Published in final edited form as:
Lancet HIV. 2019 August ; 6(8): e488–e489. doi:10.1016/S2352-3018(19)30191-2.

Use of big data to identify risk of adverse HIV outcomes

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Goals were set in 2014–15 by the UN Programme on HIV/AIDS and WHO to accelerate global HIV prevention and to reduce morbidity and mortality by 2020. The 90-90-90 goals seek to motivate improving the continuum of care with at least 90% of all people with HIV knowing their HIV status, 90% of those people taking antiretroviral therapy (ART), and 90% of people on ART achieving virological suppression. Early treatment reduces both adverse outcomes and infectiousness to others; therefore, there are compelling clinical and public health reasons to maximize 90-90-90 coverage at a community and population scale. The USA, home of the world's largest economy, lags in 90-90-90 achievement compared with other high-income nations and even middle-income countries, such as Botswana.

The HIV Research Network (HIVRN) supports health policy research in the context of shifts in the composition of vulnerable populations, changes in therapy, and differential successes in prevention and care coverage. HIVRN studies the quality, safety, and costs of health care, and the accessibility and use of services provided to people with HIV. Since 2000, diverse hospitals and community-based HIV providers have contributed data to the US observational cohort of the HIVRN. In *The Lancet HIV*, Linwei Wang and colleagues[1] use comprehensive clinical and ART prescription data from 32 242 people aged 15 years or older from 17 institutional providers to estimate the proportion of people living with HIV who were retained in ART-based care, along with CD4+ cell count progression and mortality. The investigators compared subgroups of people with HIV in three large geographical regions using a continuous multistate Markov model to describe coverage and outcomes.

HIVRN investigators found that CD4 counts were more likely to improve with time among women (vs men), men who have sex with men (vs other groups), and people with HIV who had previously been treatment naive (vs those who were ART experienced).[1] By contrast, higher ART dropout rates and less immune reconstitution as measured by CD4 count changes were seen among black people (vs other races and ethnicities) and people who inject drugs (PWID). Controlling for CD4 count and other differences, people with HIV in the south and west USA were more likely to drop out of HIV-based care than people from the northeast.

These findings highlight the need for simulation models that use CD4-cell transition probabilities to consider race, ethnicity, HIV-risk exposure categories, previous treatment status, and venue to assess the effectiveness of 90-90-90 interventions in the USA.

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I declare no competing interests.

Conclusions were robust to sensitivity analyses that calculated high and low estimates of how people with missing data, including those lost to follow-up, might have behaved if the data or individuals had been available.[1]

HIV health services and outcomes research can be immensely complex, particularly when comparing studies. Loss to follow-up in the HIVRN study was defined as having no records of medical care at HIVRN sites for at least 18 months before the study end date. Given that the WHO definition for lost to follow-up once on ART is “90 days after the last scheduled appointment”,[2] this HIVRN study will give a minimal estimate of loss.[3-5] It is plausible that efforts to locate people who are seemingly out of care[6] might have occurred at differing intensities in diverse practice settings, perhaps missing so-called silent transfers and others.

Many studies have highlighted increased risk for adverse outcomes among black people and PWID in the USA. It is not surprising, either, that people who are ART experienced might have antiviral resistance and do worse than those who are ART naive. Suboptimal outcomes for people with HIV in the southern USA are long standing,[7-9] and this analysis suggests that poor outcomes might have been exacerbated by the failure of some states to expand health insurance for people who are poor. The US Affordable Care Act (ACA or Obamacare) is the 2010 comprehensive health-care reform law designed to provide health insurance subsidies for households with incomes of 100–400% of the federal poverty amount. Furthermore, the ACA expanded the Medicaid programme in participating states to include adults with incomes of less than 138% of the federal poverty amount, and supported innovations to improve efficiency and effectiveness of medical care delivery.[10] Failure of most southern states to participate in the ACA might have increased adverse outcomes for vulnerable people with HIV.[11] Higher risks for people living in the west were unexpected; no data on people with HIV in the midwest USA were included. Scarcity of insurance coverage reduces the efficiency and effectiveness of US health care.

The use of electronic medical records has transformed the use of big data to help us thoroughly understand HIV-programme implementation challenges. Solutions must address the complex matrix of social and structural determinants of HIV disease and of access to prevention and care.[12] Studies such as that of the HIVRN deploy health informatics, data sciences, and mathematical modelling to provide such insight.

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