Impact of infectious disease epidemics on xenophobia: A systematic review

Tânia M. Silva [a], Maria V. Cade [b], Adolfo Figueiras [c,d], Fátima Roque [e,f], Maria T. Herdeiro [a], Delan Devakumar [g,*]

[a] Department of Medical Sciences, iBiMED – Institute of Biomedicine, University of Aveiro, Aveiro, Portugal
[b] Department of Medical Sciences, University of Aveiro, Aveiro, Portugal
[c] Health Research Institute of Santiago de Compostela (IDIS), University of Santiago de Compostela, Santiago de Compostela, Spain
[d] Consortium for Biomedical Research in Epidemiology and Public Health (CIBER Epidemiology and Public Health - CIBERESP), Santiago de Compostela, Spain
[e] Research Unit for Inland Development, Guarda Polytechnic Institute (UDI-IPG), Guarda, Portugal
[f] Health Sciences Research Center, University of Beira Interior (CICS-UBI), Covilhã, Portugal
[g] Institute for Global Health, University College London, London WC1N 1EH, United Kingdom

ARTICLE INFO

ABSTRACT

Background Globally, xenophobia towards out-groups is frequently increased in times of economic and political instability, such as in infectious disease outbreaks. This systematic review aims to: (1) assess the xenophobic attitudes and behaviors towards migrants during disease outbreaks; and (2) identify adverse health outcomes linked to xenophobia. *Methods* We searched nine scientific databases to identify studies measuring xenophobic tendencies towards international migrants during disease outbreaks and evaluated the resulting adverse health effects. *Results* Eighteen articles were included in the review. The findings were grouped into: (1) xenophobia-related outcomes, including social exclusion, out-group avoidance, support for exclusionary health policies, othering, and germ aversion; and (2) mental health problems, such as anxiety and fear. Depending on the disease outbreak, different migrant populations were negatively affected, particularly Asians, Africans, and Latino people. Factors such as perceived vulnerability to disease, disgust sensitivity, medical mistrust individualism, collectivism, disease salience, social representation of disease and beliefs in different origins of disease were associated with xenophobia. *Conclusions* Overall, migrants can be a vulnerable population frequently blamed for spreading disease, promoting irrational fear, worry and stigma in various forms, thus leading to health inequities worldwide. It is urgent that societies adopt effective support strategies to combat xenophobia and structural forms of discrimination against migrants.

Abbreviations

COVID-19	Coronavirus disease 2019
EVD	Ebola Virus Disease
HIV	Human Immunodeficiency Virus
H1N1	Swine Influenza A
H5N1	Avian Influenza A
H7N9	Asian Lineage Avian Influenza A
MSW	Men who have Sex exclusively with Women
MSM	Men who have Sex with Men
MRSA	Methicillin-Resistant *Staphylococcus aureus* infection
NHS	National Health System
NOS	Newcastle-Ottawa Scale
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analyses
SARS	Severe Acute Respiratory Syndrome
SARS-CoV-2	Severe Acute Respiratory Syndrome Coronavirus 2
ZIKV	Zika Virus

1. Introduction

In 2001, Durban was the stage for the World Conference against Racism, Racial Discrimination, Xenophobia and Related Intolerance, where people all over the world gathered and engaged in a broad agenda, aiming to formulate concrete recommendations and action-orientated measures to combat all forms of racism, xenophobia, and related items, as these constitute serious violations of and obstacles to the full enjoyment of all human rights and deny the self-evident truth that all human beings are born free and equal in dignity and rights (Maran, 2002).

Throughout history, migrants have been recurrently perceived as pathogen carriers during disease outbreaks (Hoppe, 2018). Past and current events highlight the discrimination and stigmatization that international migrant's face during disease outbreaks (White, 2020). For example the 1860–1890 epidemic in San Francisco, US, where Chinese migrants were perceived as smallpox carriers and blamed for spread-

---

ing the disease, supposedly because they had disregarded the sanitary laws, although the number of infected people were still lower among the Chinese population (Craddock, 1995). Humans have been affected by six pandemics/epidemics since 1900: the 1918 influenza pandemic, the 1957–1958 H2N2 virus pandemic, the 1968 H3N2 pandemic, the 1981 – today HIV/AIDS epidemic, the 2009 H1N1 pandemic and the novel Coronavirus disease 2019 (COVID-19) pandemic (Bil et al., 2019; Eisinger and Fauci, 2018). As emerging infectious diseases are expected to increase over time (Jones et al., 2008), it is important to understand their full societal effects. Previous literature has highlighted some of the growing xenophobic tendencies during these periods, negatively impacting (i) the out-group's access to healthcare; (ii) the out-group's mental health; (iii) combat of the disease (Schaller et al., 2015; Johnson et al., 2004; Navarrete and Fessler, 2006; Fischer et al., 2019). Out-groups are a group of foreign individuals, that are not part of the host population, with a specific trait, often seen as undesirable or threatening to others, and highly associated with disease transmission during an infectious disease outbreak (Navarrete and Fessler, 2006; Fischer et al., 2019). Preventive measures and interventions have not been efficiently deployed to support and improve the health of these groups.

A previous study has systematically assessed the prevalence of stigma in several infection disease epidemics (Yuan et al., 2021). This study has shown that over a third of vulnerable populations, namely people from low- and middle-income countries or with lower education, reported infectious disease epidemic-related stigma, with the highest prevalence of stigma being observed in infected patients, followed by community members and healthcare workers (Yuan et al., 2021). Moreover, the past has strongly suggested that infectious disease outbreaks are often accompanied by an increase in xenophobic sentiments, with several current studies showing that xenophobia and its associated forms are a major concern for public health, as perceived discrimination has shown to have a significant impact on both individuals' physical and mental health, particularly in racial and ethnic minorities (Sylvia Chou and Gaysynsky, 2021; Fan et al., 2021; Huang and Liu, 2020). To our knowledge, no systematic review has collated the evidence of infectious disease outbreaks and xenophobia towards international migrants. To effectively combat epidemics and reduce stigmatization and discrimination, it is important to measure and analyze xenophobia towards foreigners as pathogen carriers. This paper responds to that call by systematically reviewing and summarizing the available literature, aiming to quantitatively evaluate xenophobic tendencies against international migrants, and the resulting adverse health effects during infectious disease outbreaks.

2. Methods

2.1. Protocol and registration

We followed the guidelines in the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) Statement (PRISMA, 2022), for the conduction of this systematic review and registered this study at Research Registry (reference reviewregistry912) (Cade et al., 2020).

2.2. Search strategy

Searches in the scientific databases MEDLINE-PubMed, Scopus, Web of Science, Scielo, Global Index Medicus, Dignity Institute Catalogue, Lilacs, Cochrane Library and Embase were conducted between May 21st, 2020 and July 2nd, 2020. The search strategy was primarily designed to identify relevant studies measuring xenophobic tendencies towards outgroups during a disease outbreak, and to assess the existence of adverse health consequences resulting from those trends. Electronic searches were complemented by reference list screening of papers found. The search keywords used in all scientific databases and the definition of important concepts (International Organization for Migration (IOM),

2020) are describedin the Supplemental Material. Searches were conducted by two independent researchers (TMS and MC).

2.3. Study inclusion criteria

Research studies were eligible if they complied with the following inclusion criteria: (1) international migrants during an epidemic; (2) the existence of xenophobic tendencies; (3) observational and interventional studies (with study protocols, non-peer-reviewed publications, reviews, systematic reviews, and meta-analyses being excluded). In the case of studies including both quantitative and qualitative methodology, only quantitative data were collected. Only papers written in English, Portuguese or Spanish were included during the selected period.

All titles and abstracts retrieved from the electronic databases research were independently reviewed by two blind researchers (TMS, MC), with each publication being classified as meeting the selection criteria or not. The full text of potentially eligible articles was then independently screened by the same researchers (TMS, MC), and discussed with a third researcher (MTH, DD or FR) where there was disagreement.

2.4. Quality assessment of included studies

The quality of the studies was examined using an adapted version of the Newcastle-Ottawa Scale (NOS) for all the included articles (Herzog et al., 2013). For each study, both risk of bias and quality assessment were separately conducted by two researchers (TMS, MC). In the case of disagreement, a third person reviewed the paper (MTH, DD or FR). The quality assessment used a "star system" on three domains:

(1) Selection of study groups (5 stars maximum);
(2) Comparability of the groups (2 stars maximum);
(3) Ascertainment of the exposure or outcome of interest (3 stars maximum).

Additionally, the highest quality studies were awarded up to ten stars, with studies having less than 5 points being identified as representing a high risk of bias.

2.5. Data extraction and analysis

Nine scientific databases were searched to select the eligible articles (Fig. 1) by using the keywords described in the search strategy (Supplementary Material). Afterwards, a selection based on the review of articles with date out of scope, followed by title, abstract, review of duplicates, and additional records was performed, with the selected articles being then assessed for perusal of full-text, and considered eligible to be included in the present review, as they met the inclusion criteria. The analyzed articles were summarized in three tables containing the author's information and publication year, country, disease type, study period, setting, sample size, study population and sociodemographic characteristics, study design, data collection methodology, and outcomes, namely if xenophobic trends were associated with international migrants during an infectious disease outbreak. Data were extracted by two researchers (TMS, MC) acting independently using Microsoft Excel, with the results of their respective analyses being compared. A third reviewer (DD) resolved disagreements.

3. Results

3.1. Study selection

5550 references were identified from the scientific databases search and 148 articles were assessed for full-text assessment, including nine papers obtained by screening the reference lists of articles from the database search. Sixteen studies were considered eligible for inclusion (Fig. 1) (Bil et al., 2019; He et al., 2020; Krings et al., 2012; Gilles et al., 2013; Huang et al., 2011; Joffe et al., 2011; Des Jarlais
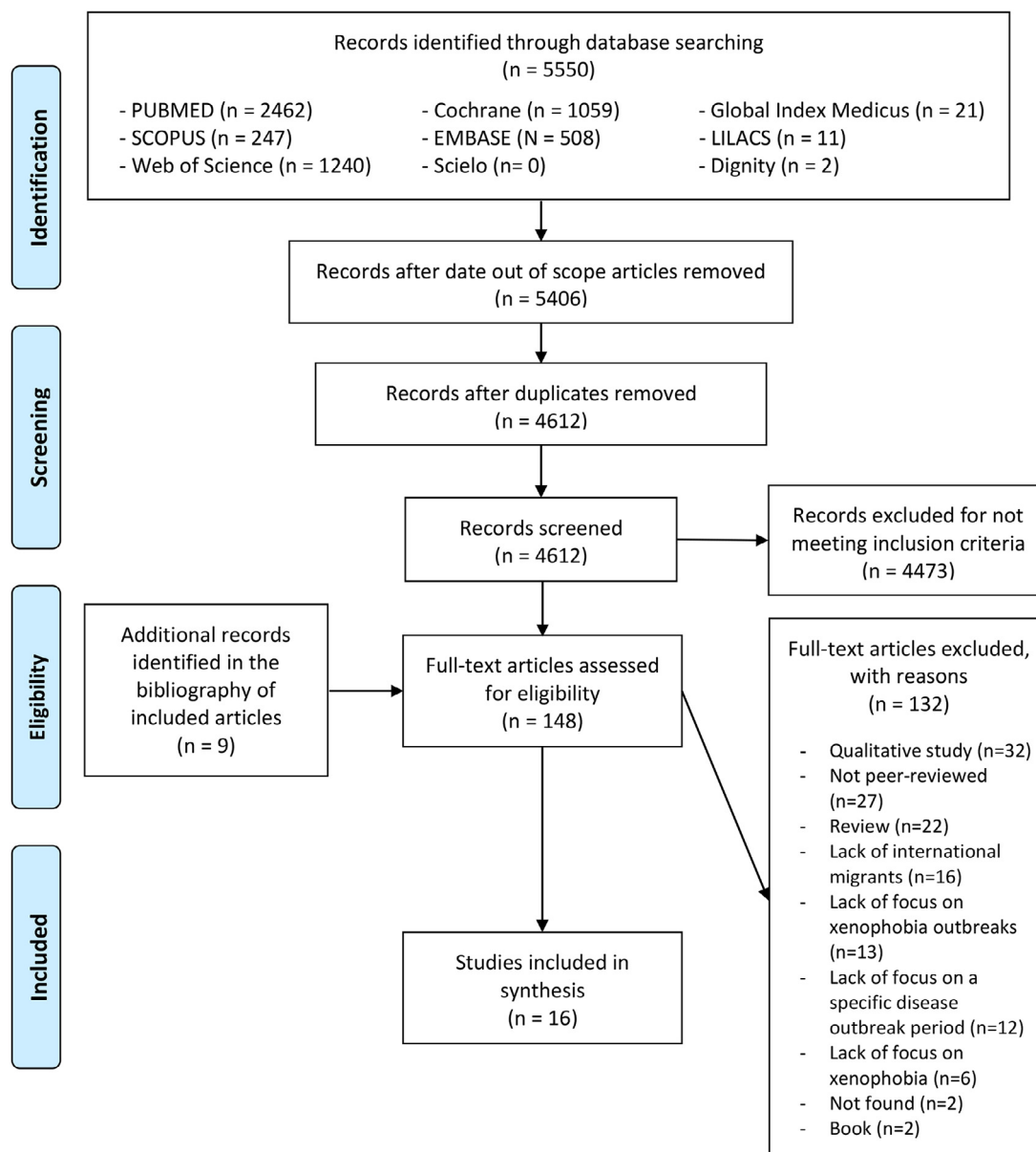
```
┌─────────────────────────────────────────────────────────────────┐
│        Records identified through database searching              │
│                        (n = 5550)                                 │
│                                                                   │
│  - PUBMED (n = 2462)    - Cochrane (n = 1059)   - Global Index    │
│  - SCOPUS (n = 247)     - EMBASE (N = 508)        Medicus (n = 21)│
│  - Web of Science       - Scielo (n= 0)         - LILACS (n = 11) │
│    (n = 1240)                                   - Dignity (n = 2) │
└─────────────────────────────────────────────────────────────────┘
```

Identification

```
┌─────────────────────────────────────────────┐
│   Records after date out of scope articles   │
│               removed                         │
│               (n = 5406)                      │
└─────────────────────────────────────────────┘
```

Screening

```
┌─────────────────────────────────────────────┐
│      Records after duplicates removed         │
│               (n = 4612)                      │
└─────────────────────────────────────────────┘
```

```
┌──────────────────────┐          ┌──────────────────────────┐
│   Records screened   │─────────▶│  Records excluded for not │
│      (n = 4612)      │          │  meeting inclusion criteria│
└──────────────────────┘          │        (n = 4473)         │
                                  └──────────────────────────┘
```

Eligibility

```
┌──────────────────┐     ┌──────────────────────┐     ┌──────────────────────────────┐
│ Additional records│────▶│ Full-text articles   │────▶│ Full-text articles excluded, │
│ identified in the │     │ assessed for         │     │       with reasons           │
│ bibliography of   │     │ eligibility          │     │        (n = 132)             │
│ included articles │     │ (n = 148)            │     │                              │
│ (n = 9)           │     └──────────────────────┘     │ - Qualitative study (n=32)   │
└──────────────────┘                                   │ - Not peer-reviewed (n=27)   │
                                                       │ - Review (n=22)              │
                                                       │ - Lack of international       │
                                                       │   migrants (n=16)            │
                                                       │ - Lack of focus on           │
                                                       │   xenophobia outbreaks       │
                                                       │   (n=13)                     │
                                                       │ - Lack of focus on a         │
**Included**                                           │   specific disease           │
                                                       │   outbreak period (n=12)     │
         ┌──────────────────────┐                      │ - Lack of focus on           │
         │ Studies included in  │                      │   xenophobia (n=6)           │
         │     synthesis        │                      │ - Not found (n=2)            │
         │     (n = 16)         │                      │ - Book (n=2)                 │
         └──────────────────────┘                      └──────────────────────────────┘
```

Fig. 1. PRISMA flow diagram.

et al., 2006; Zheng et al., 2005; Rzymski and Nowicki, 2020; Kam, 2019; Stuermer et al., 2017; Earnshaw et al., 2019; Kim et al., 2016; Prati and Pietrantoni, 2016; Goodwin and Sun, 2014; Eicher et al., 2014).

3.2. Study main characteristics

A summary description of the key characteristics of the included articles is presented in Tables 1–3. Fifteen studies had a cross-sectional design, and one was a cohort. A full description of the main outcomes can be found at Table S1.

3.2.1. Study location
Eight studies were conducted in Europe (Bil et al., 2019; Krings et al., 2012; Gilles et al., 2013; Joffe et al., 2011; Rzymski and Nowicki, 2020; Stuermer et al., 2017; Prati and Pietrantoni, 2016; Eicher et al., 2014), five at the United States of America (US) (Huang et al., 2011; Des Jarlais et al., 2006; Kam, 2019; Earnshaw et al., 2019; Kim et al., 2016), two in Asia (Zheng et al., 2005; Goodwin and Sun, 2014), and one in multiple countries (He et al., 2020).

3.2.2. Disease classification
More than 30% of the studies referred to an Influenza A outbreak, namely swine and avian (Krings et al., 2012; Gilles et al., 2013; Huang et al., 2011; Goodwin and Sun, 2014; Eicher et al., 2014), with the remaining being associated to COVID-19 (He et al., 2020; Rzymski and Nowicki, 2020), Human Immunodeficiency Virus (HIV) (Bil et al., 2019), Ebola Virus Disease (EVD) (Stuermer et al., 2017; Earnshaw et al., 2019; Kim et al., 2016; Prati and Pietrantoni, 2016), Severe Acute Respiratory Syndrome (SARS) (Des Jarlais et al., 2006; Zheng et al., 2005), Methicillin-Resistant *Staphylococcus aureus* infection (MRSA) (Joffe et al., 2011), and Zika Virus (ZIKV) (Kam, 2019).

3.2.3. Study population
About two thirds of the included studies were applied to migrants (Bil et al., 2019; He et al., 2020; Zheng et al., 2005; Rzymski and Nowicki, 2020; Goodwin and Sun, 2014), namely Asian (n = 4), or European citizens and/or residents (Krings et al., 2012; Gilles et al., 2013; Joffe et al., 2011; Stuermer et al., 2017; Prati and Pietrantoni, 2016; Eicher et al., 2014). The remaining articles included the US popu-

Table 1

Table of study characteristics.

Authors / Year	Country	Disease Type	Study Period	Setting	Sample Size (*n*)	Study Population		Study Design	Data Collection Methodology		
						International Migrants	National Residents		Online / Internet	Telephone / Mobile phone	In paper
Rzymski et al. 2020	Poland	COVID-19	February 2020	Asian migrants in a Medical Sciences University (75.3% from Taiwan)	85	Asian medical students	ND	Cross-sectional study	Anonymous survey	ND	Questionnaire
He et al. (2020)	Multicentre study (*n* = 70)	COVID-19	February 2020	Asian (Chinese) migrants living in different countries overseas	1904	Overseas Chinese residents	ND	Cross-sectional study	Survey platform ("SurveyStar", Changsha Ranxing Science and Technology) Secondary data from Internet.	ND	Secondary data from newspapers / other sources of documentation
Bil et al. (2019)	Netherlands	HIV	July 2013 – June 2015	Migrants living with HIV	247	MSM, MSW and women (from Sub-Saharan Africa, Latin America / Caribbean, Europe and Other)	MSM and MSW	Cross-sectional study	Clinic survey Questionnaire	ND	Clinic survey Questionnaire
Kam et al. (2019)	United States of America	ZIKV	2016	American public	769	ND	Nationally representative sample of US adults' citizens	Cross-sectional study	Survey	ND	ND
Stürmer et al. (2016)	Germany	EVD	November 2014 – March 2015	German citizens enroled at University	218	ND	German students	Cross-sectional study	Two time-lagged testing survey	ND	ND
Earnshaw et al. (2016)	United States of America	EVD	October – mid-December 2014	Online survey with US residents	202	ND	Adult US residents	Cross-sectional study	Online survey with data collection via Amazon Mechanical Turk (MTurk), which "yields younger, and fewer Black and Latino participants"	ND	ND

4

Table 1 (*continued*)

Authors / Year	Country	Disease Type	Study Period	Setting	Sample Size (*n*)	Study Population		Study Design	Data Collection Methodology		
						International Migrants	National Residents		Online / Internet	Telephone / Mobile phone	In paper
Kim, et al. (2016)	United States of America	EVD	December 2014	US residents in different states	1000	ND	Nationally representative sample of US residents	Cross-sectional study	Interview Survey through the commercial public-survey research firm YouGov	ND	ND
Prati et al. (2016)	Italy	EVD	January – March 2015	Italian Citizens selected through snowball method	486	ND	Convenience sample of Italian adults	Cross-sectional study	Survey Questionnaire	ND	Questionnaire
Goodwin et al. (2014)	China	H7N9	April 2003	New migrants and migrants	1011	ND	Shanghai region residents (southern mainland China)	Cross-sectional study	ND	Interview	ND
Eicher et al. (2013)	Switzerland	H5N1 and H1N1	March – June 2009 (Wave 1) March – June 2010 (Wave 2)	French-speaking Swiss resident's attitudes towards protection measures in the context of epidemics	$N_{(total)}$ = 606 H5N1/H5N1 group: N = 309 H5N1/H1N1 group: N = 297	ND	French-speaking Swiss adults	Cross-sectional study	Two-wave longitudinal survey (platform not specified)		
Krings et al. (2012)	Switzerland	H5N1	June 2007	Swiss citizens from 4 French-speaking University campuses	249	ND	Swiss students	Cross-sectional study	Questionnaire during lectures (platform not specified)		
Gilles et al. (2013)	Switzerland	H5N1	June 2006 (Wave 1) June 2007 (Wave 2)	Swiss students from 4 French-speaking Universities measuring uncertainty occurrence and othering	442	ND	Swiss students	Cross-sectional study	Two-wave repeated survey using collective symbolic coping model	ND	ND

Table 1 (*continued*)

Authors / Year	Country	Disease Type	Study Period	Setting	Sample Size (n)	Study Population		Study Design	Data Collection Methodology		
						International Migrants	National Residents		Online / Internet	Telephone / Mobile phone	In paper
Huang et al. (2011)	ND	H1N1 (study 1) Seasonal Flu (studies 2 and 3)	Fall 2009 (study 1) ND (studies 2 and 3)	Vaccinated and unvaccinated participants in the context of a disease vs non-disease-threat (Study 1) Vaccinated participants in the context of disease-related threat (Study 2) Undergraduate participants (Study 3)	N = 135 (study 1) N = 26 (study 2) N = 26 (study 3)	ND	Vaccinated and unvaccinated individuals (study 1) Vaccinated individuals (study 2) Undergraduate students (study 3)	Cross-sectional study (studies 1 and 2) Randomized study (study 3)	Survey Local newspaper excerpts Background questionnaire (for study 1)	ND	ND
Joffe et al. (2011)	Great Britain	MRSA	ND	Residents from greater London area	60	ND	Purposive sample of adults from London split evenly by gender, type of newspaper, 1 overnight stay in hospital over the last year and a quarter from ethnic minorities.	Cross-sectional study	ND	ND	In-depth tape-recorded interview Questionnaire
Des Jarlais et al. (2006)	United States of America	SARS	March 2002 – February 2004	New York City metropolitan area residents on 11th September 2001	928	ND	Representative sample of adults living in the New York City metropolitan area	Cohort study	ND	Survey Questionnaire Follow-up interviews	ND
Zheng et al. (2005)	Japan	SARS	Early October – mid-November 2003	Asian (Chinese) migrants recruited at multiple locations at Tokyo University	161	Chinese students from mainland China (living in Japan)	ND	Cross-sectional study	ND	ND	Focus-group interviews Questionnaire

Abbreviations: COVID-19 – Coronavirus disease 2019; HIV – Human Immunodeficiency Virus; ZIKV – Zika Virus; EVD – Ebola Virus Disease; H7N9 – Asian Lineage Avian Influenza A; H5N1 – Avian Influenza A; H1N1 – Swine Influenza A; MRSA – Methicillin-Resistant Staphylococcus aureus infection; SARS – Severe Acute Respiratory Syndrome; US – United States of America; ND – Not-defined; MSM – Men who have Sex with Men; MSW – Men who have Sex exclusively with Women.

Table 2
Sociodemographic characteristics of the study' participants.

Authors	Sociodemographic Characteristics					Migrants Work Type
	Gender	Age	Educational Level	Ethnicity and Residential Status	Socioeconomic Status and Political Preferences	
Rzymski et al.	42.4% Males 58.6% Females	M ± SD = 23.8 ± 3.8	100% Higher educational level	Residents in Poland for at least half a year: M ± SD = 2.7 ± 1.4 years	ND	Medical students
He et al.	Males Females (no proportions available)	16–20, 21–30, 31–40, 41–50, 51–60, >60 (no proportions available)	Primary school, Middle school, High school, College, Post-graduate (no proportions available)	Permanent residency, Non-permanent residency (no proportions available)	Low-income, Low-middle income, Upper-middle income, High income (no proportions available)	ND
Bil et al.	91.9% Males 8.1% Females	Median = 41 IQR = 33–49 $p = 0.002$	43.3% Higher educational level $p = 0.003$	77.7% Permanent residency permit 14.8% Temporary residency permit 7.4% Unknown or refugee status	39.4% Low income level (less than minimum wage) $p < 0.001$	75.2% Currently working
Kam et al.	Males and Females (no proportions available)	IQR: 18–91 (0 to 1)	Six categories from: No high school (0) to Post-graduation (1)	White, Black, Hispanic (no proportions available)	Household income (16 categories) from: < \$10 K (0) to \$500K+ (1) Seven categories from: Very liberal (0) to Very Conservative (1)	ND
Stürmer et al.	31.2% Males 68.8% Females	M ± SD = 36.42 ± 11.34 Range = 18–69	100% Higher level education	ND	89% Income between 2000 and 2500 euros 6.4% No monthly income 4.6% Income higher than 6000 euros M = 4.03, SD = 1.49 (1 = left, 10 = right)	73.4% part-time students working full-time professionally in: 35.6% Education, social services and healthcare, 20.0% Management or retail, 20.0% Administration or law, 11.9% Science and research, 6.9% Artistic and cultural professions, 5.6% Technical professions
Earnshaw et al.	54.5% Males 45.5% Females	M ± SD = 34.07 ± 10.31	55.4% Associate or bachelor's degree, 35.1% High school or less, 9.4% Master's or doctoral degree	74.3% White/European-American, 7.4% Latin/Hispanic-American, 6.9% Black/African-American, 5.9% Asian/Asian-American, 5.4% Other and multiple	Upper, middle and lower class	ND
Kim, et al.	47.9% Males 52.1% Females	M ± SD = 46.46 ± 17.05 Range = 18–90	47.5% Some college or completed college, 37.6% Completed high school, 8.6% Post-graduate education, 6.3% Not completed high school	70.3% White, 11.1% Black, 9.7% Hispanic, 4.8% Asian, 4.1% Other	Median family income: \$40,000–\$49,000 range	ND
Prati et al.	34.2% Males 65.8% Females	M ± SD = 33.22 ± 12.27 Range = 18–87	33.1% Higher educational level	ND	34.9% Without preference 24.1% Center-Left 19.5% Left 9.4% Center-Right 6.4% Center 5.6% Right	41.2% Employed

Table 2 (*continued*)

Authors	Sociodemographic Characteristics					Migrants Work Type
	Gender	Age	Educational Level	Ethnicity and Residential Status	Socioeconomic Status and Political Preferences	
Goodwin et al.	41% Males 59% Females	M ± SD = 49.5 ± 16.8 18.3% 18–30 26.3% 31–46 34.7% 47–64 20.7% ≥65	ND	ND	ND	37.5% Factory worker, 20.1% Business, 17.1% Service industry, 13.1% Professional technicians or experts, 6.7% Agriculture, fishery and farming, 2.9% Other, 2.6% Government employees
Eicher et al.	H5N1/H5N1 group: 44% Males and 56% Females H5N1/H1N1 group: 43% Males and 57% Females	H5N1/H5N1 group: M ± SD = 46.40 ± 16.40 (Males); M ± SD = 45.99 ± 15.40 (Females) H5N1/H1N1 group: M ± SD = 46.42 ± 15.43 (Males); M ± SD = 46.13 ± 16.04 (Females)	No variation between groups (similar to Switzerland general population)	ND	ND	ND
Krings et al.	29.7% Males 70.3% Females	M ± SD = 21.6 ± 4.1	100% Higher educational level	ND	ND	ND
Gilles et al.	28.5% Males 71.5% Females	M ± SD = 22.3 ± 4.6	100% Higher educational level	ND	ND	University students from various disciplines
Huang et al.	Study 1: 41.5% Males, 55.5% Females, 3% No reported gender Study 2: 38.5% Males, 61.5% Females Study 3: 53.8% Males, 46.2% Females	ND	ND (Studies 1 and 2), 100% Higher educational level (Study 3)	ND	ND	ND (Studies 1 and 2), Undergraduate students (Study 3)
Joffe et al.	~50% Males ~50% Females	Median = 49 IQR = 27–85	53.3% A-level, O-level, vocational qualifications or equivalent, 36.6% Undergraduate or post-graduated, 5.0% Other qualifications, 3.3% No qualifications, 1.2% Missing	ND	31.7% Conservative, 28.3% No political leanings, 21.7% Labor, 11.7% Liberal Democrats, 3.3% Green, 3.3% Other	71.6% Employed, 11.6% Self-employed with employees, 13.3% Self-employed without employees or Freelance workers, 3.3% Data missing
Des Jarlais et al.	45% Males 55% Females	11% 18–24, 26% 25–34, 21% 35–44, 18% 45–54, 12% 55–64, 12% ≥65	Less than high school, High school or equivalent, Some college, College degree, Graduate work	54% White, 20% Hispanic, 19% African American, 5% Asian, 3% Other	ND	ND
Zheng et al.	49.7% Males 50.3% Females	M ± SD = 30.7 ± 4.7 Range = 21–44 14.3% <25, 33.5% 26–30, 39.8% 31–35, 12.4% >35	64.6% Graduate, 22.4% Research student, 13% Undergraduate	Chinese students in the University of Tokyo, Japan	ND	Chinese students in different areas of speciality: 46.6% Engineering, 18.6% Medicine, 16.8% Arts and Sciences, 8.1% Humanities and Sociology, 5.6% Education, 4.3% Others

Abbreviations: ND – Not-defined; M – Mean; SD – Standard Deviation; SE – Standard Error; IQR – Interquartile Range; p – *p*-value.

Table 3

Xenophobia assessment and detection of its resulting adverse health outcomes during an infectious disease outbreak.

Authors	Xenophobic Tendencies Measurement	Examples of Prejudice
Rzymski et al. (2020)	% Migrant Asian students extent of prejudice (0 – 5 Likert scale (0 – not at all, 5 – very much)): 61.2% in general (those wearing a face mask (71.2%) and those not wearing a mask (28.2%); 47.1% on public transportation and streets (Mean = 3); 24.7% at university (Mean = 4); 21.2% in shops (Mean = 3); 21.2% in health service units (Mean = 3); 12.9% at restaurants (Mean = 5).	Stepping away, changing seats on bus, and covering mouth and nose; Being asked to keep a safe distance and remove face masque; Showing judgmental facial expressions; Spitting and using offensive language; Making xenophobic comments and jokes about coronavirus; Opening doors with a tissue after an Asian student has touched the handle; Assuming that wearing a face masque is equal to being positive for SARS-CoV-2; Asking doctors why students are making clinical rounds and displaying terrified reactions; Staring at them continuously, pointing with a finger, asking if they carry coronavirus and whispering comments in Polish.
He et al. (2020)	Discrimination experienced by 25.11% of the respondents. Groups more likely to experience discrimination: women (25.59%), youths [age 16–20: (20.34%), age 21–30: (32.82%], those less educated [primary school: (16.67%), middle school: (30.88%)] and migrants that reside in high-income countries (25.81%). Groups more likely to experience violent overactions: women (29.98%), youths [age 16–20: (35.59%), age 21–30: (35.57%)], those less educated (primary school: (8.33%), middle school: (41.18%)) and migrants that reside in high-income countries (31.25%).	Different forms of discrimination described: being laid-off without proper cause, rejection of rental housing and commonly reported abuses in the public; Social outcomes: social exclusion and social stigma; Fear.
Bil et al. (2019)	43% migrants reported discrimination; 46% migrant and non-migrant MSM reported discrimination due to their sexuality. Difficulties in accessing healthcare by migrant groups [MSM (OR: 8.6, 95% CI: 2.3, 28.5), heterosexual men (OR: 6.4, 95% CI: 1.3, 30.7) and women (OR: 8.8, 95% CI: 2.0, 39.0)], compared to non-migrants. Increased difficulties in accessing healthcare by migrants MSM, especially if born in sub-Saharan Africa (OR: 12.4, 95% CI: 1.0, 157.3), another country in Europe (OR: 9.0, 95% CI: 2.1, 38.3) or another region in Spain (OR: 19.9, 95% CI: 4.8, 83.4), compared to non-migrant MSM.	ND
Kam et al. (2019)	11.5% respondents show a high concern about ZIKV spreading to where they live; 35.3% respondents avoid travel to disease hot spots; 20.8% respondents think US government should prevent all foreign citizens from entering the US until the outbreak is over. Respondents want the US government to focus more on protecting Americans than fighting the outbreak abroad. Disgust sensitivity in attitudes (evaluations of potentially disgusting situations): disgust sensitive participants were more concerned with Zika spreading to where they live and would more likely call for barriers to passenger's entry coming from Zika spots.	Social rejection and social stigma; Marginalization of stigmatized groups and xenophobia predisposition in the form of othering.
Stürmer et al. (2016)	Use of Likert scale (1–7 scale; 1 = strongly disagree, 7 = strongly agree): EVD threat as risk of contamination: Mean = 2.86; Perceived threat on intergroup's social identity based on intergroup differences (Symbolic threat): Mean = 3.03; Support for quarantining migrants from Africa: Mean = 4.15; Support for closing borders: Mean = 2.08; Personal beliefs in the sociocultural origins of EVD: Mean = 3.38 (1–5 scale; 1 = not at all; 5 = most certainly)	

Table 3 (*continued*)

Authors	Xenophobic Tendencies Measurement	Examples of Prejudice
	Right-Wing Authoritarianism (prejudice-related measure) associated with: - Support for quarantining migrants from Africa: $\beta = 0.15$, 95% CI = 0.087, 0.216 - Support for closing borders: $\beta = 0.11$, 95% CI = 0.039, 0.171 Perceived Vulnerability to Disease (fear of infection-related measure) associated with: - Support for quarantining migrants from Africa: $\beta = 0.04$, 95% CI = 0.002, 0.080 - Support for closing borders: $\beta = 0.04$, 95% CI = 0.005, 0.081	Symbolic prejudice towards African migrants; Restrictive health policies; Social exclusion and fear.
Earnshaw et al. (2016)	Xenophobia measurement (use of Likert 1–5 scale; 1 = strongly disagree, 5 = strongly agree): General population: Mean = 2.46; For those who agree with conspiracy theories: Mean = 3.13 $p < 0.001$; For those who do not agree/are neutral with conspiracy theories: Mean = 2.33 $p < 0.001$. Statistically significant association between conspiracy belief agreement and: Greater xenophobia: $p < 0.001$; Lower support for quarantining people who had contact with EVD patients: $p = 0.06$.	Conspiracy beliefs agreement; Lower intended care-seeking and lower support for quarantining people who had contact with EVD patients.
Kim et al. (2016)	For people coming from Liberia, Sierra Leone & Guinea: Mean (1 = I do not support to 3 = I do support): Travel ban: Mean = 2.03, 95% CI = 1.97, 2.09; Mandatory 21-day quarantine: Mean = 2.22, 95% CI = 2.16, 2.28; A ban from public schools of children who return from any of these countries: Mean = 2.12, 95% CI = 2.07, 2.18; Prejudice against West Africans: Mean = -1.17 (-4.5 to 3.5 scale), 95% CI = 1.26, -1.07; Prejudice against Undocumented Migrants: Mean = -0.35 (-4.25 to 3.6 scale), 95% CI = 0.46, -0.24. Relationships of individualism and collectivism with perceived vulnerability to EVD: Individual level: High levels of perceived vulnerability - participants with high collectivism scores showed significantly lower levels of xenophobia (Mean = 0.19, 95% CI = 0.12, 0.27); Low levels of perceived vulnerability - low individualism score participants with significantly greater levels of xenophobia (Mean = -0.13, 95% CI = -0.23, -0.05). State level: Higher perceived vulnerability predicted higher xenophobia ($\beta = 0.28$, 95% CI = 0.06, 0.11); Low collectivism score: stronger relationship between perceived vulnerability and xenophobia ($\beta = 0.36$, 95% CI = 0.36, 0.52).	Xenophobic tendencies in the form of policy support for out-group exclusion; Perceived vulnerability associated with increased xenophobia uniformly; Joint influence of perceived vulnerability, collectivism and individualism on xenophobia; Fear.
Prati et al. (2016)	Use of Likert scale (0 to 10 scale; 0 = not at all, 10 = extremely): Subtle prejudice against African migrants: Mean = 3.11; Blatant prejudice against African migrants: Mean = 2.26. Individual's risk perception and positive association of EVD fear with levels of prejudice toward African migrants: Subtle prejudice associated with: Male gender, higher age, unemployment, affective response to EVD, and lower EVD knowledge.	

Table 3 (*continued*)

Authors	Xenophobic Tendencies Measurement	Examples of Prejudice
		ND
	Blatant prejudice associated with: Male gender, age, lower level of education, affective response to EVD, and lower EVD knowledge. Higher scores for prejudice for centre-right / right political preferences: Subtle (Mean = 3.60 / Mean = 3.95); Blatant (Mean = 2.73 / Mean = 3.28).	
Goodwin et al. (2014)	23.1% participants believed new migrants could be the cause of H7N9; 37.7% participants considered migrants to be at greater risk to contract H7N9; 17.1% participants avoided being physically closed to recent migrants. Significant association of changing behaviors per the recommendations with attributing H7N9 to: new migrants (OR: 1.31, 95% CI: 1.10, 1.55) and poor Chinese hygiene (OR: 1.30, 95% CI: 1.12, 1.52). Non-recommended behavior significantly predicted by association of H7N9 with poor Chinese hygiene (OR: 1.54, 95% CI:1.25, 1.90).	Stigmatization and "othering" of those associated with the threat.
Eicher et al. (2013)	The study explored the link between prior beliefs and the perceived effectiveness of protection measures in two influenza outbreaks (H1N1 and H5N1). Perception that outbreak origin is due to unhygienic out-groups if they believe the world is dangerous. Blaming outgroups for unhygienic actions was associated with support for discriminatory measures.	Blame against the unhygienic out-groups, associated with stronger support for discrimination of unfamiliar others; Discrimination measure targeting out-groups based in: - avoid contact with people from foreign countries; - avoid contact with foreign businessmen.
Krings et al. (2012)	Positive correlation between Avian Influenza (AI) salience and avoiding foreigners to prevent infection ($p < 0.05$). Participants from 1 of the 4 universities showed stronger beliefs in avoiding foreigners (Mean = 3.84, $n = 51$), compared to participants from the other 3 universities (Mean = 3.00, $n = 198$). Positive association between foreigner avoidance and germ aversion ($\beta = 0.17$, $p = 0.02$). Association between less favorable attitudes toward foreigners and stronger beliefs in the efficacy of foreigner avoidance ($p < 0.01$). The impact of AI salience on beliefs in foreigner avoidance was stronger for participants holding unfavorable attitudes toward foreigners.	Prejudice against foreigners in the form of negative reactions and attitudes; Disease-based foreign avoidance; Social exclusion.
Gilles et al. (2011)	The study was divided in two waves and measured threat to out-groups. Quantification of threat was based on the number of countries thought to have Avian influenza. 86% of participants ticked Asian countries. There was no association between social dominance orientation (the idea that groups are hierarchically ordered in society) or Germ aversion and othering towards Asian or other frequently mentioned countries. People feeling germ aversion and supporting a hierarchical view of society attribute human cases of disease threat to more foreign countries.	Xenophobia predisposition to foreign countries not experiencing Avian Influenza human cases (mainly Asian countries) in the form of othering; Out-group blame and stigmatization.
Huang et al. (2011)	Study 1: Prejudice measurement (predicted interaction of threat condition with vaccination status): $p = 0.02$. Vaccinated and unvaccinated groups: Vaccinated participants with a lower score on the adapted 1–5 Modern Racism Scale ($M = 2.47$); Unvaccinated participants primed with disease threat associated with increased prejudice levels;	

Table 3 (*continued*)

Authors	Xenophobic Tendencies Measurement	Examples of Prejudice
	Relationship between vaccination status and anti-immigrant attitudes (indirect effect = -0.24, p = 0.041). Study 2: Predicted interaction between contamination/protection frame and germ aversion (b = 18.17, p = 0.014); Germ aversion negatively predicts attitudes toward out-group members (b = -9.98, p = 0.05); and positively predicts attitudes toward out-group members (b = 8.19, p = 0.10). Study 3: Germ aversion negatively associated with attitudes toward out-group members (b = -0.79, p = 0.05).	Study 1: Vaccination status predicts perceived vaccine effectiveness (protection), which then predicts anti-immigrant prejudice in the context of a disease-related threat. Study 2: Subjective perceptions of protection from disease influence attitudes toward out-groups; Perceived infectability; Prejudice against out-groups. Study 3: Relationship between protection from disease and chronic GA only for perceptions of out-groups; Stigmatization against out-groups.
Joffe et al. (2011)	28.3% foreigners partly blamed for MRSA in the National Health System (NHS); 23.3% foreigners as causes and carriers of disease: (i) 15% in their roles as cleaners, 3.3% doctors or 10% nurses; (ii) 13.3% described using racial slurs; (iii) 6.7% associated with terrorism; 26.7% foreigners used for comparisons of NHS to foreign healthcare systems.	Strong blame against foreigner cleaners (cheapest, lowest quality and knowledgeable and less motivated NHS workforce); Putative negative characteristics attributed to foreigners, such as lack of dedication, passion, professional knowledge, lack of motivation and language deficits.
Des Jarlais et al. (2006)	Used Likert scale (1 = disagree strongly, 4 = agree strongly): People should avoid areas in the US heavily populated by Chinese: Mean = 1.70; All Chinese should be forcibly checked for SARS: Mean = 2.12; Chinese should not be allowed to enter the US: Mean = 1.68. Stigmatizing methods of SARS control was linked to lower educational levels. Participants with less than high school education agreed that: 16% they would avoid areas in the US heavily populated by Chinese; 48.6% all Chinese should be forcibly checked for SARS; 28.1% Chinese should not be allowed to enter the US.	Blame and fear; Social exclusion.
Zheng et al. (2005)	18.6% students with SARS-related social discrimination experiences at public places (hotels, shops); 31.7% students with awareness of SARS discrimination against other Chinese in Japan; 23.0% contact decrease between students and other Chinese (fear of getting SARS during the outbreak – prevention behavior).	Social discrimination under the guise of SARS prevention.

Abbreviations: ND – Not-defined; r – Pearson correlation; p – *p*-value; IQR – Interquartile Range; SD – Standard Deviation; OR – Odds Ratio; CI – Confidence Interval; SE – Standard Error; β, B – Coefficient measure; MSM – Men who have Sex with Men; SDO – Social Dominance Orientation; US – United States of America; SARS-CoV-2 – Severe Acute Respiratory Syndrome Coronavirus 2; ZIKV – Zika Virus; EVD – Ebola Virus Disease; H7N9 – Asian Lineage Avian Influenza A; H5N1 – Avian Influenza A; H1N1 – Swine Influenza A; AI – Avian Influenza; MRSA – Methicillin-Resistant Staphylococcus aureus infection; SARS – Severe Acute Respiratory Syndrome.

lation (Des Jarlais et al., 2006; Kam, 2019; Earnshaw et al., 2019; Kim et al., 2016), and one article did not report the participants nationality (Huang et al., 2011).

Three quarters of the studies included national residents (Krings et al., 2012; Gilles et al., 2013; Huang et al., 2011; Joffe et al., 2011; Des Jarlais et al., 2006; Kam, 2019; Stuermer et al., 2017; Earnshaw et al., 2019; Kim et al., 2016; Prati and Pietrantoni, 2016; Goodwin and Sun, 2014; Eicher et al., 2014), with three being conducted with national representative adult samples (Des Jarlais et al., 2006; Kam, 2019; Kim et al., 2016) and three with European students (Krings et al., 2012; Gilles et al., 2013; Stuermer et al., 2017). Three studies included international migrants (He et al., 2020; Zheng et al., 2005; Rzymski and Nowicki, 2020), and one study included both national residents and international migrants (Bil et al., 2019).

3.2.4. Sociodemographic features

All studies included men and women, mainly adults, with 7 studies being applied to people with a higher educational level (Krings et al., 2012; Gilles et al., 2013; Huang et al., 2011; Zheng et al., 2005; Rzymski and Nowicki, 2020; Stuermer et al., 2017; Earnshaw et al., 2019). All studies conducted in the US were composed by participants with different ethnicities (Des Jarlais et al., 2006; Kam, 2019; Earnshaw et al., 2019; Kim et al., 2016).

3.2.5. Outcomes of interest

Within the scope of this systematic review, we evaluated the following leading outcomes (Tables 3 and S1 of Supplemental Material):

(a) Xenophobia Assessment and Measurement

Overall, we observed an increased trend for xenophobic behaviors and attitudes toward migrants during an infectious disease outbreak. When grouping the xenophobic measurements by infectious disease type, we were able to establish a link between the outcomes detected and the disease outbreak.

COVID-19 was associated with negative sentiments, particularly fear, together with increased prejudice experienced by Asians across the world, commonly reported on public transportation and streets (47.1%) (Rzymski and Nowicki, 2020). A multicenter study identified Chinese women, youths, and people with lower education, with no permanent resident status and living in high-income countries, as groups more likely to experience discrimination and even violent overactions (He et al., 2020).

HIV studies revealed an association between disease-related discrimination and ethnicity, race or country of origin and sexuality (Men who have Sex with men (MSM) migrants) (Bil et al., 2019). Uncertainty of their rights and difficulties in general healthcare access were more likely experienced by migrants, mainly MSM, compared to non-migrants (Bil et al., 2019).

Only one ZIKV outbreak study was included (Kam, 2019), with disgust sensitivity, a "disease-avoidance mechanism", being the most prominent predictor of views on ZIKV among the US respondents. The study reported that participants believe foreign citizens should be banned until the breakout is over (20.8%) (Kam, 2019).

The 2014–2016 EVD epidemic in West Africa resulted in a rise in discrimination against African migrants worldwide, primarily those from Guinea, Serra Leone and Liberia (Stuermer et al., 2017; Earnshaw et al., 2019; Kim et al., 2016; Prati and Pietrantoni, 2016). Prejudice was positively associated to EVD risk perception and negatively linked to EVD knowledge levels, even when controlling for sociodemographic variables, as political preferences (Prati and Pietrantoni, 2016). Among the EVD studies, restrictive health policies supported by Western citizens, in the form of mandatory quarantine and/or closing borders for African migrants, were found in 75% of the papers (Stuermer et al., 2017; Earnshaw et al., 2019; Kim et al., 2016). EVD exacerbated preexisting prejudice towards African migrants, increasing support for exclusionary policies (Stuermer et al., 2017). A significant association was found between endorsement of conspiracy beliefs and reports of greater xenophobia, lower EVD knowledge and greater medical mistrust of medical organizations in 16% of an US residents study sample (Earnshaw et al., 2019). Furthermore, greater fear of EVD, lower intended care-seeking and lower quarantine support for EVD patients were also reported (Earnshaw et al., 2019). Another study revealed an association between increased EVD perceived vulnerability and increased xenophobia was moderated by individualism or collectivism (Kim et al., 2016). The relationship between increased xenophobia and increased vulnerability, was more pronounced among US participants displaying high individualism and low collectivism scores (Kim et al., 2016).

Three different Influenza A disease types, namely Swine Influenza A (H1N1) (Huang et al., 2011; Eicher et al., 2014), Avian Influenza A (H5N1) (Krings et al., 2012; Gilles et al., 2013; Eicher et al., 2014), and Asian Lineage Avian Influenza A (H7N9) (Goodwin and Sun, 2014), as well as seasonal flu were assessed (Huang et al., 2011). All the studies reported visible discrimination against foreigners, namely Asian migrants, in various ways. Three of these studies (60%) described foreigners as disease carriers, thus being socially stigmatized and avoided (Krings et al., 2012; Gilles et al., 2013; Eicher et al., 2014). Participants from the H7N9 study believed new migrants were the cause of the disease (23.1%), were at greater risk to contract the disease (37.7%), and thus avoided being physically close to them (17.1%) (Goodwin and Sun, 2014). Social representations about the origins and protection measures efficiency in the context of both swine and avian flu revealed that people with lower belief in a dangerous world scores will have a higher perception that official protection measures are effective (Eicher et al., 2014). Higher scores are linked to outbreaks explanation via hygienic origins, which are then related with out-group discrimination measures (Eicher et al., 2014). A positive association between perceived disease salience and beliefs in the efficiency of avoiding foreigners as protective measures was reported during an H5N1 outbreak (Krings et al., 2012). This association was moderated by attitudes toward foreigners. Participants holding less favorable social attitudes toward foreigners believed that foreigner avoidance could help prevent infection (Krings et al., 2012). Othering, in the form of out-group blame processes, was very likely to occur during an H5N1 outbreak (Gilles et al., 2013). People with increased germ aversion and supporting an hierarchical society view (social dominance orientation) attributed H5N1 human disease cases to foreign countries, particularly the Asian ones (86%) (Gilles et al., 2013). During an H1N1 and seasonal flu outbreaks, disease protective interventions, as vaccination and hand washing, along with its resulting perceived immunity, were capable of attenuating the association between disease concerns (disease threats, chronic germ aversion) and out-groups prejudice (Huang et al., 2011).

The MRSA emerging infectious disease has an impact on public concerns and is widely associated with 'dirty' National Health System (NHS) hospitals. This study blamed foreigners for MRSA spread in NHS hospitals, especially cleaners and nurses, as they were seen as disease carriers (Joffe et al., 2011).

The two SARS studies revealed increased discrimination levels toward Chinese migrants in the form of avoidance (16%), compulsory checking (~49%) and strict border control (28.1%), particularly by less educated respondents, as well as social stigma (18.6%), aiming to control and prevent SARS (Des Jarlais et al., 2006; Zheng et al., 2005).

All studies revealed different forms of discrimination and prejudice against international migrants. Most of these xenophobic tendencies were more prominent during a disease epidemic period (White, 2020; O'Neill, 2020). Depending on the infectious disease, different out-groups were negatively affected, with Asian migrants, mainly Chinese, being mostly associated to COVID-19 (He et al., 2020; Rzymski and Nowicki, 2020), MSM migrants to HIV (Bil et al., 2019), South/Central Americans to ZIKV (Kam, 2019), West African migrants to EVD (Stuermer et al., 2017; Earnshaw et al., 2019; Kim et al., 2016; Prati and Pietrantoni, 2016), Asians to Influenza A (Krings et al., 2012; Gilles et al., 2013; Huang et al., 2011; Goodwin and Sun, 2014; Eicher et al., 2014), non-Europeans to MRSA (Joffe et al., 2011), and East Asians to SARS (Des Jarlais et al., 2006; Zheng et al., 2005). Among the East Asians, in 25% of the studies the Chinese population was avoided, socially stigmatized and blamed, for instance, due to their perceived poor hygiene (He et al., 2020; Des Jarlais et al., 2006; Zheng et al., 2005; Goodwin and Sun, 2014).

Social discrimination or social exclusion were identified in half of the studies and were strongly associated to COVID-19 (He et al., 2020; Rzymski and Nowicki, 2020), ZIKV (Kam, 2019), H5N1 (Krings et al., 2012; Gilles et al., 2013; Eicher et al., 2014), SARS (Des Jarlais et al., 2006; Zheng et al., 2005), and partly to EVD (Stuermer et al., 2017; Kim et al., 2016). The most common and persistent xenophobia-related feelings identified within the studies were fear, worry, blame, and germ aversion, with a prevalence of more than 65% (Huang et al., 2011; Joffe et al., 2011; Des Jarlais et al., 2006; Zheng et al., 2005; Rzymski and Nowicki, 2020; Stuermer et al., 2017; Earnshaw et al., 2019; Prati and Pietrantoni, 2016; Eicher et al., 2014). More than half of the studies have also revealed that perceived vulnerability to disease and infection, and out-group avoidance were predominant factors (Krings et al., 2012; Gilles et al., 2013; Des Jarlais et al., 2006; Zheng et al., 2005; Rzymski and Nowicki, 2020; Kam, 2019; Stuermer et al., 2017; Kim et al., 2016; Goodwin and Sun, 2014; Eicher et al., 2014). Moreover, reduced healthcare-seeking and support for exclusionary health policies, as border control and quarantine requirement, were reported in more than one third of the studies (Bil et al., 2019; Des Jarlais et al., 2006; Kam, 2019; Stuermer et al.,

2017; Earnshaw et al., 2019; Kim et al., 2016), especially during EVD outbreaks.

(a) Detection of diverse health effects

Among the included studies, half reported the presence of health consequences experienced by the respondents, such as anxiety, psychological isolation and depressive symptoms (He et al., 2020; Des Jarlais et al., 2006; Zheng et al., 2005; Kam, 2019; Stuermer et al., 2017; Earnshaw et al., 2019; Kim et al., 2016; Goodwin and Sun, 2014). All these harmful health consequences are reported as resulting from discriminatory-driven behaviors emerging during an epidemic. The depressive symptoms described by Chinese migrants, either living in US or studying in Japan, during the SARS epidemic resulted in a significant psychosocial impact on their lives, often caused by blame and restrictive health policies (Des Jarlais et al., 2006; Zheng et al., 2005). Anxiety was reported in two studies and was greatly associated to disease threat and to xenophobic attitudes and behaviors (Kam, 2019; Goodwin and Sun, 2014). Neuroticism, was assessed as a proxy for individual-level anxiety, and was shown to significantly predict some ZIKV-related dependent variables, such as disease concern, travel refusal to ZIKV areas and ZIKV intervention assistance in US (Kam, 2019).

3.3. Quality assessment

The quality assessment is shown in Table S2 (Herzog et al., 2013). The average score among all studies was 8, meaning that, in general, most of the studies presented a good quality level. None of the studies was considered unsatisfactory (score of 4/10 or below). More than 80% of the studies were considered to have a good or very good level of methodological quality (Bil et al., 2019; He et al., 2020; Krings et al., 2012; Gilles et al., 2013; Des Jarlais et al., 2006; Zheng et al., 2005; Stuermer et al., 2017; Earnshaw et al., 2019; Goodwin and Sun, 2014; Eicher et al., 2014).

4. Discussion

To our knowledge, this is the first quantitative review of the impact of epidemics on xenophobia. Our review confirms the existence of high levels of xenophobia and associated outcomes during an infectious disease epidemic, together with adverse health effects among international migrants worldwide.

Our review clearly indicates that during times of epidemics/pandemics, these out-groups are repeatedly accused of being contagious disease carriers and blamed for spreading the disease to other countries, resulting in a rise in their anxiety levels (Faulkner et al., 2004; Devakumar et al., 2020a). Previous studies have shown these xenophobic tendencies may be due to several reasons, including a false perception of their unhygienic habits, deprived nutrition status triggered by their particular food choices, poor health practices and barriers to basic medical services (Faulkner et al., 2004; Mason, 2012; Mukumbang et al., 2020). The reality is that migrants are at increased risk of contracting a disease themselves, rather than being a risk to the local population, due to the poor conditions they often live in and lack of preventative healthcare (Abubakar et al., 2018). Moreover, migrants living and seeking protection in poor, marginalized and frequently violent urban areas are disproportionally affected by xenophobic attitudes and behaviors that are a threat to their own lives (Misago et al., 2015).

Furthermore, in addition to the pressure associated with the migration process, a close link has been reported between xenophobia and the adverse health outcomes experienced by these minoritized communities, either in the form of anxiety, fear, depression or psychological isolation (Agudelo-Suárez et al., 2011; Gkiouleka et al., 2018; Selvarajah et al., 2020). Different discriminatory attitudes and behaviors have emerged toward international migrants, according to the disease analyzed, and negative feelings have arisen, leading to an amplification of both existing and new inequities (Bambra et al., 2020). Moreover, through-

out history, the inequities emerged during different pandemics have led to increased rates of infection and mortality, mainly among deprived communities, with a higher focus in countries more socially unequal (Bambra et al., 2020).

Previous studies have described the development and tested xenophobia-based scales, namely a fear-based xenophobia measurement tool for attitudes assessment toward migrants (van der Veer et al., 2011, 2013). However, the quantification of this global phenomenon is still challenging and difficult.

In the last decades, several studies have highlighted the consequences of these stigmatizing tendencies during an infectious disease outbreak (Fischer et al., 2019). The main trends found were the emergence of critical inequalities (either health, economic, social, ethnic, racial, political) (Mukumbang et al., 2020; Bambra et al., 2020; Craig et al., 2017; Devakumar et al., 2020b), mandatory health screening specific to foreigners in some countries (Abubakar et al., 2018; Welshman, 2006), reduced healthcare access (Mukumbang et al., 2020; Abubakar et al., 2018), and poorer adherence to prescribed treatments (Abubakar et al., 2018; Craig et al., 2017).

Considering the recent COVID-19 outbreak, an evident increased number of acts of racial discrimination and xenophobia have been occurring towards Asian people, mostly Chinese, living in host countries (Devakumar et al., 2020a, 2020c). Furthermore, populations like Black, minority ethnic and migrant groups are also at great risk of being infected (Devakumar et al., 2020a). Fear of infection and violent overactions were common outcomes reported during this epidemic, together with social exclusion, different forms of prejudice and health inequalities, being in accordance with other studies describing distinct pandemics (Mukumbang et al., 2020; Bambra et al., 2020). Reports of disease-avoidance mechanisms through disgust feelings and perceived vulnerability to disease, ultimately leading to behavioral avoidance, were found to be xenophobic predictors during epidemics. These mechanisms mainly happen by avoiding the sick, protecting the homeland and closing the borders (Kam, 2019; Faulkner et al., 2004; Oaten et al., 2009). The implementation of exclusionary and restrictive policy practices have been systematically used during several outbreaks, namely EVD, aiming to control disease transmission (Emrick et al., 2016), and were shown to be associated more closely to pre-existing symbolic prejudice towards migrants, rather than to fear of infection (Stuermer et al., 2017). Furthermore, people with beliefs in sociocultural origins of EVD have the strongest feeling of symbolic threat against migrants, and will thus demonstrate an even higher support for restrictive health policies (Stuermer et al., 2017). Throughout these times, conspiracy beliefs endorsement, comparable to reports of mistrustful information by competent authorities or social media, led to a lower support of quarantine policies for migrants. Perceived vulnerability to disease is linked to a 'belief in a dangerous world', which in turn predicts prejudicial attitudes against particular out-groups (Faulkner et al., 2004). This suggests that a combination of individual differences in contextual conditions and ideological beliefs about group hierarchies are a requirement for the perception of disease threat as coming from "outside".

Moreover, xenophobic tendencies against out-groups, as well as the occurrence of anxiety and depression symptoms, have also been demonstrated in other infectious diseases, in non-outbreak scenarios, including tuberculosis (Craig et al., 2017) or leprosy (Somar et al., 2020).

4.1. Future measures to help fight the epidemic

Migrants are often scapegoated and blamed for increased rates of an infectious disease. This may be done by governments to divert from their own failings (Devakumar et al., 2020a). To successfully prevent and reduce the negative impact of epidemics on the well-being of migrant populations, it is urgent to accurately address the major xenophobia-related attitudes, behaviors, and outcomes, by taking into consideration past pandemic scenarios. These insights will aid in the development of social support interventions and preventive programmes in society,

aiming not only to increase the knowledge and awareness of society about xenophobic tendencies against migrants, but also to implement efficient public health measures and recommendations that can greatly improve the health of the disadvantaged communities mostly affected by the epidemics. Migrants access to equal healthcare services free of charge and to social security programmes should be immediately applied in the pandemic combat. As migrants are frequently scapegoated (Devakumar et al., 2020a), it is extremely important to condemn the false statements about them, demand for correct political rhetoric and educate the public, thus preventing prejudices from spreading and escalating. Moreover, the adoption of public health principles ensuring safety, equal treatment, and social support to all will give confidence to the local population and prevent migrants from being blamed.

4.2. Strengths and limitations

This study presents several strengths, including a rigorous and extensive search strategy through major scientific databases, together with the use of a reliable quality score assessment scale. Additionally, different disease outbreak types were included, allowing us to collect information on a wide range of discriminatory attitudes and behaviors against the study population.

However, our review also presents a few limitations that merit discussion. Only published original quantitative peer-reviewed research papers were included, with the majority being very heterogeneous. Moreover, it was difficult to establish a cross-comparison between the obtained data, since no standardized xenophobia measures were described, with almost all included studies relying on self-report. As we are not aware of any type of validated quantitative method to measure xenophobia, we recommend the development of a xenophobia questionnaire to be validated in different environments, aiming to obtain comparable results in different countries and distinct seasons. The comparison of migrant groups across diverse destination countries can sometimes lead to bias, as the majority will continue to have unmet health needs. The rather low number of studies included in this review demonstrates general issues in research on "international migrants" during infectious diseases outbreaks.

5. Conclusions

This study presents a comprehensive summary showing that xenophobia and prejudice directed towards migrants is common during infectious disease outbreaks. This constitutes a serious public health concern. It is urgent that societies adopt effective support strategies to combat xenophobia and structural forms of discrimination against migrants. Governments and public health authorities must guarantee the health, safety, and social inclusion of us all, namely by reducing the threats of infectious disease-related xenophobia. To achieve this, they must act to combat the stigma faced by these often marginalized and minoritized groups, improve knowledge and awareness in society about infectious diseases, and strengthen global healthcare services, especially during pandemics.

Declarations

Ethics approval and consent to participate.
Not applicable.
The authors declare the following financial interests/personal relationships which may be considered as potential competing interests:

Consent for publication

Not applicable.

Availability of data and materials

All data has been previously published.

Declaration of Competing Interest

The authors declare that they have no competing interests. The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

CRediT authorship contribution statement

Tânia M. Silva: Investigation, Data curation, Methodology, Formal analysis, Writing – review & editing, Writing – original draft. **Maria V. Cade:** Conceptualization, Investigation, Data curation, Methodology, Formal analysis, Writing – review & editing, Writing – original draft. **Adolfo Figueiras:** Writing – review & editing. **Fátima Roque:** Conceptualization, Writing – review & editing, Supervision. **Maria T. Herdeiro:** Conceptualization, Writing – review & editing, Supervision. **Delan Devakumar:** Conceptualization, Writing – review & editing, Supervision.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.jmh.2022.100085.

References

Abubakar, I., Aldridge, R.W., Devakumar, D., Orcutt, M., Burns, R., Barreto, M.L., et al., 2018. The UCL–Lancet Commission on migration and health: the health of a world on the move. Lancet 392, 2606–2654. doi:10.1016/S0140-6736(18)32114-7.

Agudelo-Suárez, A.A., Ronda-Pérez, E., Gil-González, D., Vives-Cases, C., García, A.M., Ruiz-Frutos, C., et al., 2011. The effect of perceived discrimination on the health of immigrant workers in Spain. BMC Public Health 11, 652. doi:10.1186/1471-2458-11-652.

Bil, J.P., Zuure, F.R., Alvarez-Del Arco, D., Prins, J.M., Brinkman, K., Leyten, E., et al., 2019. Disparities in access to and use of HIV-related health services in the Netherlands by migrant status and sexual orientation: a cross-sectional study among people recently diagnosed with HIV infection. BMC Infect. Dis. 19, 906. doi:10.1186/s12879-019-4477-2.

Bambra, C., Riordan, R., Ford, J., Matthews, F., 2020. The COVID-19 pandemic and health inequalities. J. Epidemiol. Commun. Health doi:10.1136/jech-2020-214401.

Craddock, S., 1995. Sewers and scapegoats: spatial metaphors of smallpox in nineteenth century San Francisco. Soc. Sci. Med. 41, 957–968. doi:10.1016/0277-9536(94)00409-M.

Cade M.V., Devakumar D., Silva T.M., Figueiras A., Roque F., Herdeiro M. Xenophobia during epidemics: a systematic review. reviewregistry912. Res Regist 2020. https://www.researchregistry.com/browse-the-registry#registryofsystematicreviewsmeta-analyses/registryofsystematicreviewsmeta-analysesdetails/5ecfd55073e6e400150ea599/ (accessed May 28, 2020).

Craig, G.M., Daftary, A., Engel, N., O'Driscoll, S., Ioannaki, A, 2017. Tuberculosis stigma as a social determinant of health: a systematic mapping review of research in low incidence countries. Int. J. Infect. Dis. 56, 90–100. doi:10.1016/j.ijid.2016.10.011.

Des Jarlais, D.C., Galea, S., Tracy, M., Tross, S., Vlahov, D., 2006. Stigmatization of newly emerging infectious diseases: AIDS and SARS. Am. J. Public Health 96, 561–567. doi:10.2105/AJPH.2004.054742.

Devakumar, D., Bhopal, S.S., Shannon, G., 2020a. COVID-19: the great unequaliser. J. R. Soc. Med. 113, 234–235. doi:10.1177/0141076820925434.

Devakumar, D., Selvarajah, S., Shannon, G., Muraya, K., Lasoye, S., Corona, S., et al., 2020b. Racism, the public health crisis we can no longer ignore. Lancet 395, e112–e113. doi:10.1016/S0140-6736(20)31371-4.

Devakumar, D., Shannon, G., Bhopal, S.S., Abubakar, I., 2020c. Racism and discrimination in COVID-19 responses. Lancet 395, 1194. doi:10.1016/S0140-6736(20)30792-3.

Eisinger, R.W., Fauci, A.S., 2018. Ending the HIV/AIDS pandemic1. Emerg. Infect. Dis. 24, 413–416. doi:10.3201/eid2403.171797.

Earnshaw, V.A., Bogart, L.M., Klompas, M., Katz, I.T., 2019. Medical mistrust in the context of Ebola: implications for intended care-seeking and quarantine policy support in the United States. J. Health Psychol. 24, 219–228. doi:10.1177/1359105316650507.

Eicher, V., Clemence, A., Bangerter, A., Mouton, A., Green, E.G.T., Gilles, I, 2014. Fundamental beliefs, origin explanations and perceived effectiveness of protection measures: exploring laypersons' chains of reasoning about influenza. J. Commun. Appl. Soc. Psychol. 24, 359–375. doi:10.1002/casp.2170.

Emrick, P., Gentry, C., Morowit, L., 2016. Ebola virus disease: international perspective on enhanced health surveillance, disposition of the dead, and their effect on isolation and quarantine practices. Disaster Mil. Med. 2, 13. doi:10.1186/s40696-016-0023-6.

Fischer, L.S., Mansergh, G., Lynch, J., Santibanez, S., 2019. Addressing disease-related stigma during infectious disease outbreaks. Disaster Med. Public Health Prep. 13, 989–994. doi:10.1017/dmp.2018.157.

Fan, W., Qian, Y., Stigma, Jin Y., 2021. Perceived discrimination, and mental health during China's COVID-19 outbreak: a mixed-methods investigation. J. Health Soc. Behav. 62, 562–581. doi:10.1177/00221465211040550.

Faulkner, J., Schaller, M., Park, J.H., Duncan, L.A., 2004. Evolved disease-avoidance mechanisms and contemporary xenophobic attitudes. Gr. Process. Intergr. Relat. 7, 333–353. doi:10.1177/1368430204046142.

Gilles, I., Bangerter, A., Clémence, A., Green, E.G.T., Krings, F., Mouton, A., et al., 2013. Collective symbolic coping with disease threat and othering: a case study of avian influenza. Br. J. Soc. Psychol. 52, 83–102. doi:10.1111/j.2044-8309.2011.02048.x.

Goodwin, R., Sun, S., 2014. Early responses to H7N9 in southern Mainland China. BMC Infect. Dis. 14. doi:10.1186/1471-2334-14-8.

Gkiouleka, A., Avrami, L., Kostaki, A., Huijts, T., Eikemo, T.A., Stathopoulou, T., 2018. Depressive symptoms among migrants and non-migrants in Europe: documenting and explaining inequalities in times of socio-economic instability. Eur. J. Public Health 28, 54–60. doi:10.1093/eurpub/cky202.

Hoppe, T, 2018. "Spanish Flu": when infectious disease names blur origins and stigmatize those infected. Am. J. Public Health 108, 1462–1464. doi:10.2105/AJPH.2018.304645.

Huang, J., Liu, R., 2020. Xenophobia in America in the age of coronavirus and beyond. J. Vasc. Interv. Radiol. 31, 1187–1188. doi:10.1016/j.jvir.2020.04.020.

Herzog, R., Álvarez-Pasquin, M.J., Díaz, C., Del Barrio, J.L., Estrada, J.M., Gil, Á., 2013. Are healthcare workers' intentions to vaccinate related to their knowledge, beliefs and attitudes? a systematic review. BMC Public Health 13, 154. doi:10.1186/1471-2458-13-154.

He, J., He, L., Zhou, W., Nie, X., He, M., 2020. Discrimination and social exclusion in the outbreak of COVID-19. Int. J. Environ. Res. Public Health 17. doi:10.3390/ijerph17082933.

Huang, J.Y., Sedlovskaya, A., Ackerman, J.M., Bargh, J.A., 2011. Immunizing against prejudice: effects of disease protection on attitudes toward out-groups. Psychol. Sci. 22, 1550–1556. doi:10.1177/0956797611417261.

International Organization for Migration (IOM) n.d. https://www.iom.int/key-migration-terms (accessed May 21, 2020).

Jones, K.E., Patel, N.G., Levy, M.A., Storeygard, A., Balk, D., Gittleman, J.L., et al., 2008. Global trends in emerging infectious diseases. Nature 451, 990–993. doi:10.1038/nature06536.

Johnson, J.L., Bottorff, J.L., Browne, A.J., Grewal, S., Hilton, B.A., Clarke, H., 2004. Othering and being othered in the context of health care services. Health Commun. 16, 255–271. doi:10.1207/S15327027HC1602_7.

Joffe, H., Washer, P., Solberg, C., 2011. Public engagement with emerging infectious disease: the case of MRSA in Britain. Psychol. Health 26, 667–683. doi:10.1080/08870441003763238.

Krings, F., Green, E.T., Bangerter, A., Staerklé, C., Clémence, A., Wagner-Egger, P., et al., 2012. Preventing contagion with avian influenza: disease salience, attitudes toward foreigners, and avoidance beliefs. J. Appl. Soc. Psychol. 42, 1451–1466. doi:10.1111/j.1559-1816.2012.00907.x.

Kam, C.D., 2019. Infectious disease, disgust, and imagining the other. J. Political 81, 1371–1387. doi:10.1086/704438.

Kim, H.S., Sherman, D.K., Updegraff, J.A., 2016. Fear of Ebola: the influence of collectivism on xenophobic threat responses. Psychol. Sci. 27, 935–944. doi:10.1177/0956797616642596.

Maran, R., 2002. A report from the United Nations World Conference against racism, racial discrimination, xenophobia, and related intolerance, Durban, South Africa, 2001. Soc. Justice 29, 177–185.

Mason, K.A., 2012. Mobile migrants, mobile germs: migration, contagion, and boundary-building in Shenzhen, China after SARS. Med. Anthropol. 31, 113–131. doi:10.1080/01459740.2011.610845.

Mukumbang, F.C., Ambe, A.N., Adebiyi, B.O., 2020. Unspoken inequality: how COVID-19 has exacerbated existing vulnerabilities of asylum-seekers, refugees, and undocumented migrants in South Africa. Int. J. Equity Health 19, 141. doi:10.1186/s12939-020-01259-4.

Misago, J.P., Freemantle, I., Landau L.B. Protection from xenophobia: an evaluation of UNHCR's Regional Office for Southern Africa's Xenophobia Related Programmes 2015. https://www.unhcr.org/research/evalreports/55cb153f9/protection-xenophobia-evaluation-unhcrs-regional-office-southern-africas.html (accessed September 25, 2020).

Navarrete, C.D., Fessler, D.M.T., 2006. Disease avoidance and ethnocentrism: the effects of disease vulnerability and disgust sensitivity on intergroup attitudes. Evol. Hum. Behav. 27, 270–282. doi:10.1016/j.evolhumbehav.2005.12.001.

O'Neill C. The "othering" of disease: xenophobia during past pandemics n.d. https://www.wiley.com/network/featured-content/the-othering-of-disease-xenophobia-during-past-pandemics (accessed September 22, 2020).

Oaten, M., Stevenson, R.J., Case, T.I., 2009. Disgust as a disease-avoidance mechanism. Psychol. Bull. 135, 303–321. doi:10.1037/a0014823.

PRISMA Statement-Checklist 2022.

Prati, G., Pietrantoni, L., 2016. Knowledge, risk perceptions, and xenophobic attitudes: evidence from Italy during the Ebola outbreak. Risk Anal. 36, 2000–2010. doi:10.1111/risa.12537.

Rzymski, P., Nowicki, M., 2020. COVID-19-related prejudice toward Asian medical students: a consequence of SARS-CoV-2 fears in Poland. J. Infect. Public Health 13, 873–876. doi:10.1016/j.jiph.2020.04.013.

Schaller, M., Murray, D.R., Bangerter, A., 2015. Implications of the behavioural immune system for social behaviour and human health in the modern world. Philos. Trans. R. Soc. B Biol. Sci. 370, 20140105. doi:10.1098/rstb.2014.0105.

Sylvia Chou, W.Y., Gaysynsky, A, 2021. Racism and xenophobia in a pandemic: interactions of online and offline worlds. Am. J. Public Health 111, 773–775. doi:10.2105/AJPH.2021.306230.

Stuermer, S., Rohmann, A., Mazziotta, A., Siem, B., Barbarino, M.L., 2017. Fear of infection or justification of social exclusion? The symbolic exploitation of the ebola epidemic. Political Psychol. 38, 499–513. doi:10.1111/pops.12354.

Selvarajah, S., Deivanayagam, T.A., Lasco, G., Scafe, S., White, A., Zembe-Mkabile, W., et al., 2020. Categorisation and minoritisation. BMJ Glob. Health 5, e004508. doi:10.1136/bmjgh-2020-004508.

Somar, P., Waltz, M., van Brakel, W., 2020. The impact of leprosy on the mental wellbeing of leprosy-affected persons and their family members – a systematic review. Glob. Ment. Health 7, e15. doi:10.1017/gmh.2020.3.

van der Veer, K., Yakushko, O., Ommundsen, R., Higler, L., 2011. Cross-national measure of fear-based xenophobia: development of a cumulative scale. Psychol. Rep. 109, 27–42. doi:10.2466/07.17.PR0.109.4.27-42.

van der Veer, K., Ommundsen, R., Yakushko, O., Higler, L., Woelders, S., Hagen, K.A., 2013. Psychometrically and qualitatively validating a cross-national cumulative measure of fear-based xenophobia. Qual. Quant. 47, 1429–1444. doi:10.1007/s11135-011-9599-6.

White, A.I.R., 2020. Historical linkages: epidemic threat, economic risk, and xenophobia. Lancet 395, 1250–1251. doi:10.1016/S0140-6736(20)30737-6.

Welshman, J., 2006. Tuberculosis, migration, and medical examination: lessons from history. J. Epidemiol. Commun. Health 60, 282–284. doi:10.1136/jech.2005.038604.

Yuan, K., Huang, X.L., Yan, W., Zhang, Y.X., Gong, Y.M., Su, S.Z., et al., 2021. A systematic review and meta-analysis on the prevalence of stigma in infectious diseases, including COVID-19: a call to action. Mol. Psychiatry doi:10.1038/s41380-021-01295-8.

Zheng, G., Jimba, M., Wakai, S., 2005. Exploratory study on psychosocial impact of the severe acute respiratory syndrome (SARS) outbreak on Chinese students living in Japan. Asia Pac. J. Public Health 17, 124–129. doi:10.1177/101053950501700211.