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Impact of H1N1 on socially disadvantaged populations: summary of a systematic review

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Background Previous reviews found that the H1N1 pandemic was associated with a large proportion of hospitalizations, severe illness, workplace absenteeism, and high costs. However, the burden among socially disadvantaged groups of the population is unclear. This is a summary of a previously published systematic review commissioned by the World Health Organization on the burden of H1N1 pandemic (influenza A/Mexico/2009 (H1N1)) among socially disadvantaged populations.

Methods MEDLINE and EMBASE were searched to identify studies reporting hospitalization, severe illness, and mortality attributable to the 2009 H1N1 pandemic among socially disadvantaged populations, including ethnic minorities and low-income or lower-middle-income economy countries (LIC/LMIC). SAS and Review Manager were used to conduct random effects meta-analysis.

Results Forty-eight cohort studies and 14 companion reports including 44 777 patients were included after screening 787 citations and 164 full-text articles. Twelve of the included studies provided data on LIC/LMIC, including one study from Guatemala, two from Morocco, one from Pakistan, and eight from India, plus four companion reports. The rest provided data on ethnic minorities living in high-income economy countries (HIC). Significantly more hospitalizations were observed among ethnic minorities versus nonethnic minorities in two North American studies [1313 patients, odds ratio (OR) 2·26 (95% confidence interval: 1·53–3·32)]. Among hospitalized patients in HIC, statistically significant differences in intensive care unit admissions (n = 8 studies, 15 352 patients, OR 0·84 [0·69–1·02]) and deaths (n = 6 studies, 14 757 patients, OR 0·85 [95% CI: 0·73–1·01]) were not observed.

Conclusion We found significantly more hospitalizations among ethnic minorities versus nonethnic minorities in North America, yet no differences in intensive care unit admissions or deaths among H1N1-infected hospitalized patients were observed in North America and Australia. Our results suggest a similar burden of H1N1 between ethnic minorities and nonethnic minorities living in HIC.

Keywords Ethnic minority, H1N1 subtype, influenza A, low-income country, low-middle-income country, vulnerable populations.

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Introduction

Previous studies found that the H1N1 pandemic was associated with a large proportion of hospitalizations, severe illness, workplace absenteeism, and high costs.[1–4] However, the burden among socially disadvantaged groups of the population is unclear. Our research team was commissioned by the World Health Organization (WHO) Global Influenza Programme (GIP) to conduct a systematic review on the burden of H1N1 pandemic (influenza A/Mexico/2009 (H1N1)) among socially disadvantaged populations. The research question that guided the systematic review was 'what is the evidence that the burden of H1N1 was associated with social disadvantage?' The results of this study were recently published in *PLoS One*.[5] Here, we present a summary of our methods and findings.

Methods

Literature searches were developed and executed by an experienced librarian (Perrier) with input from the research team in MEDLINE and EMBASE from 2009 until July 25, 2011. We also conducted targeted searching in PubMed for relevant studies from low-income and lower-middle-income economy countries (LIC/LMIC), as classified by the World Bank.[6] In addition, we hand-searched the Eurosurveillance Journal and the Centers for Disease Control and Prevention (CDC) Morbidity and Mortality Weekly Report, scanned the reference lists of included studies or relevant reviews,[7–9] contacted authors of conference proceeding abstracts, and asked GIP members if they were aware of potentially relevant studies.

Studies were included if they reported the burden (defined as proportions of patients who were hospitalized, had severe

illness, or died) among socially disadvantaged populations infected with laboratory-confirmed influenza A/Mexico/2009 (H1N1). The types of social disadvantage that were of interest to the WHO included ethnic minorities, persons of low socioeconomic status, groups without access or disproportionate access to health care, and those living in LIC/LMIC. The literature search results were screened by two independent reviewers at the citation (title and abstract) and full-text levels. Discrepancies were resolved through team discussion.

Two reviewers independently abstracted data on study characteristics, patient characteristics, outcomes, and appraised methodological quality using the Newcastle Ottawa Scale (NOS).[10] We contacted authors for further information as needed, and in the instance of companion reports (when multiple studies reported H1N1 data from the same patient population), only one study was chosen as the major publication.

We reported descriptive results (i.e., study and patient characteristics) and conducted a random effects meta-analysis.[11] Methodological, clinical, and statistical (e.g., I^2 statistic[12]) heterogeneity were assessed. Analyses were conducted in SAS (SAS 9.1 software, SAS Institute Inc., Cary, NC, USA) and Review Manager version 5.[13]

Results

After screening 787 titles and abstracts and 164 full-text articles, 48 cohort studies plus 14 companion reports met eligibility criteria and were included.[14–73] These studies examined H1N1 between March 1, 2009 and October 24, 2010, and the most common factor of social disadvantage reported was ethnic minority status (36/48 studies), except in 12 studies that considered H1N1-infected patients from LIC/LMIC, which were analyzed separately for each country (one study from Guatemala,[57] two from Morocco,[58,59] one from Pakistan,[73] and eight from India, plus four companion reports).[60–71]

The methodological quality was generally low across studies. Exceptions were that 10 studies did not use a representative sample[15,24,30,36,38,42,51,62,72] and four studies included patients who were severely ill, hospitalized, or dead at the beginning of the study. In addition, only 13 studies controlled for comorbidities[17,24,27,34,36,41,42,49,51,53,54,56] and 18 studies did not report their follow-up rate or had a withdrawal rate of 10% or greater.[16,17,24,38,41,49,51,53,55,58,60–62,65,66,72,73]

The outcome of hospitalization was reported in 24 studies.[19–21,23,25,27,31,32,34–40,43–45,49,52,54–56] Two studies reported hospitalizations among ethnic minorities compared to nonethnic minorities in high-income economy countries (HIC), and a significantly greater proportion of ethnic minority patients were hospitalized versus nonethnic minority patients (OR 2·26, 95% CI: 1·53–3·32, Table 1).[20,29] All LIC/LMIC studies reported hospitalization data, and the prevalence ranged from 11% in Morocco[59] to 45% in India.[65]

Severe illness [defined as intensive care unit (ICU) admission, pneumonia, or respiratory failure] was reported in 19 studies.[14,16,20,21,23,25,36,37,41,42,44–46,52–55] Ethnic minorities did not have a statistically significant increased risk of ICU admission in an Australian study (OR 0·24, 95% CI: 0·05–1·20),[36] yet a Canadian study observed a significantly greater proportion of ICU admissions among ethnic minorities (OR 2·76, 95% CI: 1·45–5·23).[20] The proportion of ICU admissions among H1N1-infected ranged from 0% in Morocco[59] to 9% in Guatemala.[57]

Ethnicity data regarding the proportion of patients admitted to the ICU among those hospitalized in HIC were provided in eight studies,[20,21,25,37,44,52,55] and no statistically

Table 1. Meta-analysis results for ethnic minorities versus nonethnic minorities living in high-income economy countries

Meta-analysis	Number of studies	Number of patients	I^2	Pooled odds ratio, 95% confidence interval
Hospitalizations among ethnic minorities versus nonethnic minorities in North America[20,29]	2	1313	28%	2·26 (1·53–3·32)*
ICU admissions among hospitalized ethnic minorities versus nonethnic minorities[20,21,25,37,44,52,55]	8	15,352	51%	0·84 (0·69–1·02)
Mortality among hospitalized ethnic minorities versus nonethnic minorities[19,21,25,37,44]	6	14,757	0%	0·85 (0·73–1·01)

ICU, intensive care unit.
*statistically significant.

significant differences between ethnic minority and nonethnic minority patients were observed (OR 0·84, 95% CI: 0·69–1·02, Table 1). In India, the pooled prevalence of ICU admission was 34% among hospitalized adults (95% CI: 0–79%)[61,63] and 30% among hospitalized children (95% CI: 20–40%).[62,72]

Mortality was reported in 15 studies.[15,17,19,21,24,25,27,30,33,36,37,44,51] In six of the studies, the proportion of deaths among hospitalized patients was reported by ethnicity and no statistically significant differences were observed between ethnic minority and nonethnic minority patients (OR 0·85, 95% CI: 0·73–1·01, Table 1).[19,21,25,37,44] In India, the pooled prevalence of deaths was 15% among hospitalized adults (95% CI: 7–23%)[60,61,63,66,67] and 8% among hospitalized children (95% CI: 2–13%).[62,72]

Discussion

There are some limitations to the process of our systematic review. These include that some studies were excluded because they did not report outcomes by ethnicity or did not solely include laboratory-confirmed H1N1 influenza–infected patients. Furthermore, we may have missed unpublished studies (although we did contact authors to obtain unpublished studies and included two unpublished studies J Jung, RJL Fowler *et al.* and J Louie, S Yang) and we were unable to identify studies examining other types of social disadvantage, including groups without access or disproportionate access to health care and low socioeconomic status. The quality of the included studies would be improved if the total number of individuals with H1N1 and the number of withdrawals were reported and if the analysis was adjusted for confounding variables.

Our results suggest a high burden of H1N1 across LIC/LMIC and HIC, which are consistent with previous reviews on the global burden of H1N1.[7] We found significantly more hospitalizations among ethnic minorities versus nonethnic minorities in North America, yet no statistically significant differences in ICU admissions or deaths among H1N1-infected hospitalized patients were observed in North America and Australia. Our results might be explained by confounding, yet our analysis of some confounders (comorbidity, obesity, pregnancy) showed no statistically significant increase in these H1N1 risk factors for ethnic minorities compared to nonethnic minorities. They may also be explained by biased sampling or testing of individuals in the included studies. Another reason might be that H1N1 pandemic was a different type of virus; surprisingly, the majority of cases occurred among healthy young- to middle-aged adults.[7,8] Overall, these results suggest a similar burden of H1N1 between ethnic minorities and nonethnic minorities living in HIC.

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Conflict of interest

ACT has been a paid consultant to examine cross-protection of non-influenza vaccine types for GlaxoSmithKline. The other authors have nothing to declare.

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