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How patterns of migration can influence the heterosexual transmission of HIV in the Netherlands

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ABSTRACT

Objectives Migrants originating from countries with high HIV prevalence account for a large number of heterosexually acquired HIV infections in Western European countries. These migrants may be infected before migrating and they may engage in unsafe sexual practices both in the country of residence and in their country of origin. We investigate how patterns of migration may affect the heterosexual HIV epidemic in the Netherlands.

Methods A mathematical model was used that describes the transmission of HIV in heterosexual partnerships between African migrants, Caribbean migrants, and the local Dutch population. Infection of migrants before migrating to the Netherlands and during trips to their country of origin was also accounted for.

Results The incidence of HIV infection among adult heterosexuals in 2010 was 1.50 new infections per 100,000 individuals per year. If the number of migrants entering the country increases, then the incidence of HIV will increase, although this change among Dutch will be negligible. Moreover, if HIV prevalence among those migrating to the Netherlands (at the time of entry to the country) is higher, then the incidence in the respective ethnic group will increase; among the other ethnic groups, the increase will be very small.

Conclusions Heterosexual transmission of HIV in the Netherlands occurs mostly within migrant communities. Limiting migration and introducing travel restrictions would likely have no effect on HIV incidence in countries with low HIV prevalence among heterosexuals. Policy making should focus on targeted interventions, to reduce the burden of disease in migrant communities in Europe.

Key words: Mathematical model, HIV incidence, heterosexuals, migrants.

INTRODUCTION

In many western European countries, heterosexually acquired HIV infections are frequently found among migrants from countries with high HIV prevalence.[1-3] Migrants may already be infected when they enter the country. Also, they may engage in unsafe sexual practices in the country of residence and in their country of origin, while visiting family and friends.[4,5] Mathematical modelling indicates that HIV infection during visits of migrants to their home country is very rare and that after migration transmission occurs mostly within migrant communities.[6] However, patterns of migration may change, for instance due to war, unstable political situations, or due to changing policy regulations about immigration, resulting in restricting or broadening flows of migration. To investigate how such changes may affect HIV incidence, we use a mathematical model that describes the spread of HIV via heterosexual partnerships between migrants and locals. The model is parameterised using data from the Netherlands, serving as example for high income countries with migration from HIV endemic areas.

METHODS

The model is described elsewhere in detail.[6] The modelled population includes all sexually active adult heterosexuals, 15-69 years old, stratified into three ethnic subpopulations: African migrants, Caribbean migrants, and the remaining "general" Dutch population (here called 'Dutch'). The group of migrants comprises of first and second generation migrants. Individuals get infected via sexual contacts in the Netherlands; migrants may also get infected during trips to their country of origin or they may be already infected at the time of entry to the Netherlands. Parameters relating to sexual behaviour were estimated from several Dutch studies. [7-9] In the results, the initial prevalence of HIV was 3.5% for Africans, 0.5% for Caribbeans, and 0.05% for Dutch natives.[10] Complete description of the data sources and the parameter values is given in [6].

RESULTS

From the model, the incidence of HIV among heterosexuals is estimated at 1.50 new infections per 100,000 individuals per year in 2010 (infections occurring via sexual contacts in the Netherlands or during trips of migrants to their home country).[6] Within each ethnic subpopulation, the incidence is 67.18 new infections per 100,000 African migrants, 12.12 per 100,000 Caribbean migrants, and 0.47 per 100,000 Dutch individuals.

Figure 1a shows the incidence of HIV in 2020 if the number of migrants entering the country changes (assuming that the number of second generation migrants remains constant). HIV incidence among migrants increases with the number of new migrants entering the country, although the increase is not large; for instance, among African migrants incidence increases from 65 to 66.5 new infections per 100,000, if the number of new migrants increases from 3000 to 6000. Among Dutch residents, the increase is very small (from 0.392 to 0.405 per 100,000, if the number of migrants entering the country increases from 0 to 6000 – Figure S1 in Appendix). Figure 1b shows that if the prevalence of HIV among those migrating to the Netherlands increases, then the incidence in the respective ethnic group will be considerably higher; in the other ethnic groups, however, there will be only a minor increase (Figure 1b and Figure S2 in Appendix).

In Figure 1c,d it is shown how the incidence of HIV is affected by changes in the duration of stay of African migrants. The incidence among Africans (black line) declines with increasing duration of stay. This is rather surprising because one might expect that the longer migrants stay in the country, the more (different) partners they have and hence more chances to get infected and/or to infect others. Indeed, the actual number of new infections (grey columns) does increase with increasing duration of stay. However, the size of the African community also increases with increasing duration of stay (black columns) and faster than the number of new HIV infections, resulting in a decreasing incidence. In contrast, in the non-African subpopulations, the incidence increases with the duration of stay of African migrants (Figure 1d), since the size of these communities remains constant but there are more new infections. Similar results are obtained by changing the duration of stay of Caribbean migrants: the

incidence in their own subpopulation decreases with increasing duration of stay, while the incidence in the other two subpopulations increases; the size of the Caribbean community also increases (results not shown here).

DISCUSSION

We show that changes in patterns of migration can have a considerable impact within the migrant communities living in high income countries like the Netherlands, but they hardly affect the incidence of HIV among heterosexuals in the local population. Consequently, the impact on the overall heterosexual population is minor, due to the small size of the migrant communities compared to that of the local population. Higher numbers of migrants entering the country or higher prevalence among those migrating will result in higher incidence within migrant communities. If migrants stay longer (before returning to their country or moving to another country), then there will be more new infections within their own community, but the incidence will decline, due to the increasing size of the respective migrant community. It should be stressed that these results were obtained using the same duration of stay for first and second generation migrants, because these two subgroups are not distinguished in the model (after entering the population). However, differences between first and second generation migrants have been documented in the Netherlands; for instance, second generation migrants report more sexual mixing with the Dutch than first generation migrants.[6] The model can be extended to include such differences and investigate their impact on the spread of HIV. Also it would be interesting to examine the impact of re-entrance of migrants (departing from their country of residence and returning after several years) and the importance of co-infections with other sexually transmitted infections.

In conclusion, migrants originating from high-endemic countries will not easily cause considerable increases in HIV incidence in low-endemic countries. Unstable political conditions in a country with high HIV prevalence resulting in new flows of refugees or migrants to Europe are unlikely to pose a threat for an increasing HIV incidence among the local population.

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Competing interests

None.

Author contributions

Maria Xiridou developed and analysed the model and drafted the paper. Maaïke van Veen analysed the epidemiological data and obtained parameter estimates for sexual behaviour. Roel Coutinho and Maria Prins contributed to the study design and the interpretation of the results. All authors contributed to the preparation of the manuscript.

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Figure 1: The impact of migration on HIV incidence, shown as number of new infections in 2020 per 100,000 individuals of the respective ethnic group. (a) The incidence of HIV among African migrants (solid line; values shown on left vertical axis) and among Caribbean migrants (dashed line; values shown on right vertical axis), calculated with different numbers of first generation migrants entering the population, as shown on the horizontal axis. (b) HIV incidence among African migrants, calculated with different levels of HIV prevalence (%) among those migrating to the Netherlands (at the time of entry to the country): horizontal axis shows prevalence among Africans at entry; the three lines correspond to different prevalence among Caribbeans at entry, 6% (solid line), 3% (dashed line), 0.5% (dotted line). The incidence among Caribbean migrants, among Dutch, and in the whole heterosexual population is shown in the Appendix. (c) HIV incidence among Africans (black line); number of African migrants living in the Netherlands, in thousands (black columns); and number of newly infected Africans (grey columns). (d) HIV incidence among Dutch (dashed line) and among Caribbean migrants (solid line). The horizontal axes in (c) and (d) show the duration of stay (in years) of African migrants in the Netherlands.

