



Institut Pierre Louis d'Épidémiologie et de Santé Publique
Pierre Louis Institute of Epidemiology and Public Health



Unité mixte de recherche en santé n° 1136 (UMR-S 1136)
Directrice : Dominique Costagliola

MSc internship at EPIcx lab, 2019-2020

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Real case study of epidemics on multilayer networks

Our understanding of infectious disease prevention and control is rooted in the theory of host population transmission dynamics. The pattern of host-to-host contacts along which transmission can occur drives the epidemiology of infectious diseases, determining how quickly they spread and who gets infected. Network epidemiology has made great progress in this area in the last decades, moving from homogeneous approximations to networked patterns that allow for the integration of the variation of contacts over time [1-4]. An intense activity currently focuses on the role of specific structural and temporal properties of the time-evolving and possibly multilayer contact network that are critical for disease transmission (see works by the lab [5-8] and refs. therein).

The MSc internship will focus on a real case study application of disease transmission on a multilayer temporal network of livestock movements. The project will focus on different disease transmission routes, representing the movement data (millions of animals moved between hundreds of thousands locations in space, for several years) in a multilayer fashion. Its findings will (i) provide knowledge on the role of different transmission routes, under different epidemic contexts, and (ii) help devising strategies improving prevention and control.

Requirements: good programming skills, experience in numerical simulations, strong background in statistical physics and applied maths, enthusiasm and motivation.

Plus: experience with data, with complex systems/networks analysis and modeling, with modeling of diffusion/spreading processes.

Funding: French internship allowance ~ 550€/month

To apply: send a cover letter describing your research interests and qualification for the internship and a CV detailing your exams with marks to vittoria.colizza@inserm.fr

The internship offers the possibility to continue with a PhD program along the outlined research direction.

[1] Giesecke J (2002) *Modern infectious disease epidemiology*. 2nd ed. London: Arnold.

[2] Bansal S, Grenfell BT, Meyers LA (2007) *Journal of The Royal Society Interface* 4(16):879–891.

[3] Masuda N, Holme P (2013) *F1000Prime Reports* 5 (2013).

[4] Petter Holme. *The European Physical Journal B*, 88(9):234, Sep 2015

[5] Valdano E, Poletto C, Giovannini A, Palma D, Savini L, Colizza V (2015) *PLoS Comput Biol* 11(3): e1004152

[6] A Darbon, E Valdano, C Poletto, A Giovannini, L Savini, L Candeloro, V Colizza *Preventive Veterinary Medicine* 158, 25 (2018)

[7] C Panigutti, M Tizzoni, P Bajardi, Z Smoreda, V Colizza *Royal Society Open Science* 4, 160950 (2017)

[8] E Valdano, M Re Fiorentin, C Poletto, and V Colizza *Physical Review Letters* 120, 068302 (2018)