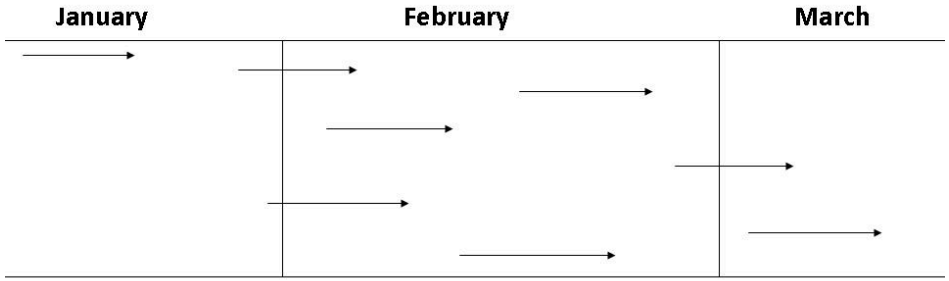
Estimating Incidence of Infectious Disease

Cases of cold infections in class 4J : Class size = 20



What is the period prevalence during February?	6/20=30.0%
What is the point prevalence on the 28th February?	1/20=5.0%
What is the incidence in February?	4/18=22.2%

Incidence

Definition: New cases developed among individuals known to have previously been disease free

Incidence proportion:

$$\frac{\text{number of new cases of disease}}{\text{population without disease at baseline}} \times 100\%$$

Incidence rate (incidence density):

$$\frac{\text{number of new cases of disease}}{\text{person-time at risk}}$$

Incidence rate

$$\text{Incidence Rate} = \frac{\text{Number of new cases of disease in a given time period}}{\text{Total person-time at risk during the follow-up period}}$$

Year	2000	2001	2002	2003	2004	Years at risk
Persons						
1	----------	----------	----------	----------	----------	5.0
2	----------	----------	----------	----------	-----x	4.5
3	----------	----------	----------	-----x		3.5
4		----------	-----x			1.5
5	----------	----------	----------	-----L		3.5
Total	4	5	4.5	3	1.5	18

Cumulative incidence

- Cumulative incidence= # of cases/# people at risk
  - All persons are weighted equally

$$\text{Incidence Risk} = \frac{\text{Number of new cases of disease in a specified period of time}}{\text{Number of disease-free persons at the beginning of that time period}}$$

Issues in defining pop at risk

- Precise definition of the denominator is essential; but often difficult
- Population at risk (denominator) should include all persons at risk of developing the outcome under investigation.
- Note that when individuals not at risk of the disease are included in the denominator the measure of disease frequency will be underestimated.

Incidence data is helpful…

- For understanding transmission patterns
- Guide decisions about when/how/who prevention programs should target
- Evaluate intervention programs
- Assess and project burden of disease among different populations

Potential Types of Bias in Incidence Studies

- **Selection bias**: participant selection that distorts the exposure-outcome relationship from that present in the target population
  - Higher test seeking behaviors during acute symptomatic phase of infection →higher cross-sectional incidence estimates
  - Cohort effect: Modified risk behaviors following initial testing and counseling → lower observed incidence rates
- **Diagnostic bias**: if the diagnosis depends on the knowledge of the exposure status
- **Loss to follow-up bias**: Differences in loss to follow-up between exposure groups can lead to bias as the people who are lost to follow-up may be more (or less) likely to have developed the outcome of interest

Article: Points of focus

- Study objective/rational
- Key methods
  - Outcome definition
  - Population sample
  - Study design
  - Incidence estimation method
- Interpret key findings from tables/figures
- Main (2-3) key take away points from paper
- Open ended question connected to topic (incidence)

Busch MP, et al. **Beyond detuning: 10 years of progress and new challenges in the development and application of assays for HIV incidence estimation**. AIDS 2010

- **Rationale:** Laboratory methods that distinguish recent from established HIV infection can improve incidence estimates generated with traditional methods (cohort, mathematical modeling, surveillance).
- **Study objective:** Literature review to summarize HIV assays/algorithms for accurate incidence estimates

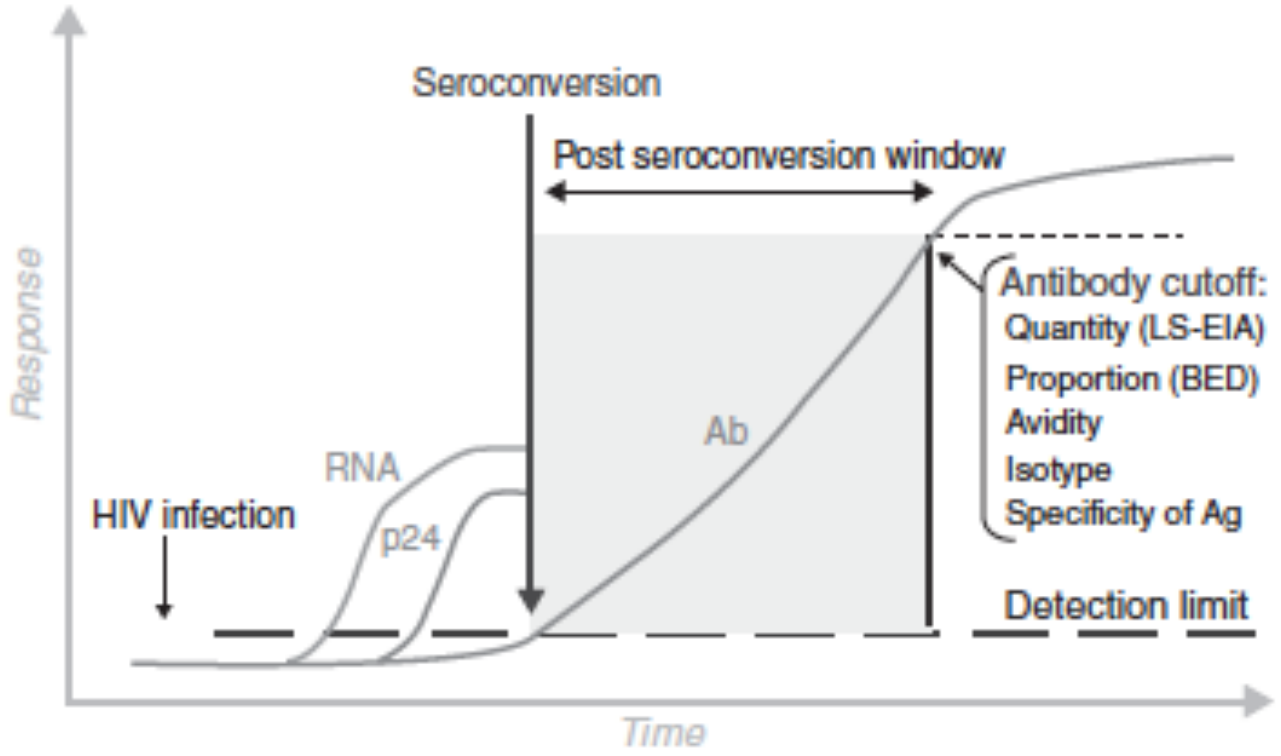


Fig. 1. Principle of assays that discriminate recent from long-standing HIV infections, based on maturation of HIV-specific antibody responses, for use in cross-sectional incidence estimation. LS-EIA, less-sensitive-enzyme immunoassay.

Key Methods

- Look-back investigations: tracing and follow-up testing of transfusion recipients who received blood from donors subsequently seroconverted.
  - Residual risk=I * WP
  - Able to generate incidence point estimates for serial stages of acute infection
  - Vital information for enhanced blood safety

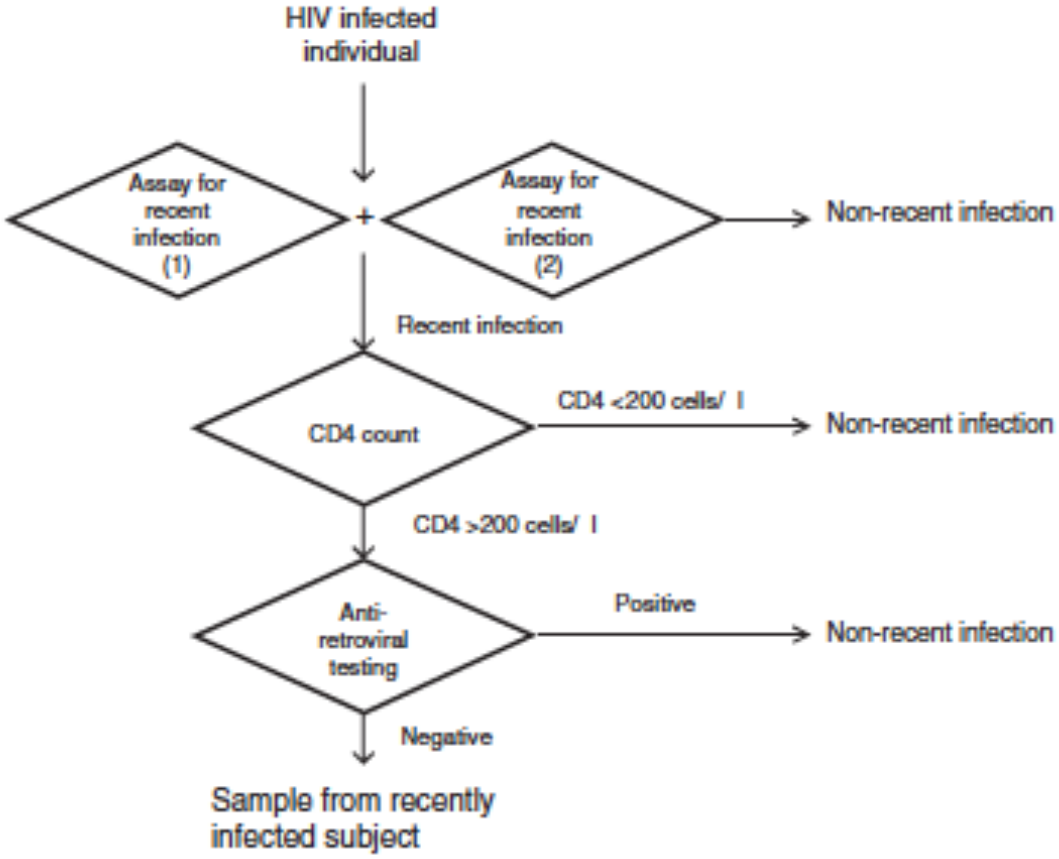


Fig. 2. Representative testing algorithm incorporating two incidence assays and available clinical data (CD4 count and antiretroviral treatment history) for determination of recent HIV infection status of specimens evaluated for HIV incidence estimation. Assay 1 and assay 2 represent two assays for recent infection, preferably based on different principles for discriminated recent from non-recent infections.

RITA (recent infection testing algorithm)

- RITA distinguishes recent from established infections
- Primarily used for monitoring at a population level
- RITA is not accurate enough to provide reliable data for individuals