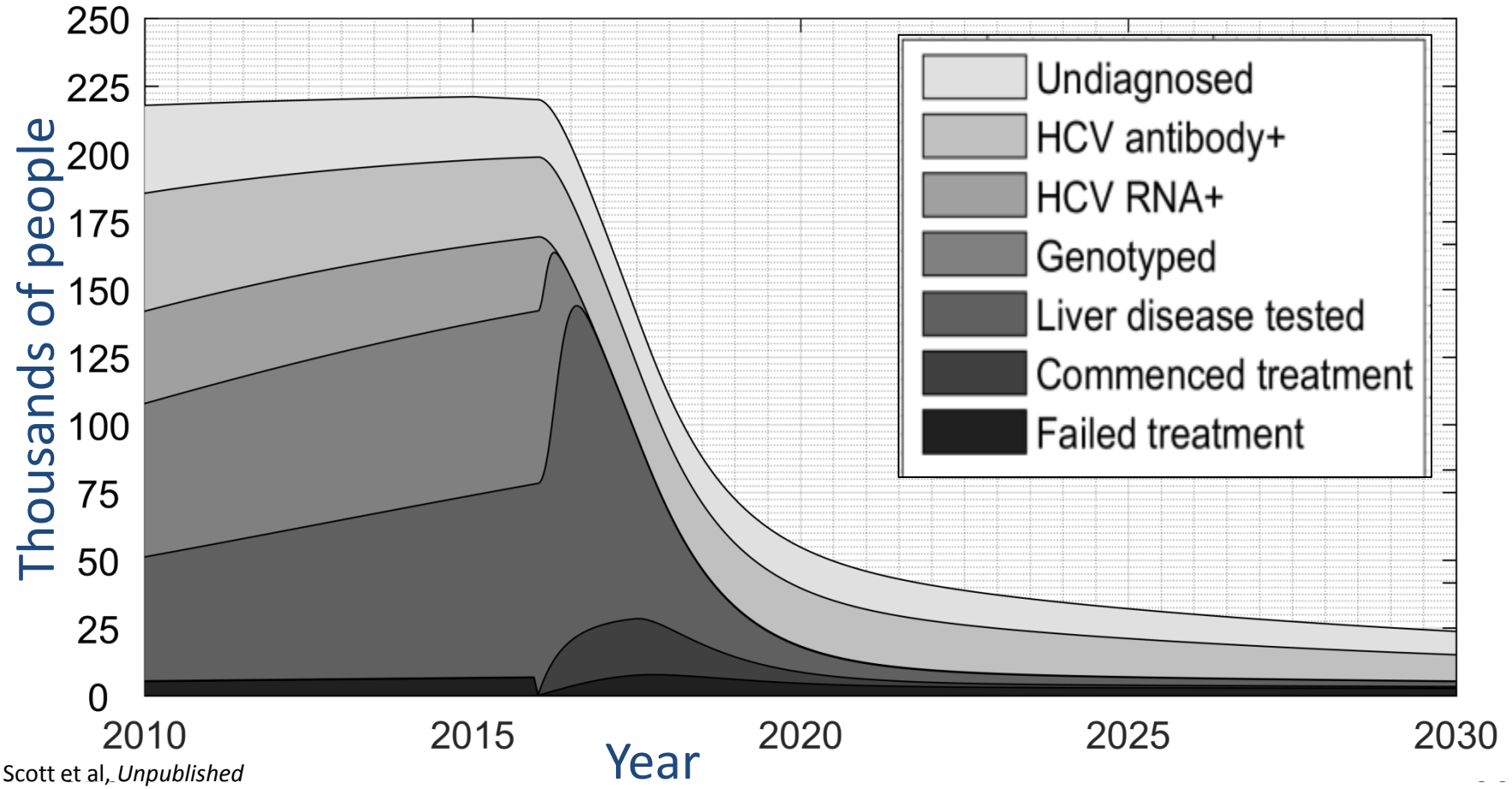
Projecting treatment scale-up alone



Scott et al, *Unpublished*

Projecting treatment scale-up alone



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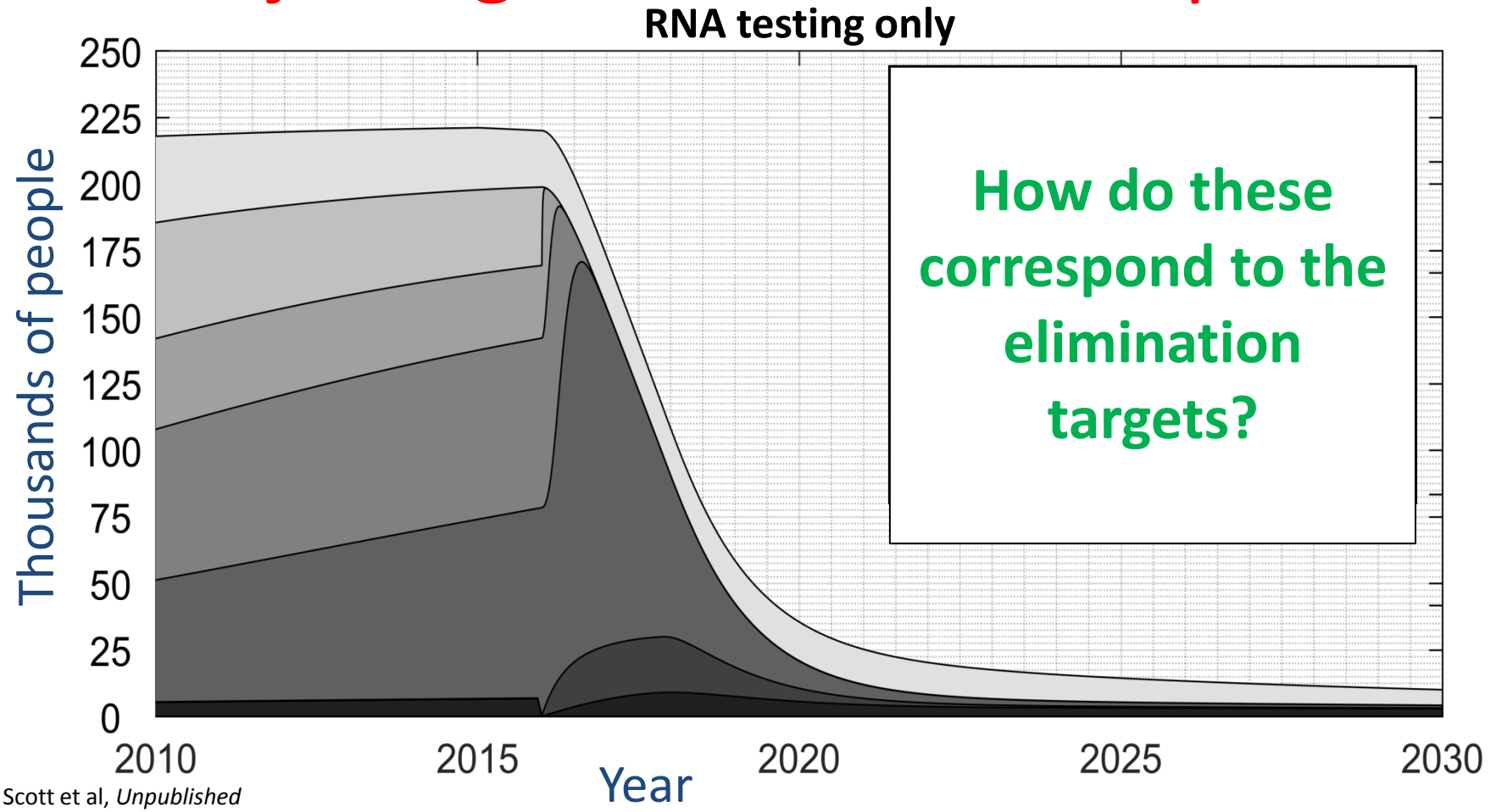
Projecting treatment scale-up alone



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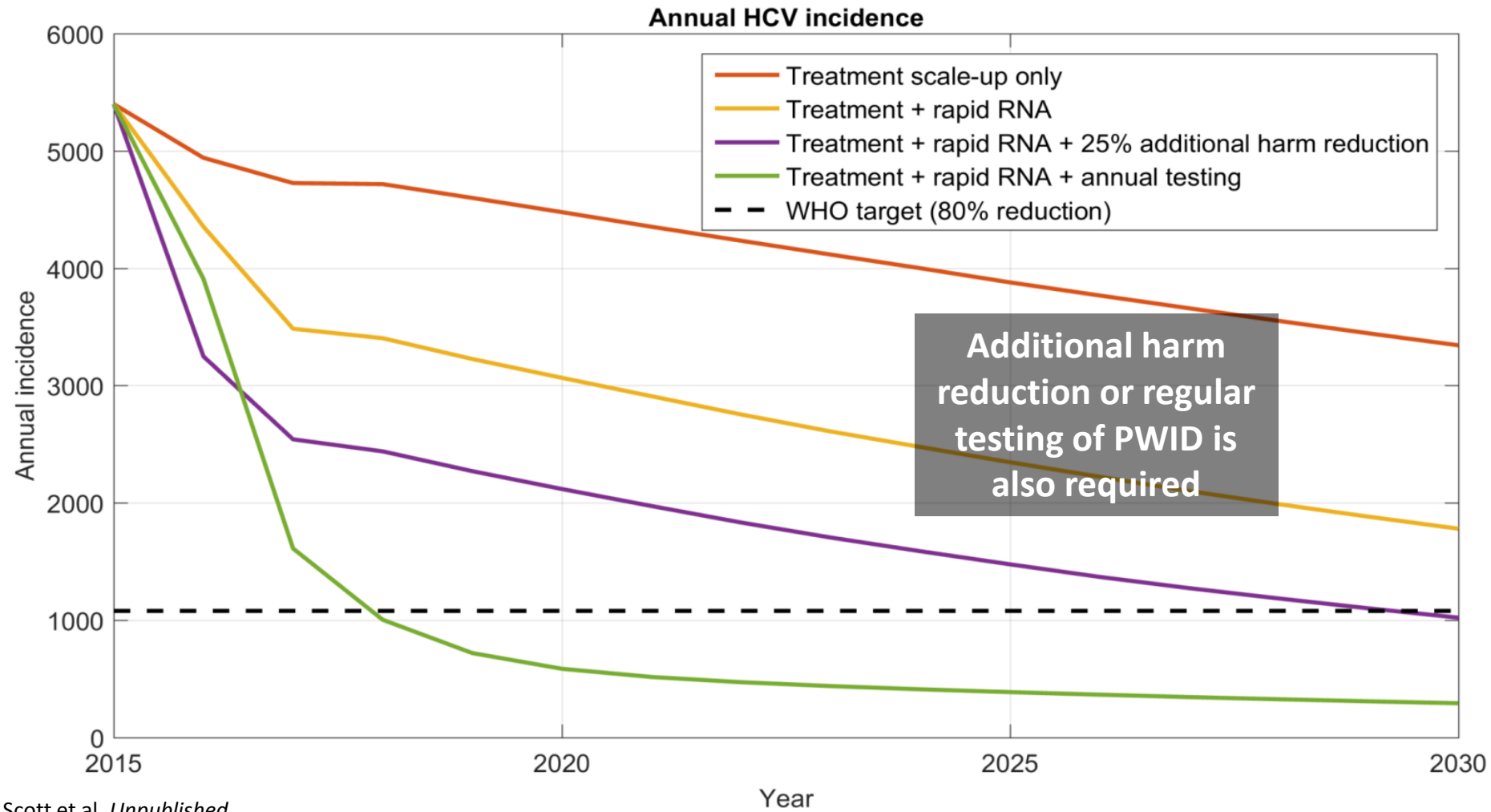

Scott et al, *Unpublished*

Harm reduction and vaccines can play a key role

- In terms of HCV transmission, vaccines have a similar effect to harm reduction:
  - Minimize infection / reinfection
- Benefit from once off administration for longer term protection (compared to maintaining NSP / OST coverage)
- A vaccine could be administered following treatment to increase the impact
  - Patients already engaged in care

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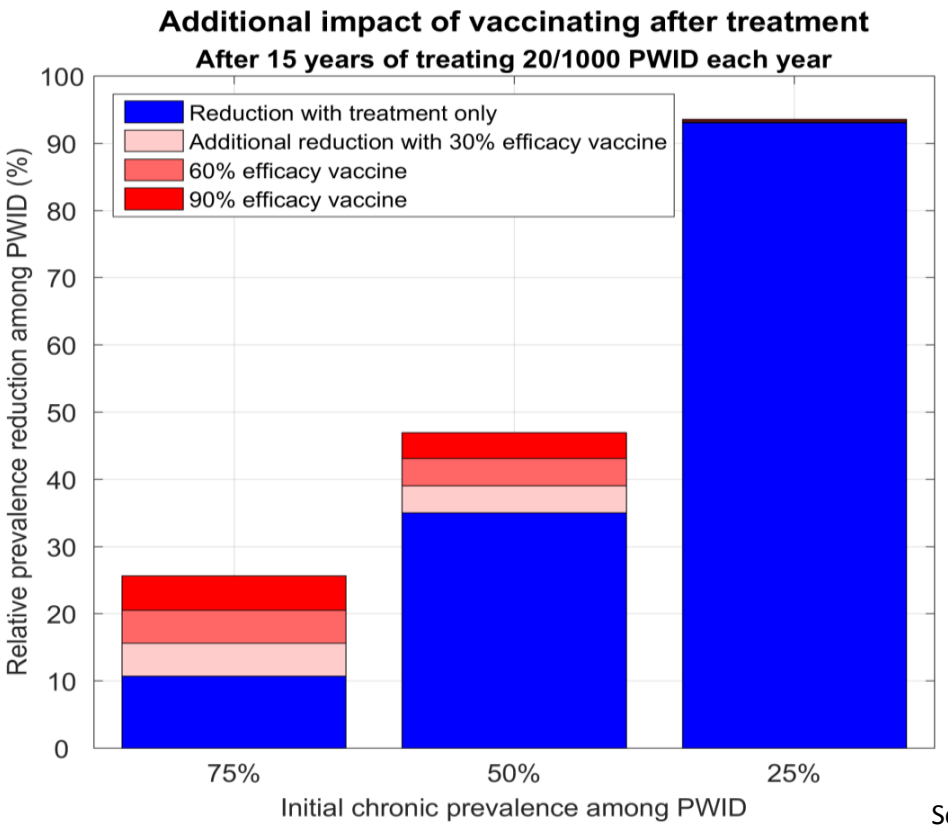
Impact of vaccinating after treatment



- Even "minimal" coverage, vaccinating PWID following treatment, could have impact.
- Particularly important for settings with:
  - High prevalence
  - High cost treatments

Scott et al, *BMC Med*, 2016

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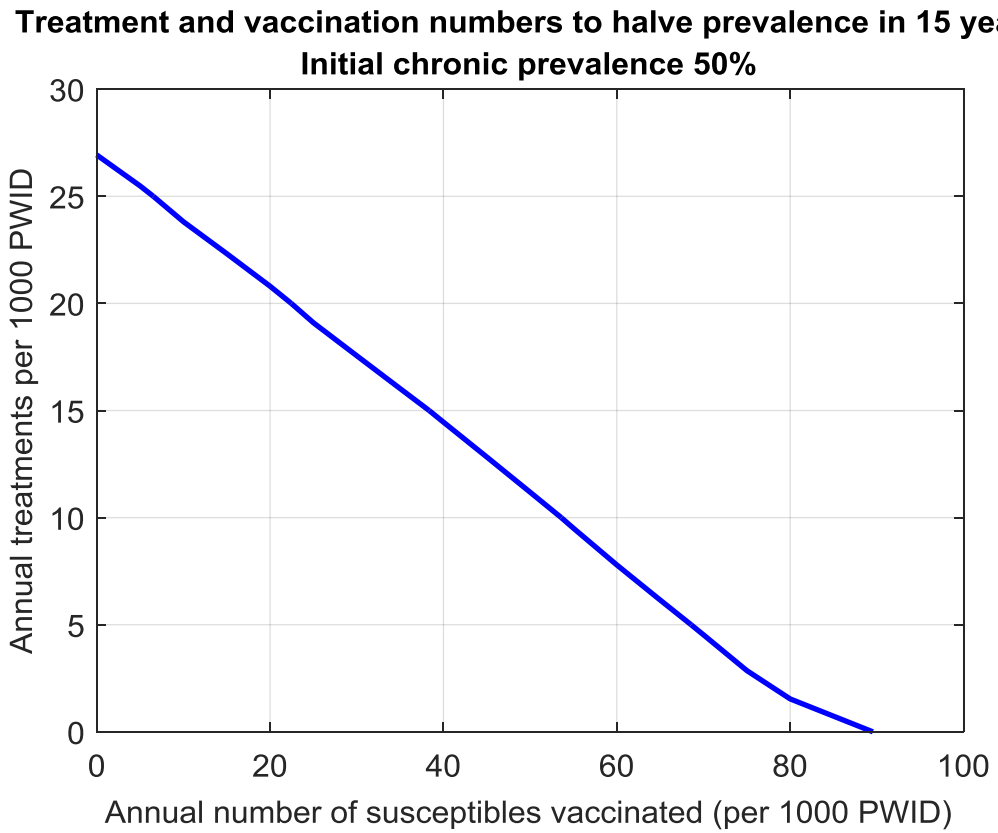
Comparing vaccines and treatment



Scott et al, *BMC Med*, 2016

- Prevalence can be halved with a vaccine alone.
- Increasing vaccine coverage reduces treatment requirements:
  - Increases the feasibility of elimination.

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International settings

Models can be used to ask how we can achieve the elimination targets:

- What are the priority populations? Are there benefits in treating by:
  - Age group (birth cohort screening)
  - Disease stage
  - Geography
  - Risk population, e.g. treatment as prevention
- What is the most cost-effective way to scale-up treatments:
  - Through prioritisation of sub-populations.
  - Across delivery methods to sub-populations.
- How much will it cost to reach our targets? If we don't have that much:
  - What is the best we can do with what we have?
  - Does this change our priorities?

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Conclusions

- Modelling shows that elimination is possible *but will require a multi-pronged approach.*
- Treatment, testing, harm reduction and vaccines programs play synergistic roles:
  - Treatment can provide significant initial impact
  - Testing is required to find undiagnosed cases and prevent transmission
    - Future novel tests such as rapid RNA likely to be required
  - Harm reduction and vaccines are required to prevent infection / reinfection
  - Together the strategy becomes feasible
- Even more critical for international settings with limited resources.

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