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MRSA in the United States, Sweden, and Syria

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OBJECTIVES

The objectives of this study were to compare the colonization and prevalence rates in the nations of the United States, Sweden and Syria, with each country being representative of different demographics and treatment methods and to analyze the healthcare practices of each nation, specifically the rates at which each nation prescribes specific broad and narrow-spectrum antibiotics. Also, this study aimed to assess the refugee crisis, which has caused a massive migration of Syrians to Sweden, to make inquiries regarding the state of MRSA in nations like Sweden. The culmination of this research is the question does the way the United States prescribes antibiotics allow for more MRSA infections to occur and what future practices can be used to help make MRSA a less dangerous pathogen in all demographics?

METHODS

This was primarily a study which synthesized data from various reports and resources to form a coherent overview of MRSA infection patterns and propose further research methods for future studies. To represent various demographics and methods of MRSA treatment three nations were chosen. Sweden and the United States were identified as developed nations with similar wealth and MRSA colonization rates but different prevalence (7, 8). Syria was chosen to be compared to the United States and Sweden because it has a high documented MRSA colonization rate and is the source of large numbers of refugees who are fleeing to countries like Sweden (4, 8). Studies were then reviewed that documented several aspects of the MRSA threat in these nations, including methods of testing, diagnosis and treatment. The data obtained was interpreted so that conclusions could be drawn and further research objectives could be proposed.
RESULTS AND FIGURES

Table 1. Background information on demographics and economics in United States, Sweden and Syria (8).

<table>
<thead>
<tr>
<th>Nation</th>
<th>Population (millions)</th>
<th>GDP Per Capita (USD)</th>
<th>Poverty Rate</th>
<th>Life Expectancy (years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>USA</td>
<td>325.7</td>
<td>57,468</td>
<td>12.70%</td>
<td>78.74</td>
</tr>
<tr>
<td>Sweden</td>
<td>9.903</td>
<td>51,599</td>
<td>7.00%</td>
<td>82.55</td>
</tr>
<tr>
<td>Syria</td>
<td>18.43</td>
<td>2,058</td>
<td>80%</td>
<td>70.09</td>
</tr>
</tbody>
</table>

Table 2. The effects of the Syrian Civil War (7, 8).

<table>
<thead>
<tr>
<th>Pre-Civil War Population</th>
<th>Post-Civil War Population</th>
<th>Internally Displaced</th>
<th>International Refugees</th>
<th>Refugees in Sweden</th>
</tr>
</thead>
<tbody>
<tr>
<td>21,020,000</td>
<td>18,430,000</td>
<td>6,000,000</td>
<td>5,000,000</td>
<td>116,384</td>
</tr>
</tbody>
</table>
Figure 1. Colonization of MRSA by nation.
MRSA colonization rates were based on official statistics presented by the CDC and CDDEP in the case of the United States and Sweden. The colonization rate for Syria was acquired by using congruent first hand studies and cross-referencing the rates found with known rates of colonization amongst well documented Syrian refugee populations in other countries. (4, 5, 6).

Figure 2. Prevalence of MRSA in the United States and Sweden.
The United States displays a MRSA prevalence of 2.6 infections per 10,000 people. Sweden has 0.3 MRSA infections per 10,000 people equating to a rate that is 8 times lower than the United States’ despite similar colonization rates (3, 6).
It was found that the United States and Sweden are on par in terms of wealth and MRSA colonization rate (2-4%). Syria, for various reasons, possesses a much higher colonization rate (15-20%) meaning that its population comes in contact with MRSA much more frequently (4, 7). Despite similarities, people in the United States are eight times as likely to develop a MRSA infection than people in Sweden (3, 6). Syria also has a problem with the availability and misuse of antibiotics that contributes to high colonization and infection rates of MRSA and other pathogens (1). The United States prescribes broad-spectrum antibiotics at much higher rates than Sweden does which would indicate that patients in the United States are subject to more depleted normal flora (7). Conversely, Sweden prescribes narrow-spectrum antibiotics at rates that far surpass the United States and Syria (7). Syrians are moving to Sweden in the midst of a refugee crisis at unprecedented rates (7, 8).

**DISCUSSION**

The United States and Sweden are similar enough in terms of wealth and development that it can be expected that they would have access to the same quality healthcare facilities, education and techniques that other countries, like Syria, may not be able to access for varying circumstances (8). It may be theorized that the difference in rates of infection between the United States and Sweden is a partial product of the way antibiotics are used in each country. The United States’ high use of broad-spectrum treatments would mean that patients in the United States are more likely to have significant portions of their normal flora inhibited (7). Since MRSA is opportunistic, patients with compromised normal flora are prime targets for infection (2). In stark contrast, Sweden’s high prescription rate of narrow-spectrum antibiotics is indicative of

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**Figure 3. Antibiotic prescription trends in Sweden and the United States.**

Broad-spectrum antibiotic prescription rates are much higher in the United States than in Sweden. In contrast, Sweden prescribes narrow-spectrum antibiotics at a much higher rate (6). Syria (not shown) has rates of prescription which are hard to quantify as antibiotics are often unavailable, used incorrectly or recycled from past infections (1).
increased antibiotic susceptibility testing (7). Prescribing antibiotics with mechanisms of action for specific infections rather than indiscriminately attacking pathogenic and normal flora is likely a contributing factor to Sweden’s low MRSA infection prevalence. While reliable data on MRSA in Syria is harder to obtain, the trend is clear that the sociopolitical conditions of the country are exacerbating the problems of MRSA. The worldwide migration trend of Syrians to other countries should be watched closely and provides new avenues for healthcare service and research as it pertains to MRSA and proper antibiotics use.

IMPLICATIONS FOR FUTURE STUDY

1. Further study on the methods of antibiotic susceptibility testing in Sweden and the United States should be conducted. Can effective methods be translated into a setting in an underserved area like Syria?

2. Tracking the immigration and MRSA colonization rates amongst Syrian refugees and the European countries they enter.

3. This study neglected to analyze the cost-effectiveness of antibiotic susceptibility testing in most cases and further research should focus on the economics of prescribing and testing.
REFERENCES:

5. The Centers for Disease Control and Prevention (CDC, 2016). (Centers for Disease Control and Prevention [CDC], 2016).
7. UN Office for the Coordination of Humanitarian Affairs. (Feb. 16, 2016).