The population impacts of ART scale-up in rural KwaZulu-Natal, South Africa: Findings from the Africa Centre's population cohort

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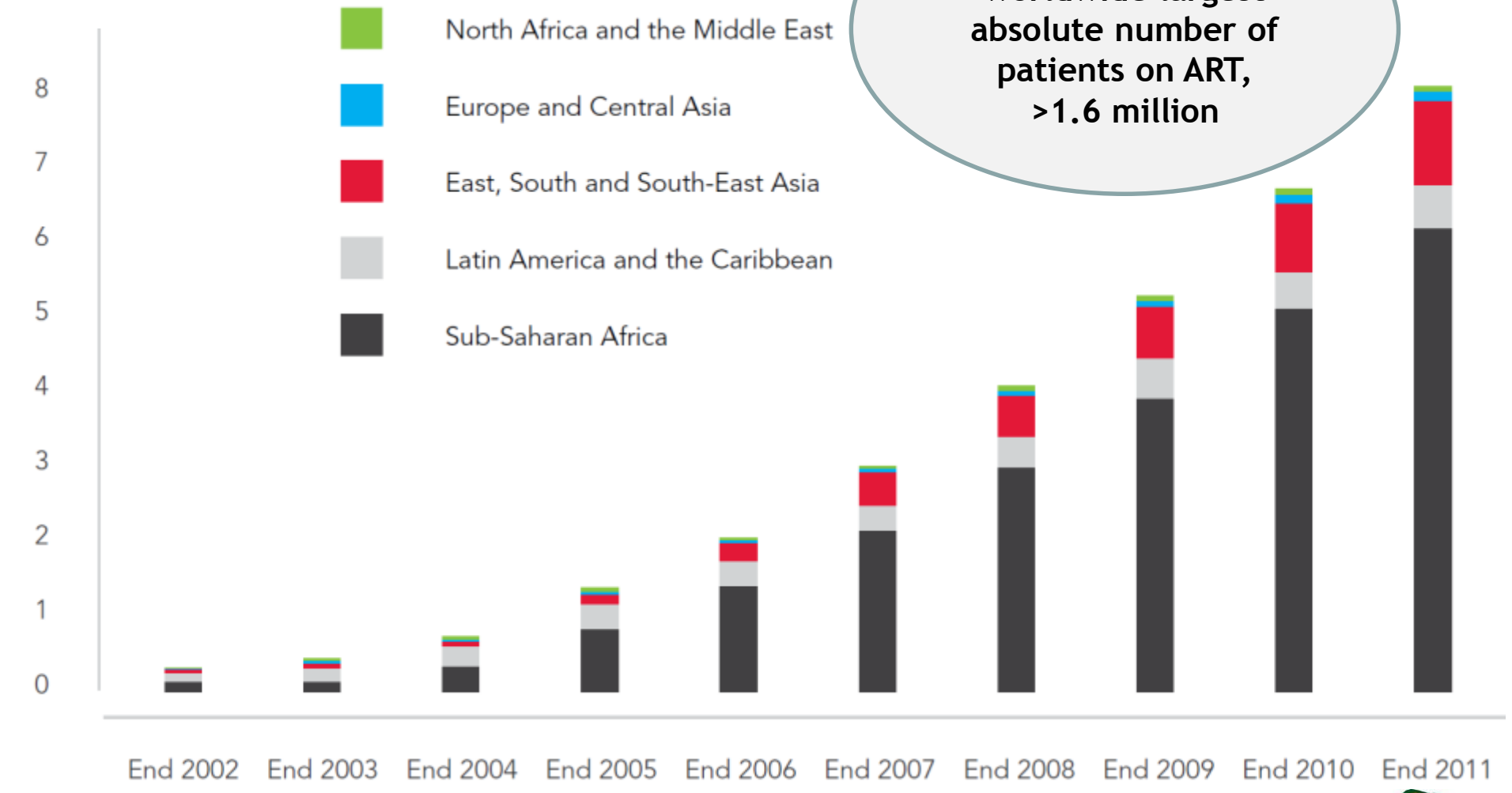
AFRICA CENTRE FOR HEALTH AND POPULATION STUDIES

Outline

- **Background**
- Mortality and HIV prevalence
- HIV incidence
- Population viral load

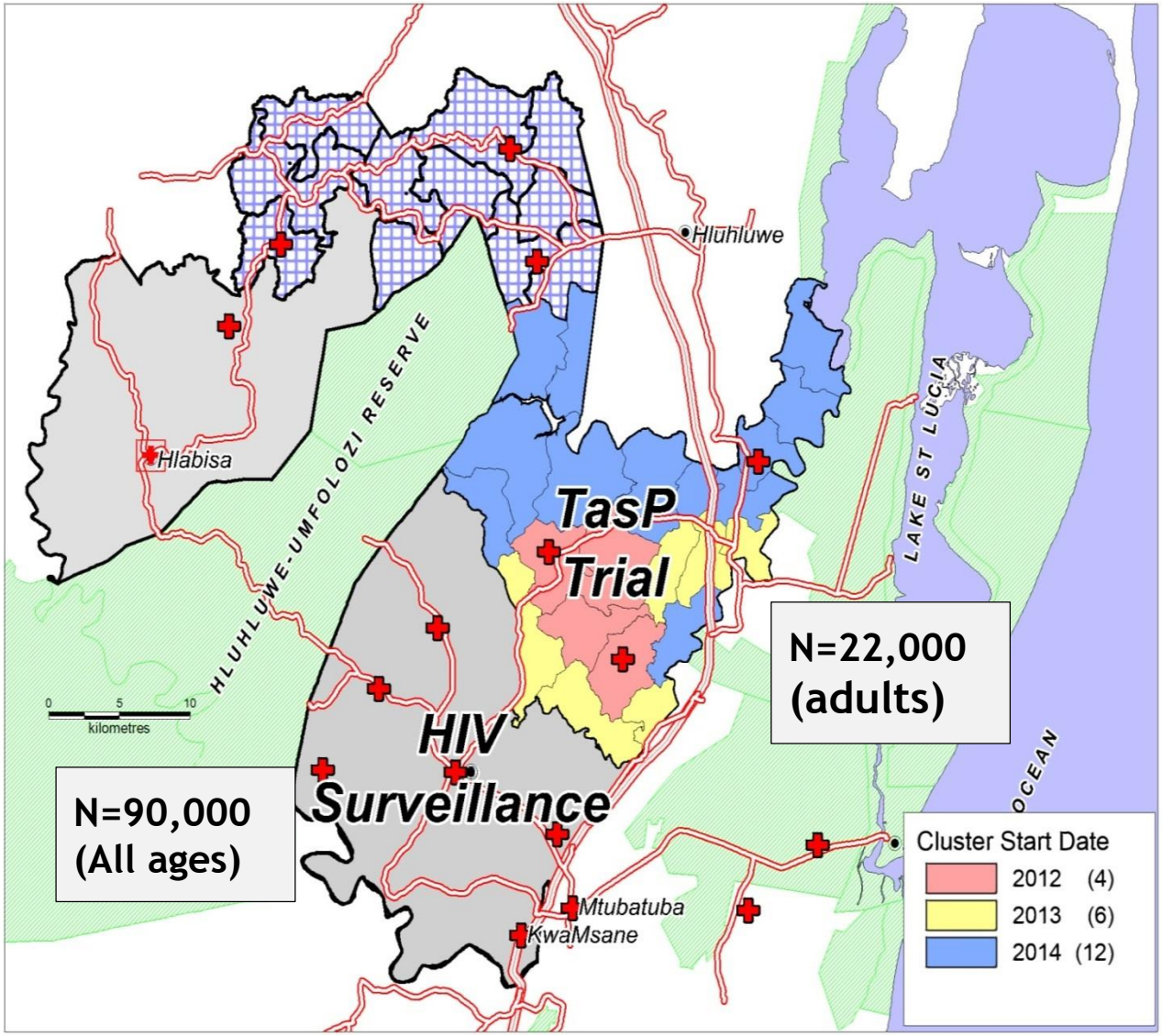
Global ART scale-up

South Africa has the worldwide largest absolute number of patients on ART, >1.6 million



UNAIDS *Report on the Global AIDS Epidemic* 2012; WHO Universal Access Report 2013; Aaron Motsoaledi 2012

Hlabisa sub-district, with the Africa Centre HIV surveillance area and the TasP Trial area



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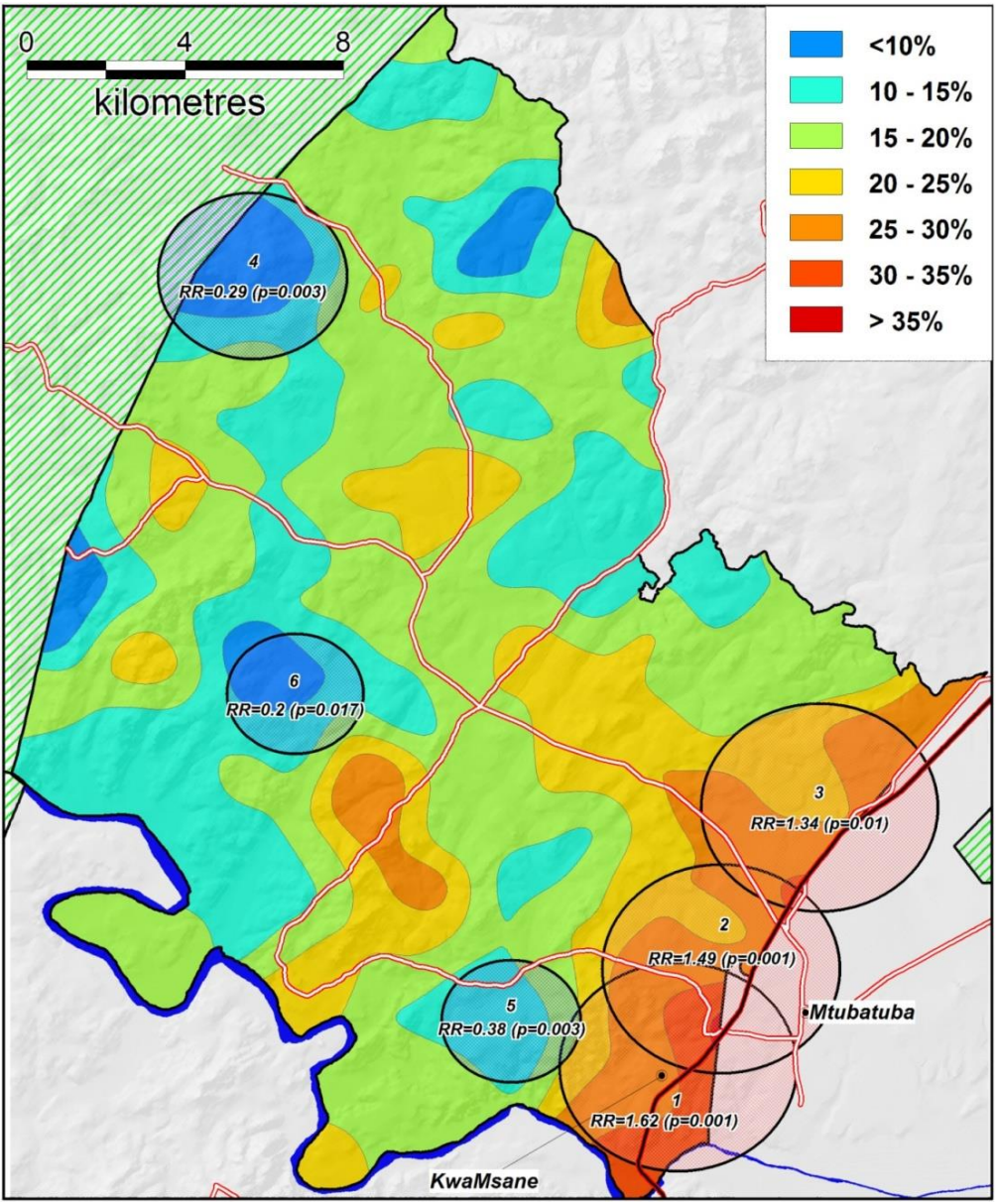
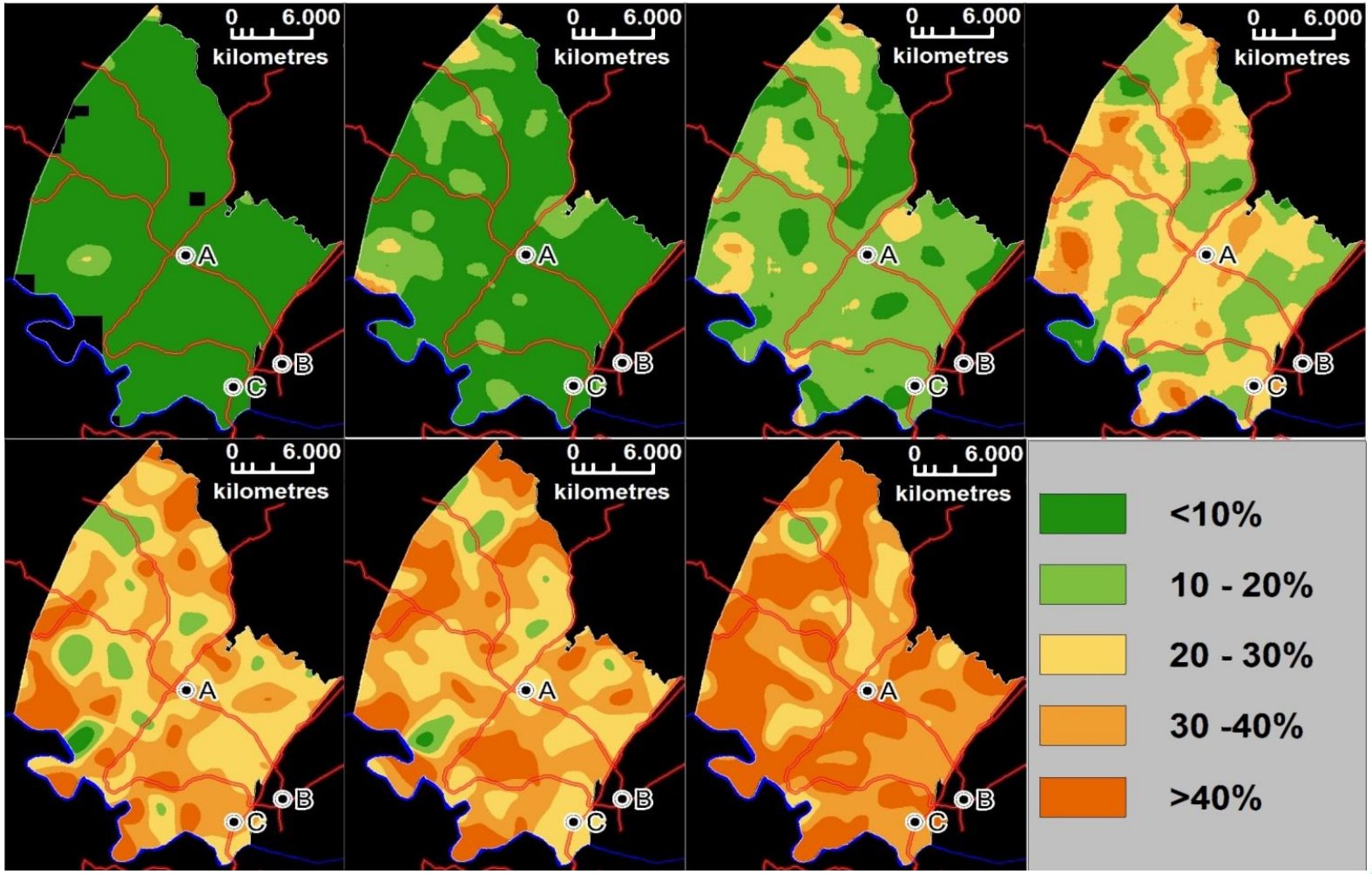
Extreme heterogeneities in HIV outcomes



Tanser et al, IJE 200

ART coverage of all HIV-infected individuals 2004-2011

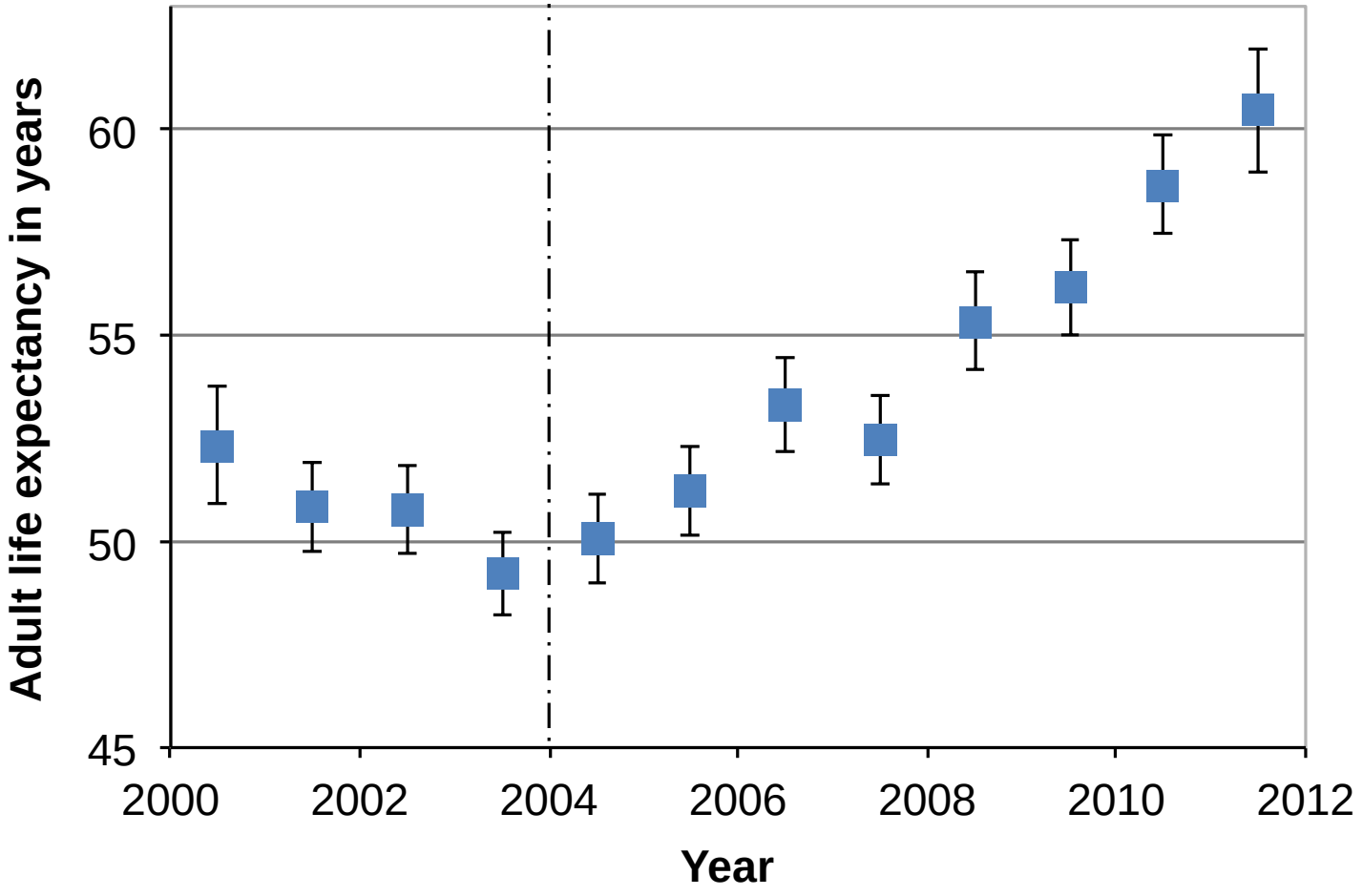


Tanser, Bärnighausen, Grapsa, Zaidi & Newell *Science* 2013

Outline

- Background
- **Mortality and HIV prevalence**
- HIV incidence
- Population viral load

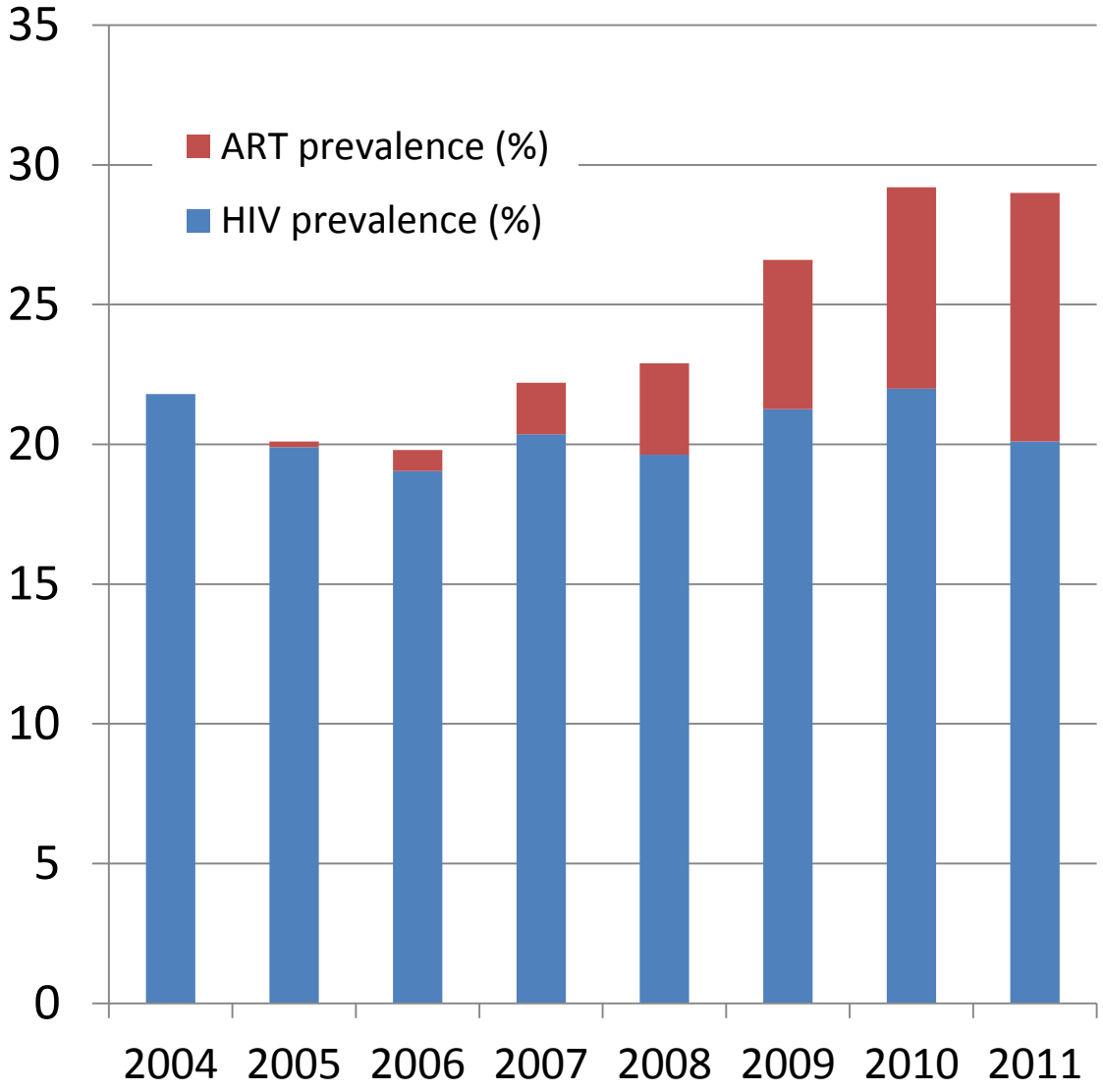
Adult life expectancy over time



13,060 deaths among 101,286 individuals aged 15 years and older, contributing a total of 651,350 person-years of follow-up time

Bor, Herbst, Newell, and Bärnighausen *Science* 2013

HIV and ART prevalence in rural KZN



Population-based HIV surveillance

Sample sizes between 17,618 and 27,303 between 2004 and 2011

Zaidi, Grapsa, Tanser, Newell, Bärnighausen *AIDS* 2013

Outline

- Background
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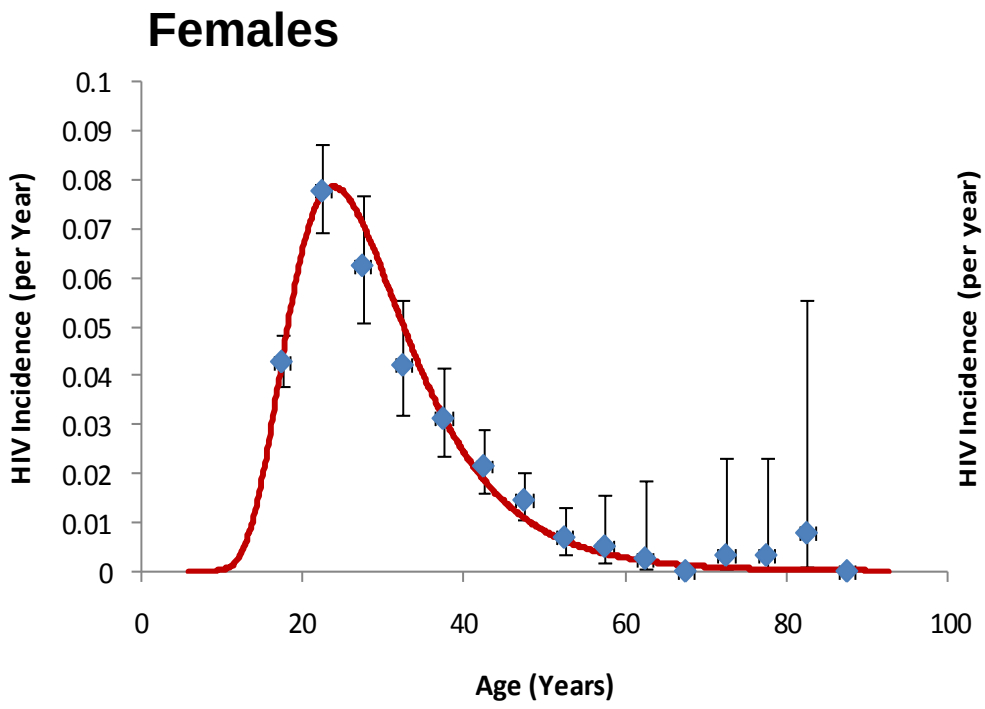
- Population viral load

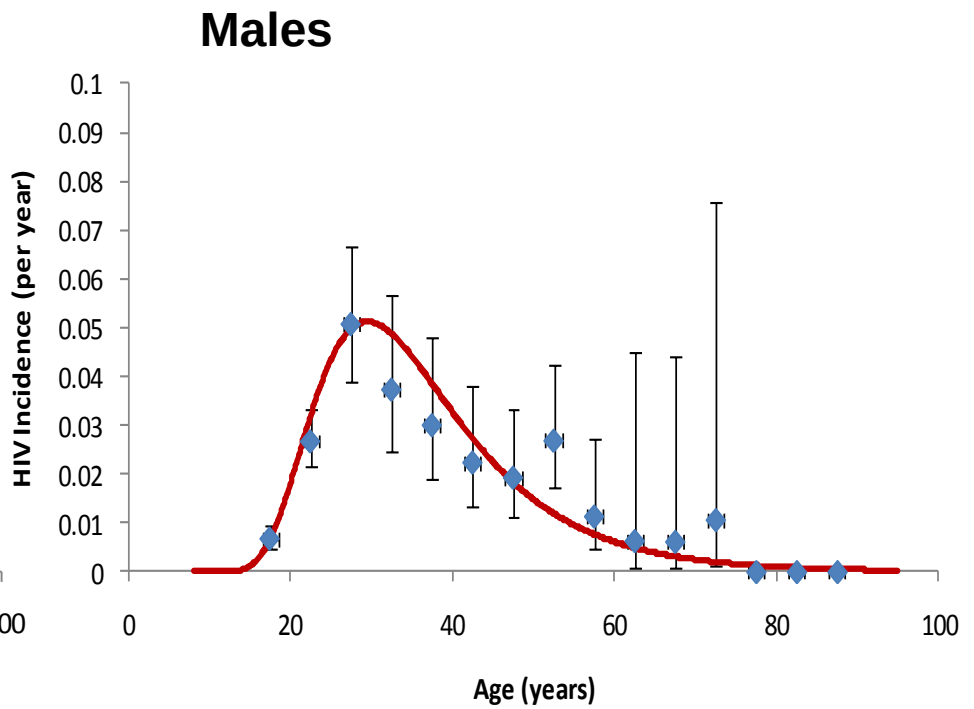
Population-based HIV surveillance

- Since 2003: Population-based HIV cohort
  - Longitudinal, dynamic cohort
  - Entire adult population living in a contiguous geographical area of 438 km^2 eligible for testing
  - Annual rounds
  - 75% of those observed to be HIV-uninfected subsequently retest
  - All individuals geo-located

Tanser, Hosegood, Bärnighausen et al. *International Journal of Epidemiology* 2007

HIV incidence by age and sex 2004-2010

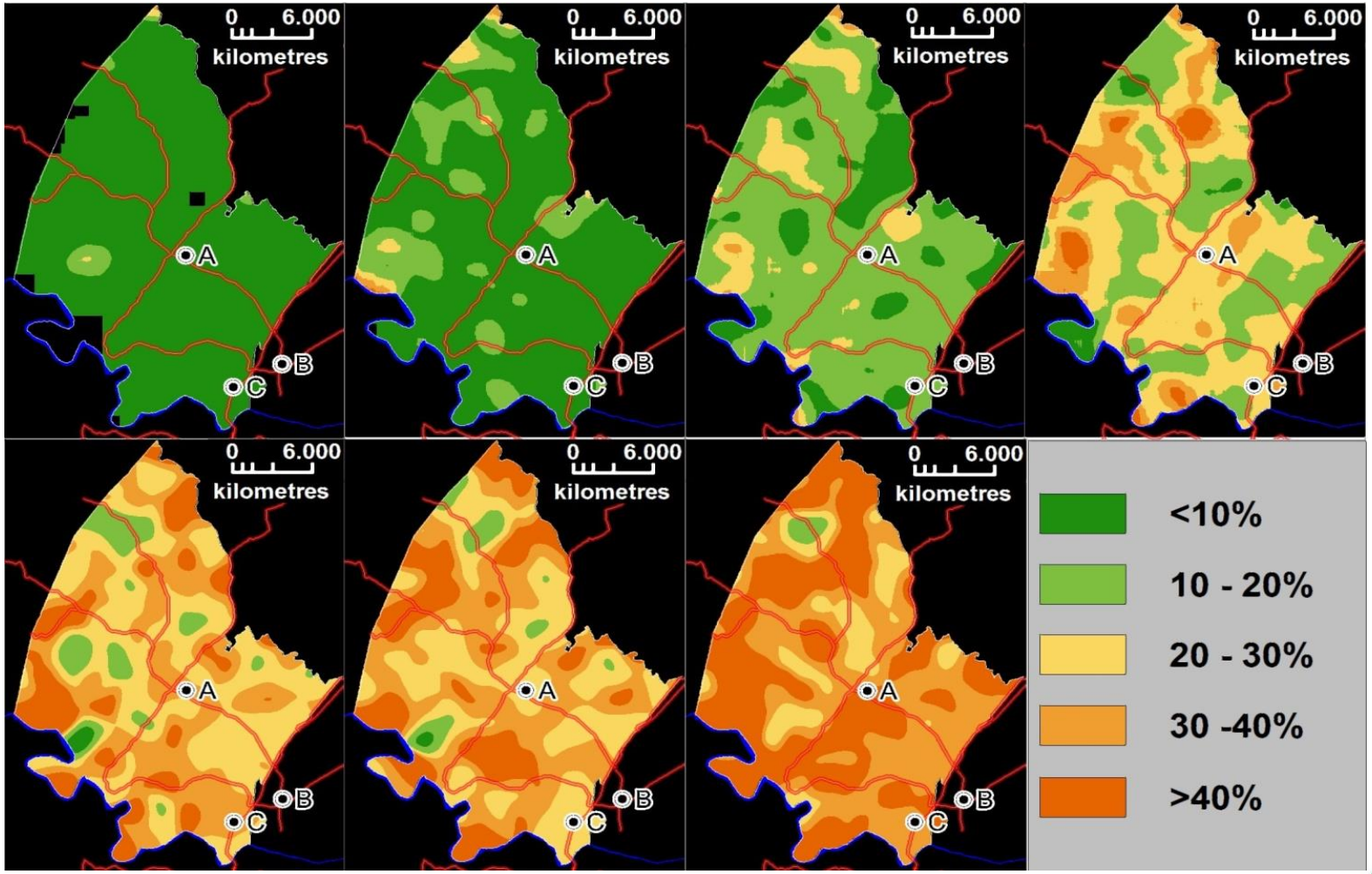




Tanser, Bärnighausen, Newell *CROI* 2011

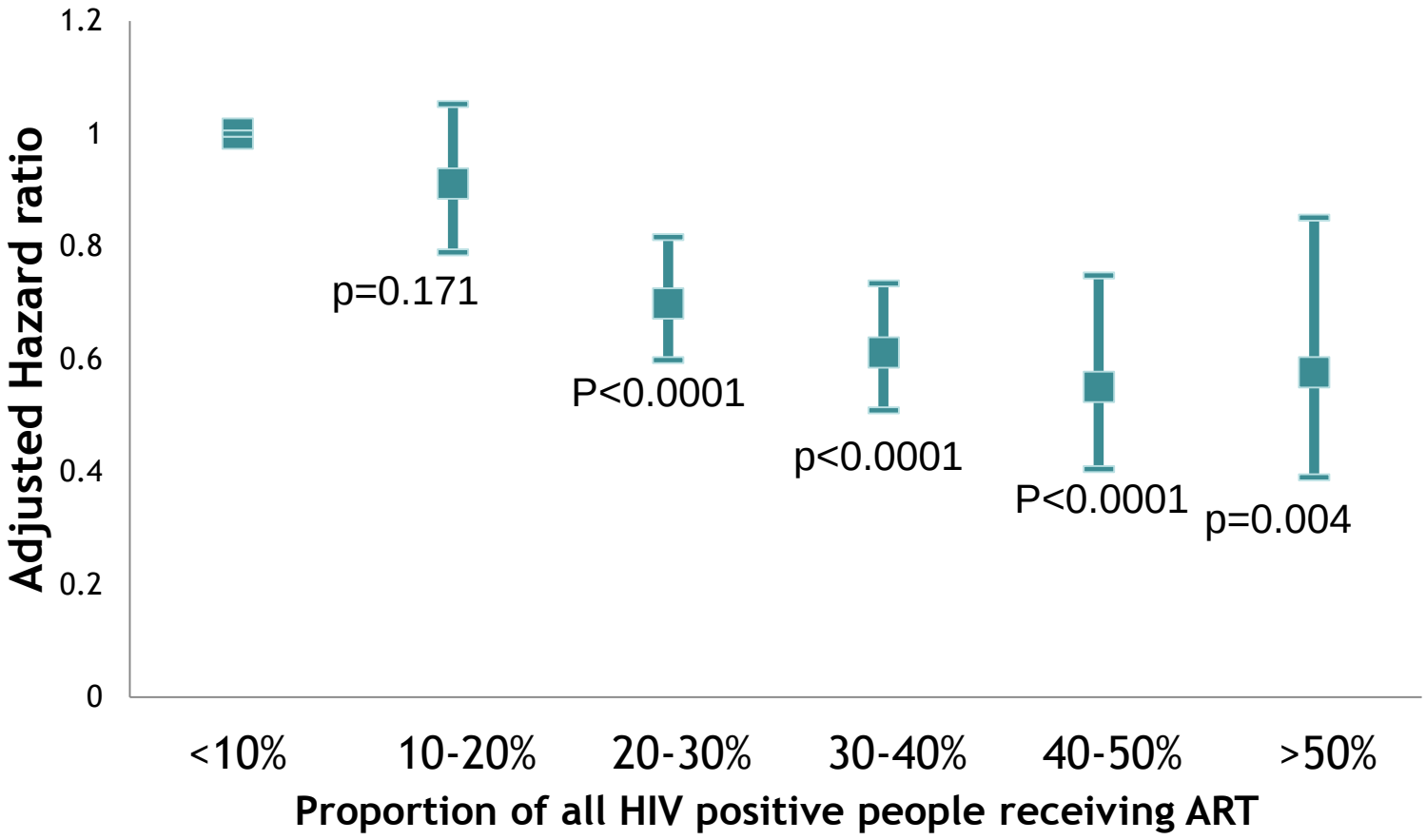
- 80% life-time risk of acquiring HIV

ART coverage of all HIV-infected individuals 2004-2011



Tanser, Bärnighausen, Grapsa, Zaidi & Newell *Science* 2013

Population impact of ART coverage on risk of HIV acquisition (2004-2012)



Survival analysis

> 17,000 HIV-negative individuals followed-up for HIV acquisition over 60,558 person-years

1,573 HIV sero-conversions

Time- (and space-) varying demographic, sexual behavior, economic and geographic controls, including HIV prevalence

Adjusted for age, sex, community-level HIV prevalence, urban vs. rural locale, marital status, >1 partner in last 12 months, and household wealth index

Use of antiretroviral therapy in households and risk of HIV acquisition in rural KwaZulu-Natal, South Africa, 2004–12: a prospective cohort study

Alain Vandormael, Marie-Louise Newell, Till Bärnighausen, Frank Tanser

Summary

Background Studies of HIV-serodiscordant couples in stable sexual relationships have provided convincing evidence that antiretroviral therapy can prevent the transmission of HIV. We aimed to quantify the preventive effect of a public-sector HIV treatment and care programme based in a community with poor knowledge and disclosure of HIV status, frequent migration, late marriage, and multiple partnerships. Specifically, we assessed whether an individual's hazard of HIV acquisition was associated with antiretroviral therapy coverage among household members of the opposite sex.

Methods In this prospective cohort study, we linked patients' records from a public-sector HIV treatment programme in rural KwaZulu-Natal, South Africa, with population-based HIV surveillance data collected between 2004 and 2012. We used information about coresidence to construct estimates of HIV prevalence and antiretroviral therapy coverage for each household. We then regressed the time to HIV seroconversion for 14 505 individuals, who were HIV-uninfected at baseline and individually followed up over time regarding their HIV status, on opposite-sex household antiretroviral therapy coverage, controlling for household HIV prevalence and a range of other potential confounders.

Findings 2037 individual HIV seroconversions were recorded during 54 845 person-years of follow-up. For each increase of ten percentage points in opposite-sex household antiretroviral therapy coverage, the HIV acquisition hazard was reduced by 6% (95% CI 2–9), after controlling for other factors. This effect size translates into large reductions in HIV acquisition hazards when household antiretroviral therapy coverage is substantially increased. For example, an increase of 50 percentage points in household antiretroviral therapy coverage (eg, from 20% to 70%) reduced the hazard of HIV acquisition by 26% (95% CI 9–39).

Lancet Glob Health 2014; 2: e209–215

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Correspondence to: Alain Vandormael, Department of Sociology, University of

Conclusion

- We find continued reductions in risk of acquiring HIV infection with increasing ART coverage in this typical rural sub-Saharan African setting
- However, there is suggestion of a “reduction saturation” effect (at coverage of >40%) under treatment guidelines of <350 $CD4^+$ cells/µl

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- Background
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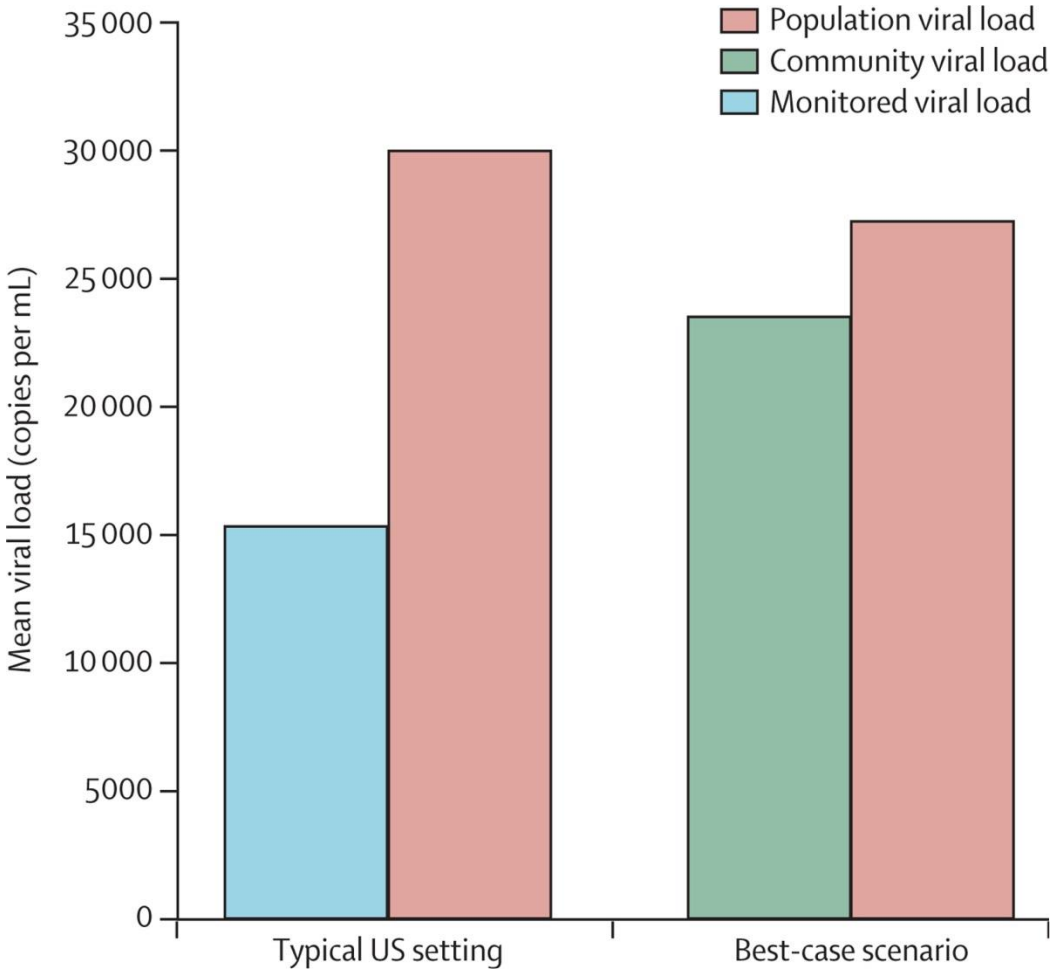
- **Population viral load**

Population/Community viral load

- Proposed as:
  - an aggregate measure of the potential for ongoing HIV transmission within a community
  - as a surveillance measure for monitoring uptake and effectiveness of antiretroviral therapy.

CVL as a measure for assessment of HIV treatment as prevention

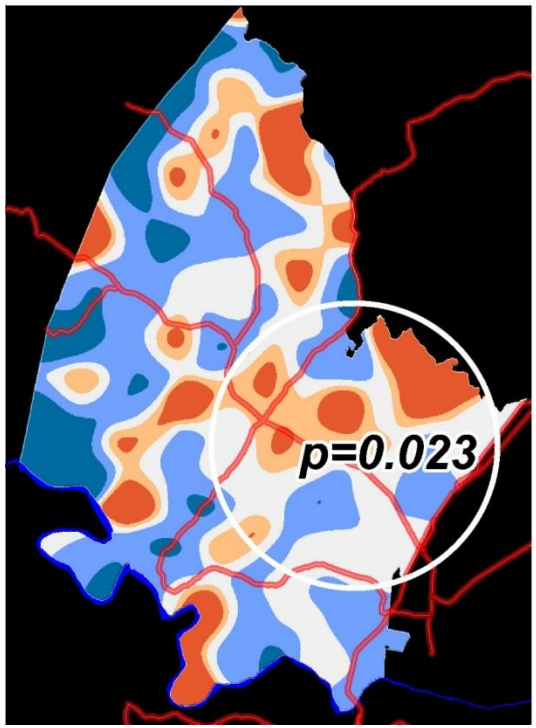


Miller, Powers, Smith et al *Lancet Infectious Diseases* 2013

Objectives

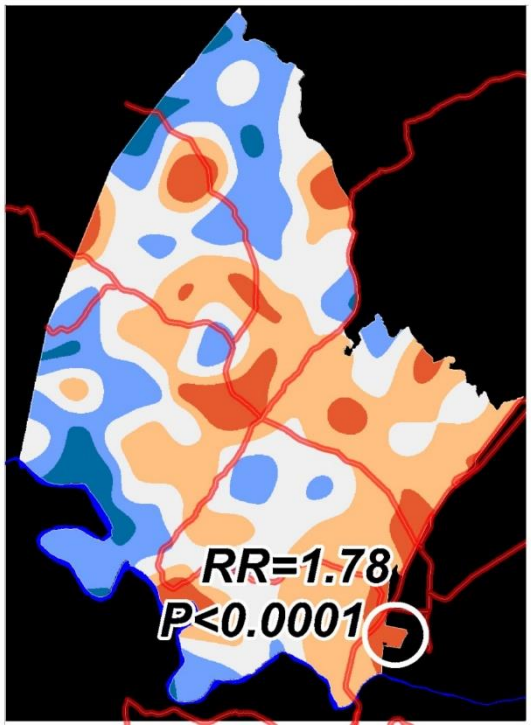
1. Asses whether ***viral loads*** in this population are randomly distributed in space or whether high or low viral loads tend to cluster in certain areas
2. Assess the degree to which different ***population viral load*** summary measures highlight known areas of high incidence
3. (Establish the degree to which different ***population viral load*** summary measures predict future risk of new HIV infection in uninfected individuals)

Population Viral Load



Copies /ml

<4000
4,000 - 8,000
8,000 - 12,000
12,000 - 16,000
>16,000



Population prev of detectable virus (PPDV)

<5%
5 - 10%
10 - 15%
15 - 20%
>20%

Tanser et al. IAS 2014

Conclusion

- To measure transmission potential of a community, any viral load summary index must take into account the size of the uninfected population
- Population prevalence of detectable virus (**PPDV**) successfully identified known areas of continued high HIV incidence
- We propose the **PPDV** as a simple community-level index of transmission potential

Acknowledgements

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Ethical approval

IRB ethical approval # BF233/09 - Population-based Biomeasures of Adult Household Members in the Africa Centre Demographic Surveillance.
IRB ethical approval # E134/06 - Proposal to link ART programme data with the Africa Centre Demographic Information System.

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