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Medical tourists – a source of imported pathogens? A review of *Methicillin-Resistant Staphylococcus aureus (MRSA)*- and *Multiresistant Gram-negative bacteria (MRGN)*-admission screenings in Arab and Russian medical tourists at University Hospital Düsseldorf (UKD) from 2017 to 2021

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Introduction
Many international patients travel to Germany solely for medical treatment (medical tourism), potentially carrying varios pathogens. Saudi Arabia and Russia exhibit a higher prevalence of multi-resistant bacteria in comparison to Germany. To adddress this concern, the German Commission for Hospital Hygiene and Infection Prevention (KRINKO) recommends MRSA-admission-screenings for patients from such high-risk regions. Moreover, MRGN-admission-screenings are recommended for patients with recent healthcare system exposure in regions with high MRGN-prevalence.

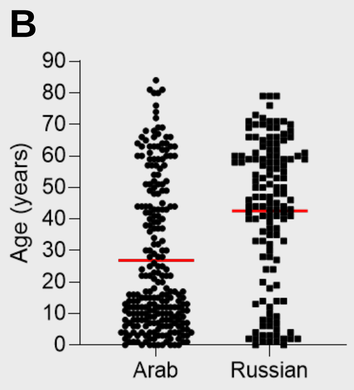
Goals
We aimed to investigate whether medical tourists from the Arabian Peninsula (Bahrain, Iran, Iraq, Jordan, Kingdom of Saudi Arabia, Kuwait, Lebanon, Oman, Qatar, United Arab Emirates, Yemen) and Russia were routinely screened for MRSA and MRGN upon admission to UKD and whether the results comply with current screening recommendations.

Materials and Methods
We analysed MRSA- and MRGN-screening results of Arab and Russian patients at first admittance to UKD from 2017 to 2021.

Results
Patient characteristics

A

		Arabian Peninsula	Russia
Number of patients		239	135
Sex			
	Male	128 (54 %)	61 (45 %)
	Female	111 (46 %)	74 (56 %)
Age at first admission			
	Range	0 - 84 years	0 - 79 years
	Mean	27 years	43 years
	Median	16 years	47 years
	< 18 years	125 (52 %)	28 (21 %)
	≥ 18 years	114 (48 %)	107 (79 %)



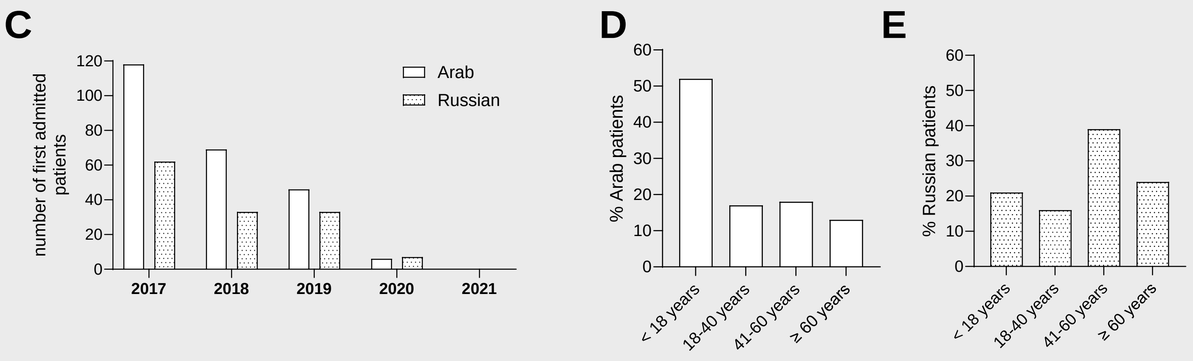


Figure 1: Patient characteristics of Arab and Russian medical tourists at first admittance to UKD from 2017 to 2021 (**A**), including age distribution (red bars indicates mean age) (**B**) in both patient groups. Annual number of first admitted Arab and Russian patients to UKD from 2017 to 2021 (**C**). Detailed age distribution in Arab (**D**) and Russian (**E**) medical tourists (in % Arab/Russian patients).

MRSA screening rates

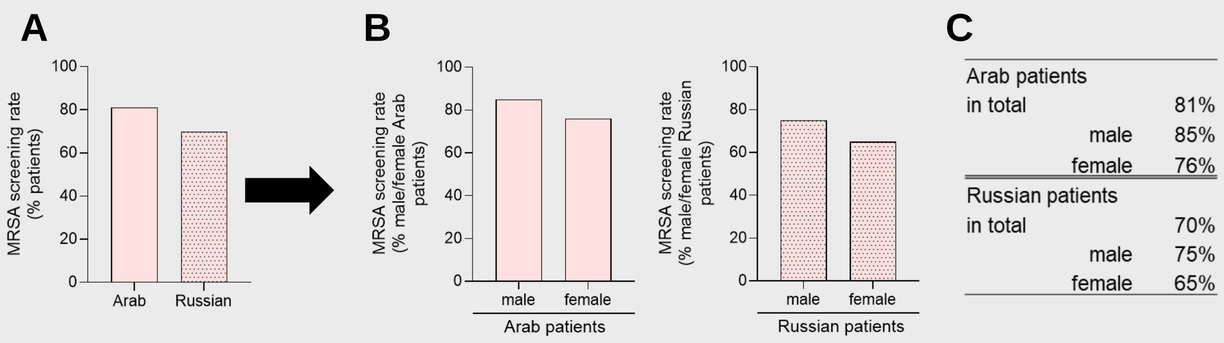


Figure 2: MRSA screening rates of Arab and Russian patients (in % Arab/Russian patients) (**A**). Differentiation of MRSA screenings rates in male and female Arab, respectively Russian patients (**B**) and tabular summary of MRSA screening rates (**C**).

MRSA prevalence

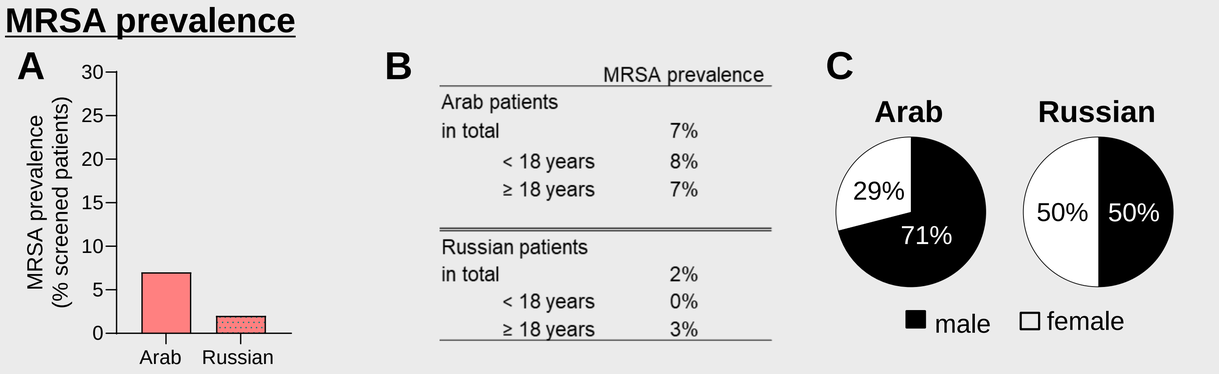


Figure 3: MRSA prevalence in Arab and Russian patients (in % screened Arab/Russian patients) (**A**). Tabular summary of MRSA prevalence (**B**) in minor and adult Arab and Russian patients and gender distribution of Arab and Russian medical tourists tested positive for MRSA (**C**).

MRGN screening rates

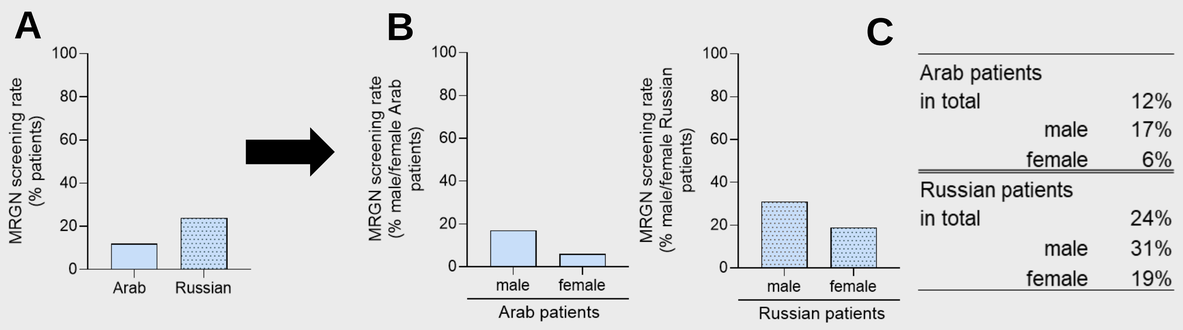


Figure 4: MRGN screening rates of Arab and Russian patients (in % Arab/Russian patients) (**A**). Differentiation of MRGN screenings rates in male and female Arab, respectively Russian patients (**B**) and tabular summary of MRGN screening rates (**C**).

MRGN prevalence

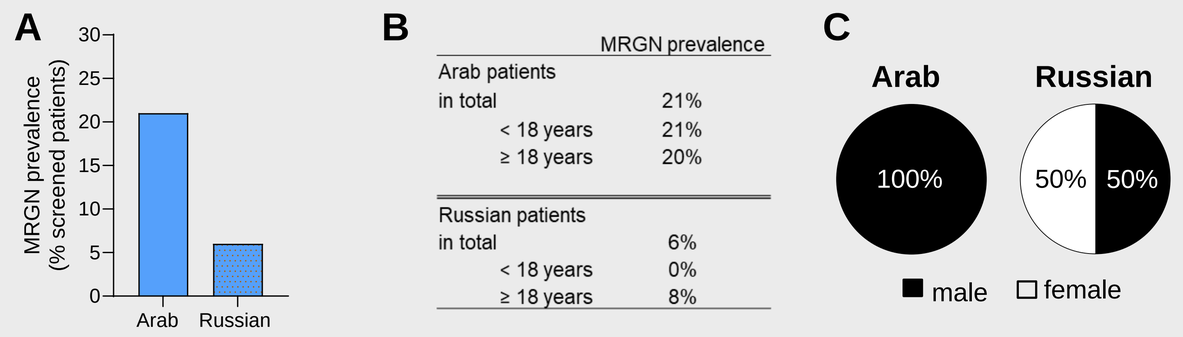


Figure 5: MRGN prevalence in Arab and Russian patients (in % screened Arab/Russian patients) (**A**). Tabular summary of MRGN prevalence in minor and adult Arab and Russian patients (**B**) and gender distribution of Arab and Russian medical tourists tested positive for MRGN (**C**).

MRGN species

	Arabian Peninsula		Russia	
	< 18 years	≥ 18 years	< 18 years	≥ 18 years
2MRGN NeoPäd Escherichia coli	2	-	-	-
3MRGN Acinetobacter baumannii	1	-	-	1
3MRGN Escherichia coli	4	12	1	8
3MRGN Enterobacter cloacae	-	1	-	-
3MRGN Klebsiella pneumoniae	-	1	-	1
3MRGN Morganella morganii	-	-	-	1
3MRGN Proteus mirabilis	1	-	-	-
3MRGN Providencia rettgeri	-	-	-	1
3MRGN Pseudomonas aeruginosa	-	1	-	-
4MRGN Acinetobacter baumannii	-	2	-	-
4MRGN Klebsiella pneumoniae	-	1	-	-
4MRGN Proteus mirabilis	-	1	-	-
4MRGN Pseudomonas aeruginosa	1	-	-	1

Figure 6 : MRGN species detected in Arab and Russian medical tourists. Cipher indicate numbers of patients tested positive for distinct MRGN species.

Summary
UKD implemented MRSA- and MRGN-screening recommendations. The respective KRINKO recommendations lead to variations in the proportions of MRSA- and MRGN-screened medical tourists. Of note, men were screened more frequently for MRSA and MRGN in both patient groups. Arab medical tourists showed higher rates of MRSA- and MRGN-positive screenings in adults and minors. Notably, 72% of Arab MRSA-positive and 100% of Arab MRGN-positive patients were male. Moreover, Arab medical tourists showed a greater variety of MRGN species compared to Russian medical tourists. Consequently, our results underscore the importance of tailored screenings for multidrug-resistant bacteria based on the specific patient population.

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