# Mean gene-wide dN/dS estimates

- Are not the way to go, **<u>except</u>** when you have very small (2-3 sequence) datasets

- **For example:**

  - The humoral arm of the immune system mounts a potent defense against viral infections

  - Existing successful vaccines are based on raising a neutralizing antibody (nAb) response to the pathogen

  - No simple host genetic basis (epitopes) of the specificity of neutralizing antibody responses is known

  - Need to measure these responses

An example of mean dN/dS utility

The extent of immune selection pressure drives intra-host evolution in HIV-1
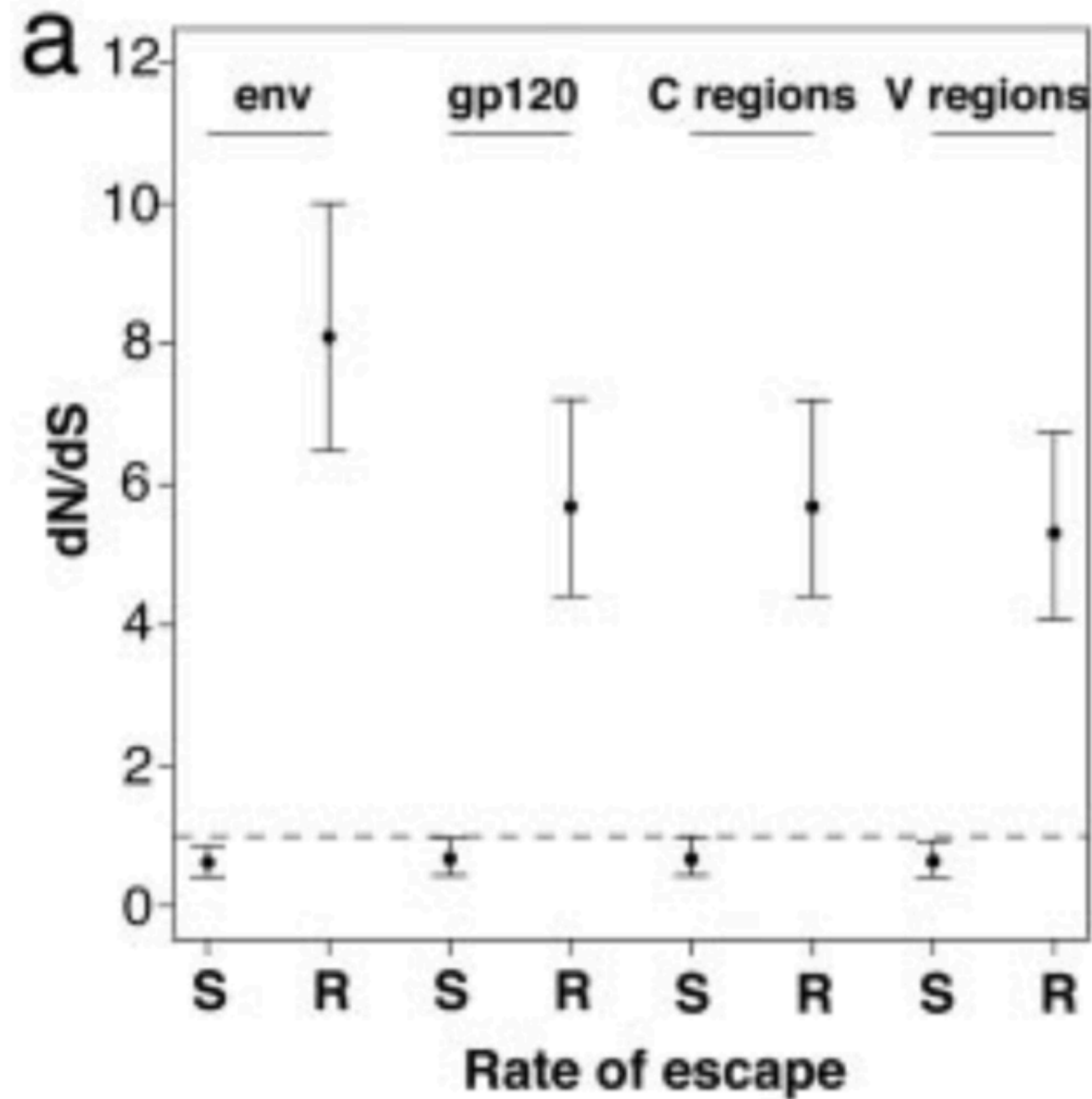
Slow (S) and Rapid (R)
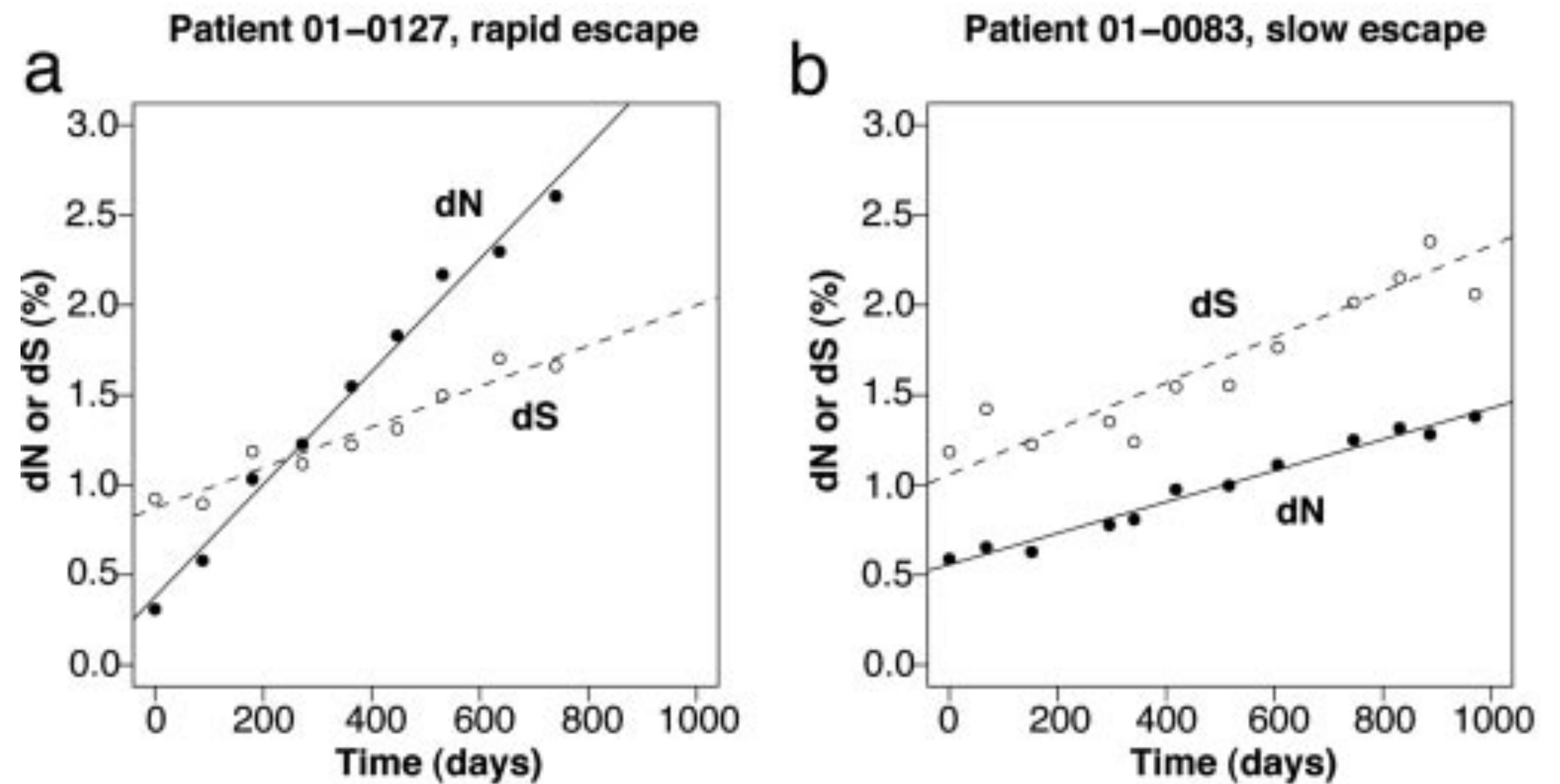
Neutralizing antibody responses drive the evolution of human immunodeficiency virus type 1 envelope during recent HIV infection

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