Peer Community In Infections

Zoonotic emergence and the overlooked case of cities

Etienne Waleckx *based on peer reviews by* ***Nicole L. Gottdenker***, ***Eric Dumonteil*** *and 1 anonymous reviewer*

Dobigny, G. & Morand, S. (2022) Zoonotic emergence at the animal-environment-human interface: the forgotten urban socio-ecosystems. Zenodo, ver. 3, peer-reviewed and recommended by Peer Community in Infections.
https://doi.org/10.5281/zenodo.6444776

Submitted: 11 April 2022, Recommended: 08 December 2022

Cite this recommendation as:
Waleckx, E. (2022) Zoonotic emergence and the overlooked case of cities. *Peer Community in Infections*, 100005.
https://doi.org/10.24072/pci.infections.100005

Published: 08 December 2022

Zoonotic pathogens, those transmitted from animals to humans, constitute a major public health risk with high associated global economic costs. Diseases associated with these pathogens represent more than 60% of emerging infectious diseases and predominantly originate in wildlife (1). Over the last decades, the emergence and re-emergence of zoonotic pathogens have led to an increasing number of epidemics, as illustrated by the current Covid-19 pandemic. There is ample evidence that human impact on native ecosystems such as deforestation, agricultural development, and urbanization, is linked to spillover of pathogens from animals to humans (2). However, research and calls to action have mainly focused on the importance of surveillance and prevention of zoonotic emergences along landscape interfaces, with special emphasis on tropical forests and agroecosystems, and studies and reviews pointing out the zoonotic risk associated with cities are scarce. Additionally, cities are sometimes wrongly seen as one homogeneous ecosystem, almost exclusively human, with a Northern hemisphere-biased perception of what a city is, which fails to take into account the ecological and socio-economic diversities that can constitute an urban area.

Here, Dobigny and Morand (3) aim to draw attention to the importance of urban ecosystems in zoonotic risk and advocate that further attention should be paid to urban, peri-urban and suburban areas. In this well-organized and well-documented review, the authors show, using updated literature, that cities are places where massive contacts occur between wildlife, domestic animals, and human inhabitants (thus constituting spillover opportunities), and that it is even likely that human and wildlife contact in urban centers is more prevalent than in wild areas, perhaps contrary to intuition. Indeed, cities currently constitute the most important environment of human life and are places for millions of close interactions between humans and animals, including pets and domestic animals, wild animals through the intrusion of wild urban-adapted species (e.g.,

some bat, rodent, or bird species among others), manipulation and consumption of wildlife meat, and the existence of wildlife meat markets, which all constitute a major risk for zoonotic spillover. In cities, lab escapees of zoonotic pathogens also exist, and trends of adaptation to urban ecological conditions of many vectors of primary health importance is also a concern. The authors further argue that cities are predominant places for both epidemic amplification of human-human transmitted pathogens, because they are places with high human densities and population growth, and for dissemination of reservoirs, vectors and pathogens, as they are transport hubs. Dobigny & Morand further predict, likely correctly, that cities may be important places for pathogen evolution. Finally, they propose actions and recommendations to limit the risk of zoonotic spillover events from urban ecosystems and future directions for research aiming at assessing this risk.

The reviewers found the manuscript well-organized and presented, timely, and bringing novel contributions to the field of zoonotic emergence. I strongly recommend this article, which should benefit a large audience, particularly in the context of the current Covid-19 pandemics and the ongoing One Health initiatives aiming at preventing future zoonotic disease emergence (4).

References:

(1) Jones KE, Patel NG, Levy MA, Storeygard A, Balk D, Gittleman JL, Daszak P (2008) Global trends in emerging infectious diseases. Nature, 451, 990–993. https://doi.org/10.1038/nature06536

(2) White RJ, Razgour O (2020) Emerging zoonotic diseases originating in mammals: a systematic review of effects of anthropogenic land-use change. Mammal Review, 50, 336–352. https://doi.org/10.1111/mam.12201

(3) Dobigny G, Morand S (2022) Zoonotic emergence at the animal-environment-human interface: the forgotten urban socio-ecosystems. Zenodo, 6444776, ver. 3 peer-reviewed and recommended by Peer Community in Infections. https://doi.org/10.5281/zenodo.6444776

(4) Morand S, Lajaunie C (2021) Biodiversity and COVID-19: A report and a long road ahead to avoid another pandemic. One Earth, 4, 920–923. https://doi.org/10.1016/j.oneear.2021.06.007

Reviews

Evaluation round #1

DOI or URL of the preprint: **https://doi.org/10.5281/zenodo.6444776**
Version of the preprint: 1

Authors' reply, 12 October 2022

Please see our rebuttal letter as well as the uploaded v2 pdf file with track changes.
Download author's reply
Download tracked changes file

Decision by **Etienne Waleckx**, posted 08 July 2022

Moderate revision

Dear authors,

Thank you for submitting your manuscript entitled "Zoonotic emergence at the animal-environment-human interface: the forgotten urban socio-ecosystems" to PCI infections. It has now been evaluated by three

independent reviewers which found the manuscript relevant, but suggested some improvements. Therefore, I invite you to submit a revised version of the manuscript that addresses the points raised during the review process. If you agree, please revise your manuscript accordingly and explain the changes carefully (or your reasons for not having followed the comments) in your rebuttal letter. Reviewer's comments can be found below.

Reviewed by Eric Dumonteil, 25 May 2022

This is a nice review, well organized and presented, with clear recommendations for future directions of discussions and research. My only concern is the heavy focus on viruses and to a leseer extent bacteria. Although this is understandable, given their rapid evolutionay time scale that can favor their rapid emergence, it would be important to better include parasites in this discussion as urban habitats can also favor their evolution as well, even though this may be a slower process. It is also surprising that the section on arthropod vectors does not extend more on vectors that are already well adapted to urban environments and responsible for major disease burden (dengue, Zika, Chagas disease, etc...).

Reviewed by anonymous reviewer 1, 13 May 2022

This review aims to draw readers' attention to the importance of urban ecosystems on disease emergence from wildlife

I found this paper very timely. The recent Covid outbreak attracted the attention on wildlife-human new interfaces due to overexploitation of agro systems in many tropical countries, but it is true that cities (including peri-urban areas) and their specific conditions were overlooked as potential important places of zoonotic emergence. Yet, the plague outbreak in middle-age in Europe was amplified in cities.

I have a number of comments, but I have to say that none of them jeopardizes the publication of this paper, which seems important to me.

1- The paper is about emergence of diseases in humans. I think that this should be emphasizes in the general introduction, because there are also potentials for cities to be important places for emergence and spread of diseases staying in the animal compartment (e.g. avian influenza)

2- P. 4, L. 5 and others references to figures. Figures 1 and 2 are of poor quality in this version. Is it possible to improve this quality? Else, P. 12, there is a reference to Figure 3, but there is no figure 3 in the version I have access to.

3- P. 9 L. 20. I would add a sentence of general conclusion for summarizing this important chapter (high animal densities + high prevalence + frequent contacts with humans = high probability of spillover)

4- P. 10 L. 17-20. At least, even if not the source, the market here played a role in the amplification of epidemics.

5- P. 12, L. 8. To hammer the nail, I would begin the sentence by something like "Importantly, even before human contamination"...

6- P. 12 or somewhere else. Maybe it would be worth adding a paragraph on cities as ideal socio-ecosystems for emergence of diseases carrying resistance to antibiotics (which would add a problem to the problem). Antibiotic resistance is noted in the "evolutionary consequences" (P. 13 after L. 23), with the possibility for recombination between microbe strains, but I think that cities, because to high level of pollution and overconsumption of antibiotics may also provide direct strong selective pressures for resistance selection, e.g.

Rilstone, V; Vignale, L; (...); Champagne, P. The role of antibiotics and heavy metals on the development, promotion, and dissemination of antimicrobial resistance in drinking water biofilms. CHEMOSPHERE 282, DOI 10.1016/j.chemosphere.2021.131048

Buelow, E; Ploy, MC and Dagot, C Role of pollution on the selection of antibiotic resistance and bacterial pathogens in the environment. CURRENT OPINION IN MICROBIOLOGY 64 , pp.117-124, DOI: 10.1016/j.mib.2021.10.005

7- P. 15, L. 13. About the heterogeneity of urban socio-environment. Well, opposing urban vs. non-urban also suppose that non-urban is also homogeneous, which is obviously not the case!

8- P. 15, L. 26 and after. Are these proposals specific to urban areas?

9- P. 17, L. 6-17. Perhaps it would be interesting to compare these recommendations with those for invasive species, in order to draw inspiration from them. E.g. (among many others)

Reaser, JK ; Burgiel, SW (...) ; Burgos-Rodriguez, J The early detection of and rapid response (EDRR) to invasive species: a conceptual framework and federal capacities assessment. BIOLOGICAL INVASIONS, Volume22, Issue1, Page1-19 DOI10.1007/s10530-019-02156-w

Miralles, L ; Ibabe, A (...);Borrell, YJ "If You Know the Enemy and Know Yourself": Addressing the Problem of Biological Invasions in Ports Through a New NIS Invasion Threat Score, Routine Monitoring, and Preventive Action Plans. FRONTIERS IN MARINE SCIENCE, Volume 8, Article Number 633118, DOI10.3389/fmars.2021.633118

10- P. 18, L. 16. This also implies sharing the knowledge rapidly, without any political ulterior motive... (Utopia, I'm afraid)

Reviewed by Nicole L. Gottdenker, 20 June 2022

This is a review-concept paper of zoonotic disease emergence in urban systems there are many of these kind of reviews in the literature, but this one has some additional novel contributions. The review overlooks some recent synthetic reviews discussiong socioecological factors related to urbanization and zoonotic disease emergence (Combs et al. 2021. https://doi.org/10.1111/gcb.16033). The review is among many that discuss urbanization and zoonotic disease. Comments regarding some details and larger issues in the paper are as follows:

Please note that there are many English/syntax errors and I am not reading the paper to capture and correct all of these-Actually, the paper seems very 'rushed' the way it has been written and merits some significant editing- will put some of the corrections below.

I think that an overall diagraom summarizing the papers key points would be useful for the reader and a good synthesis of the material. I suggest adding one (a diagram or illustration that serves as a synthesis and summmary of article's key points).

abstract:

line 18-19 Delete

'(e.g., better description of extended urban socio-ecosystems in urban health ecology studies; truly evaluated interventional researches') not necessary

line 19- I would use another term instead of 'slum' even if the UN and other agencies use it- it is a loaded term and has a heavy bias associated with it (see Gilbert, A., 2007. "The return of the slum: does language matter?".International Journal of Urban and Regional Research, 31(4), pp.697-713.)

First paragraph of the first paragraph of the introduction.

lines 23-24 (and also the end of the first paragraph of the it there are studies on per-urba, urban and suburban areas on zoonotic diseases (see studies on rabies in Canada, leptospirosis and other diseases in New Orleans, leptospirosis in Rio de Janeiro, urban Chagas in Venezuela).

introduction

line 16- change 'many researches' to 'much research'

p. 4 line 20, delete - 'Thus, whatever this is good news or not'

p. 5- change 'apprehension' to 'comprehension'

The section in page 5 'Cities as places for millions of close animal-human interactions ' makes a very good point about some cities being close to a lot of biodiversity or zoonoses and merits a bit more development of some specific examples of this point you are making (examples of some emergent diseases and these biodiverse urban locations.

section on pets and domestic animals-

again, p. 5 line 28- please use another word other than 'slums'

p. 5 line 29- change 'owner' to 'owners'

In addition to the section on 'pets and domestic animals', I suggest adding a paragraph about stray animals in urban areas (dogs and cats), some suggestions include feral cats and urbanization and disease in Soeul 'Hwang et al. 2018, PeerJ, 6, e4988. https://doi.org/10.7717/peerj.4988', urban rabies in peru- De la Puente-León, M., Levy, M. Z., Toledo, A. M., Recuenco, S., Shinnick, J., & Castillo-Neyra, R. (2020). Spatial Inequality Hides the Burden of Dog Bites and the Risk of Dog-Mediated Human Rabies. The American journal of tropical medicine and hygiene, 103(3), 1247–1257.).

p. 6 line 3, change 'death occur' to 'deaths occur'

p. 6 line 8, omit 'were recently demonstrated to'

p. 6 line 16 the sentence that urban wildlife ' shelter an overall higher pathogen richness than their non-urban counterparts' is not always/universally true, but this can be context-dependent.

p. 6 lines 22-23- the section of this sentence needs to be rephrased for clarity: ' Many testimonies (e.g., Barkham, 2017) demonstrate that 22 peri-urban zones, when not core cities are now regularly visited by sometimes large and unexpected 23 animals: '

p. 7 line 6 ' very large size' change to 'large population sizes'

also in the section on wild animals perhaps mentioning urban rabies and raccons would add to this discussion- again please use another word for slums throughout the manuscript.

p. 9- the discussion on laboratory escape is very interesting- perhaps mentioning that one of the SARS cov-2 unproven hypothesis includes lab escape. Regardless, this section should be its own subsection separate from selling animals in marketplaces.

in Section 3.3, please do not use the term 'bush meat' or 'wet market' perhaps just change the terms 'wildlife meat commerce'. Can you change 'wet market' to 'animal meat market' ?= Wet market came from a direct mandarin translation, so perhaps just usuing the term 'animal meat/product market' is better.

The last section on cities as incubators for 'evolutionary novelties'

I think brings up some interesting points but needs some cohesion with evolutionary theory or processes (perhaps organizing paragraphs in this section in terms of evolutionary processes (See Gluckman et al. 2011- Evol Appl. 2011 Mar; 4(2): 249–263.).

p. 13-This page has a couple of paragraphs that don't fit under the evolutionary novelties heading and should have their own subsection, perhaps something like

'Cities as transportation hubs for pathogen movement and exchange'

and then the next paragraph have another subsection

'Impact of urbanization on microbial interactions'

p. 14 line 12- change 'repeated animal-human transmission' to 'iteration of animal-human human-animal transmission events

p. 14 line 24- change' researches are' to 'research is'

p. 14 line 32- change 'researches' to 'research'

Cane you define briefly'riposte' as used on p. 15 and 16?

p. 18- change- 'trans sectorial- to 'trans disciplinary'

p. 18- do you know of any examples of centers of excellence in ecology and health research and training?'

The 'call for some actions' section is a bit 'rambling' perhaps shortening or significantly editing this section would increase the paper's clarity- it is a very broad paper.

I am not sure how much the Fiuure 2 reprint is useful for this study and maybe couldb be replaced by thte larger more synthetic diagram that I suggested.