

PhD program in Statistics

**DSS Statistics Seminar**

**October 14, 2022, 12:00**

<https://uniroma1.zoom.us/j/86881977368?pwd=SWRFcVFjMDZTa0lXZk05TE1zNm5adz09>  
Passcode: 432940

The three-sigma rule to  
define antibody positivity:  
is it a beauty or a beast?

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Many epidemiological studies aim to estimate the proportion of individuals currently or previously infected by a given microorganism. Given that an infection inevitably leads to an immune response, this estimation exercise often requires identifying individuals who reach a minimal level of microbe-specific antibodies in their serum. This threshold invariantly is defined by the three-sigma rule: mean plus three times the standard deviation from the hypothetical antibody-negative population. Notwithstanding not being linked to a specific parametric distribution, it has the most intuitive interpretation in the context of a normal distribution. I will then discuss the problems of estimation bias and apparent control of specificity arising from applying this rule to non-normal distributions for the seronegative population. I will use public data on antibody testing against the SARS-CoV2 to illustrate these problems. We should finally ask ourselves whether the three-sigma rule is a beautiful statistical concept or, instead, a little beast hidden in antibody data analysis.



**SAPIENZA**  
UNIVERSITÀ DI ROMA

**Dipartimento di Sanità Pubblica e Malattie Infettive  
SCUOLA DI SPECIALIZZAZIONE IN  
STATISTICA SANITARIA E BIOMETRIA**