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# BMJ Open

## Health conditions of migrants, refugees and asylum seekers on search and rescue vessels on the central Mediterranean Sea, 2016-2019.

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5 1 Health conditions of migrants, refugees and asylum seekers on  
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9 2 search and rescue vessels on the central Mediterranean Sea,  
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14 3 2016-2019.

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31 14

32 15 Key words: Refugees, Morbidity, Mediterranean Sea, Reproductive Health, Gender-Based Violence

33 16

34 17 Word count: 3,413

35 18

36 19 **Abstract**

37 20 **Objectives:** This study will contribute to the systematic epidemiological description of morbidities  
38 21 among migrants, refugees and asylum seekers when crossing the Mediterranean Sea.

39 22 **Setting:** Since 2015, Médecins sans Frontières (MSF) has conducted search and rescue activities on  
40 23 the Mediterranean Sea to save lives, provide medical services, to witness, and to speak out.

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2  
3 24 **Participants:** Between November 2016 and December 2019, MSF rescued 22,966 migrants, refugees  
4  
5 25 and asylum seekers.  
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7

8 26 **Primary and secondary outcome measures:** We conducted retrospective data analysis of data  
9  
10 27 collected between January 2016 and December 2019 as part of routine monitoring of the MSF's  
11  
12 28 health care services for migrants, refugees and asylum seekers on two search and rescue vessels.  
13  
14

15 29 **Results:** MSF conducted 12,438 outpatient consultations and 853 sexual and reproductive health  
16  
17 30 consultations (24.9% of female population, 853/3,420) and documented 287 consultations for Sexual  
18  
19 31 and Gender Based Violence (SGBV). The most frequently diagnosed health conditions among children  
20  
21 32 aged five years or older and adults were skin conditions (30.6%, 5,475/17,869), motion sickness  
22  
23 33 (28.6%, 5,116/17,869), headache (15.4%, 2,748/17,869) and acute injuries (5.7%, 1,013/17,869). Of  
24  
25 34 acute injuries, 44.7% were non-violence related injuries (453/1,013), 30.1% were fuel burns  
26  
27 35 (297/1,013) and 25.4% were violence-related injuries (257/1,013).  
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32 36 **Conclusion:** The limited testing and diagnostics capacity of the outpatient department, space  
33  
34 37 limitations, stigma and the generally short length of stay of migrants, refugees and asylum seekers on  
35  
36 38 the ships, has likely led to an underestimation of morbidities including mental health conditions and  
37  
38 39 SGBV. The main diagnoses on board were directly related to journey on land and sea and stay in  
39  
40 40 Libya. We conclude that this population may be relatively young and healthy but displays significant  
41  
42 41 journey-related illnesses and includes migrants, refugees and asylum seekers who have suffered  
43  
44 42 significant violence during their transit and need urgent access to essential services and protection in  
45  
46 43 a place of safety on land.  
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#### 51 44 **Strengths and limitations of this study**

- 52 45 • Limited quantitative data is available on the health of migrants, refugees and asylum seekers  
53  
54 46 while they are on search and rescue vessels. Unlike previous studies, we will present data  
55  
56 47 from onboard outpatient consultations (n=12,438) that were systematically offered to all  
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3 48 rescued people on one of the largest and longest running rescue vessels on the  
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5 49 Mediterranean Sea.

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8 50 • This study will contribute to the systematic epidemiological description of morbidities among  
9  
10 51 migrants, refugees and asylum seekers when crossing the Mediterranean Sea.  
11  
12 52 • Due to the limited testing and diagnoses capacity of the outpatient department, space  
13  
14 53 limitations and the generally short length of stay of migrants, refugees and asylum seekers  
15  
16 54 on the ship, it was not feasible to provide in-depth medical and psychological treatment and  
17  
18 55 support, which has likely led to an underestimation of actual morbidities including mental  
19  
20 56 health conditions and sexual and gender based violence.  
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22  
23 57 • All data presented was collected as routine MSF program data, that needed to be recorded  
24  
25 58 quickly so as not to create further delays for migrants awaiting medical care. Therefore,  
26  
27 59 some of the data was incomplete and could only be partly used for this analysis.  
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## 62 Background

63 Since 2014, a large number of migrants, refugees and asylum seekers has attempted to cross the  
64 Mediterranean Sea to reach Europe. Between 2014 and 2019, 1,995,651 migrants, refugees and  
65 asylum seekers arrived in Italy, Spain, Malta, Greece and Cyprus by boat (1). The total number of  
66 deaths and missing people on the central Mediterranean Sea route is unknown. UNHCR has reported  
67 15,946 deaths and missing people between 2014 and 2020, which is likely an underestimation (2).  
68 The underestimation is due to the occurrence of invisible migrant shipwrecks that remain unreported  
69 and the number of victims unknown (3). The most frequently recorded countries of origin varied over  
70 time as well as by destination (4)(5)(6), and include Eritrea, Ethiopia, Guinea, Chad, Gambia, Ivory  
71 Coast, Libya, Mali, Nigeria, Senegal, Sudan and South Sudan (6).

72 Many migrants, refugees and asylum seekers are fleeing protracted humanitarian emergencies in  
73 their countries of origin, embarking on long inter-regional travel prior to arriving in North Africa (5).  
74 Some migrants, refugees and asylum seekers set out to reach Europe, while others initially plan to  
75 find employment and a place to live in Libya and later might decide to travel onwards to Europe. The  
76 central Mediterranean Sea route, often via Libya to Italy, has been consistently used (1). In addition  
77 to Libya's strategic location, conflicts and instability in the country have hindered border control and  
78 created an environment where smuggling networks can flourish (5). Prior to attempting the crossing  
79 of the central Mediterranean Sea, migrants, refugees and asylum seekers often spend long periods in  
80 unofficial and official places of captivity in Libya (5). Several reports have documented unhygienic  
81 and extremely unhealthy conditions in these detention centers, characterized by overcrowding, lack  
82 of ventilation, insufficient quantities and quality of food and lacking water and sanitation facilities  
83 (7)(8). Recently, MSF published data on health conditions of migrants, refugees and asylum seekers  
84 detained in eight official detention centers where MSF has provided medical services. This report  
85 documented the dire living circumstances and adverse health effects of arbitrary detention on  
86 migrants, refugees and asylum seekers at official detention centers in Libya (9). Even prior to arriving

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2  
3 87 in Libya, many migrants, refugees and asylum seekers have experienced violence including extortion,  
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5 88 ill-treatment, trafficking, forced labor and sexual exploitation in their country of origin, or along the  
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7 89 way (5).  
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10 90 Since 2015, Médecins sans Frontières (MSF) has conducted search and rescue activities on the  
11  
12 91 central Mediterranean Sea to save lives, to provide medical services, to witness, and to speak out.  
13  
14 92 Between 2015 and 2018, MSF has operated the ship “Aquarius” in partnership with non-  
15  
16 93 governmental organization SOS Mediterranée. Between December 2018 and July 2019, MSF had to  
17  
18 94 halt their search and rescue activities on the ship “Aquarius”. In July 2019, search and rescue  
19  
20 95 operations were resumed with SOS Mediterranée on the ship “Ocean Viking” (10).  
21  
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23

24 96 On these vessels, MSF has been providing outpatient medical consultations, screening and triage,  
25  
26 97 referrals, sexual and reproductive health services including support for survivors of sexual and  
27  
28 98 gender-based violence. MSF does not provide systematic mental health screening for migrants,  
29  
30 99 refugees and asylum seekers, but psychological first aid. Treatment and diagnoses were performed  
31  
32 100 by physicians based on clinical assessment and routine tests (body temperature, blood pressure,  
33  
34 101 blood sugar, urine dipstick, malaria rapid test, pregnancy test). As on other search and rescue vessels,  
35  
36 102 the MSF medical teams are working under constant pressure of the urgent assessment and  
37  
38 103 treatment and support of hundreds of rescued persons in distress when a rescue is completed,  
39  
40 104 complex logistical arrangements, and depending on the season, harsh meteorological circumstances  
41  
42 105 (11)(12)(13).  
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46

47 106 There have been publications on the health conditions of migrants, refugees and asylum seekers in  
48  
49 107 migrant reception centers in Italy, Spain and Greece (14)(15)(16)(17). These studies show that the  
50  
51 108 majority of the diagnoses at migration reception centers were dermatological, such as scabies, skins  
52  
53 109 infections and dermatitis of various origins. Respiratory infections and varicella were the most  
54  
55 110 frequent infectious diseases, commonly related to the conditions experienced during the journey.  
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3 111 Limited quantitative data is available on the health of migrants, refugees and asylum seekers while  
4  
5 112 they are on search and rescue vessels (11)(13). Unlike previous studies, we will present data from  
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7 113 onboard consultations that were systematically offered to all rescued people on one of the largest  
8  
9 114 and longest running rescue vessels on the Mediterranean Sea. This study will contribute to the  
10  
11 115 systematic epidemiological description of morbidities among migrants, refugees and asylum seekers  
12  
13 116 when crossing the Mediterranean Sea.  
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16

## 17 117 **Methods**

18  
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20  
21 118 We conducted retrospective data analysis of data collected between January 2016 and December  
22  
23 119 2019 as part of the routine monitoring of the MSF's outpatient health care services for migrants,  
24  
25 120 refugees and asylum seekers on two search and rescue vessels on the central Mediterranean Sea. We  
26  
27 121 analyzed data that was collected on the "Aquarius" between January 2016 and December 2018 and  
28  
29 122 on the "Ocean Viking" between January and December 2019.  
30  
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## 33 123 **Study population**

34  
35  
36 124 The study population consists of all migrants, refugees and asylum seekers who were rescued by MSF  
37  
38 125 search and rescue vessels ("Aquarius" and "Ocean Viking") on the central Mediterranean Sea  
39  
40 126 between January 2016 and December 2019.  
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## 44 127 **Data sources and data collection**

45  
46  
47 128 *Routine program data:* The total number of migrants, refugees and asylum seekers is established and  
48  
49 129 recorded by the medical team at the start of each rescue in a register. Some basic demographic  
50  
51 130 information is also captured, including sex, numbers of children under five years old, unaccompanied  
52  
53 131 minors and pregnant women, and the country of origin of the migrants, refugees and asylum  
54  
55 132 seekers.  
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3 133 *Routine medical data:* Clinical data collection took place as a routine medical activity. The datasets  
4  
5 134 contain data from all migrants, refugees and asylum seekers who presented at the MSF outpatient  
6  
7 135 department (OPD) on the search and rescue vessels with a medical complaint. The medical data  
8  
9  
10 136 collection includes the number of new and follow-up OPD consultations and sexual and reproductive  
11  
12 137 health consultations, including consultations for Sexual and Gender Based Violence (SGBV). Medical  
13  
14 138 evacuation and ambulatory referrals upon disembarkation were made based on case severity as  
15  
16 139 assessed by the medical team and were captured in the routine medical data. The medical data bases  
17  
18  
19 140 also contain data on the diagnoses of patients seen at the OPD, aggregated per week.  
20  
21

## 22 141 Data analysis

23  
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25 142 Following data cleaning and transfer to STATA version 16 (Stata corporation, Texas, USA), we  
26  
27 143 conducted descriptive analysis of the available program and medical data. Indicators were calculated  
28  
29 144 as proportions (e.g. morbidities).  
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## 32 145 Ethical considerations

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36 146 This is a retrospective analysis of routinely collected data. Therefore, it has been exempted from full  
37  
38 147 ethical review by MSF Holland's research committee. The data in the utilized datasets did not contain  
39  
40 148 individual identifiers. The data sets were password protected and only accessible by the first and last  
41  
42 149 author.  
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## 45 150 Patient and Public Involvement

46  
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49 151 For this study, we retrospectively analyzed aggregated routine data from the outpatient department  
50  
51 152 on two search and rescue vessels. Patients were not involved in the study design or implementation.  
52  
53 153 Due to the short length of stay of patients on the search and rescue vessels, we are unable to  
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55 154 disseminate the study findings to the patients.  
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## 156 Results

### 157 Demographic characteristics

158 Over the course of three years (November 2016 - December 2019), 22,966 migrants, refugees and  
 159 asylum seekers were rescued by MSF's search and rescue vessels on the central Mediterranean Sea.  
 160 UNHCR reported that during this same period 176,278 crossed the central Mediterranean Sea to Italy  
 161 (18). Among rescued migrants, refugees and asylum seekers were 3,420 women (14.9%,  
 162 3,420/22,966). A total of 12,438 medical consultations were conducted between January 2016 and  
 163 December 2019. Due to the number of rescued people and the characteristics of the intervention,  
 164 the number of outpatient consultations fluctuated per month (Figure 1).

165 *Figure 1. Number of migrants, refugees and asylum seekers rescued by MSF's search and rescue*  
 166 *vessels on the Mediterranean Sea and number of consultations at MSF's Outpatient Department by*  
 167 *month*

168 Note: No rescues took place in February and July 2018 and between October 2019 and July 2019. Data on number of  
 169 outpatient department consultations missing for June, 2017.

170  
 171 Between November 2017 and December 2019, 4,261 unaccompanied minors were rescued (18.6%,  
 172 4,261/22,966). Of the total number of rescued people, 328 were children under five (1.4%,  
 173 328/22,966). Of the female population, 2,205 women were travelling alone (59.2%, 2,205/3,420) and  
 174 346 of the rescued women were pregnant (10.1%, 346/3,420). The countries of origin of migrants,  
 175 refugees and asylum seekers were Nigeria (18.0%, 4,140/22,966), followed by Eritrea (10.4%,  
 176 2,395/22,966), Guinea Conakry (8.3%, 1,916/22,966), Ivory Coast (7.2%, 1,656/22,966) and  
 177 Bangladesh (6.2%, 1,432/22,966) (Table 1).

178  
 179 *Table 1. Demographic characteristics and country of origin of migrants, refugees and asylum seekers*  
 180 *rescue by MSF's search and rescue vessels on the Mediterranean Sea, November 2016- December*  
 181 *2019*

	n	% <sup>1</sup>
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<b>Number of rescued people</b>	22,966	
<i>Male</i>	19,546	85.1
<i>Female</i>	3,420	14.9
<i>Women traveling alone</i>	2,025	59.2 <sup>2</sup>
<i>Pregnant women</i>	346	10.1 <sup>2</sup>
<i>Unaccompanied minors</i>	4,261	18.6
<i>Children &lt; 5 yo</i>	328	1.4
<b>Country of origin</b>		
<b>Sub-Saharan Africa</b>		
<i>Nigeria</i>	4,140	18.0
<i>Eritrea</i>	2,395	10.4
<i>Guinea Conakry</i>	1,916	8.3
<i>Ivory Coast</i>	1,656	7.2
<i>Sudan</i>	1,195	5.2
<i>Senegal</i>	1,166	5.1
<i>Gambia</i>	1,128	4.9
<i>Ghana</i>	857	3.7
<i>Cameroon</i>	593	2.6
<i>Somalia</i>	436	1.9
<i>Sierra Leone</i>	351	1.5
<i>Ethiopia</i>	167	0.7
<i>Guinea Bissau</i>	155	0.7
<i>Mali</i>	129	0.6
<i>Burkina Faso</i>	118	0.5
<i>Togo</i>	102	0.4
<i>Niger</i>	99	0.4
<i>South Sudan</i>	59	0.3
<i>Chad</i>	49	0.2
<i>Benin</i>	31	0.1
<i>Democratic Republic of Congo</i>	9	0.0
<i>Uganda</i>	9	0.0
<i>Central African Republic</i>	4	0.0
<i>Liberia</i>	2	0.0
<b>Asia</b>		
<i>Bangladesh</i>	1,432	6.2
<i>Syria</i>	334	1.5
<i>Pakistan</i>	273	1.2
<i>Palestina</i>	41	0.2
<i>Yemen</i>	22	0.1
<i>Iraq</i>	5	0.0
<i>Afghanistan</i>	3	0.0
<b>North Africa</b>		
<i>Egypt</i>	199	0.9
<i>Algeria</i>	126	0.5
<i>Tunesia</i>	57	0.2
<i>Morocco</i>	21	0.1
<i>Libya</i>	18	0.1
<b>Other / Unknown</b>		
<i>Other</i>	96	0.4
<i>Unknown</i>	3573	15.6

Note:

<sup>1</sup>Percentage of total number of rescued people

<sup>2</sup>Percentage of total number of rescued women

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## 186 Health conditions

187 Between January 2016 and December 2019, MSF conducted 12,438 outpatient consultations, of  
 188 which 9,811 were new consultations (78.9%, 9,811/12,438). Additionally, MSF performed 143 ante-  
 189 natal care consultations (41.3% of self-reported female pregnant population, 143/346) and  
 190 conducted 853 sexual and reproductive health consultations (24.9% of female population,  
 191 853/3,420).

192 In addition, MSF documented 287 consultations for SGBV, of which the vast majority (99.7%,  
 193 286/287) took place 72 hours or more after the incident occurred. Five women were recorded who  
 194 were pregnant after a rape. There were eight women recorded who requested termination of  
 195 pregnancy (TOP), of which six were referred upon disembarkation in Europe.

196 MSF organized 23 urgent medical referrals which required immediate transport to referral health  
 197 facilities by fast boat or by helicopter. An additional 1,552 non-urgent medical referrals were  
 198 organized who were referred to non-MSF clinics upon arrival on the mainland (Table 2).

199 *Table 2. MSF consultations and referrals of migrants, refugees and asylum seekers on MSF's search*  
 200 *and rescue vessels on the Mediterranean Sea, 2016-2019*

	N	%
<b>All consultations</b>	<b>12,438</b>	
<i>Number of new consultations</i>	9,811	78.88
<i>Number of dressings New</i>	772	6.21
<i>Number of dressings Follow-up</i>	334	2.69
<i>Number of injections</i>	1,310	10.53
<i>Other follow-up</i>	211	1.70
<b>SRH consultations<sup>1</sup></b>	<b>853</b>	<b>6.86</b>
<i>ANC consultations<sup>2</sup></i>	143	25.04
<b>SGBV consultations<sup>1</sup></b>	<b>287</b>	<b>2.31</b>
<i>SGBV consultations &lt;72hrs<sup>3</sup></i>	1	0.35
<i>SGBV consultations &gt;72 hours<sup>3</sup></i>	286	99.65
<i>Pregnant due to rape<sup>4</sup></i>	5	6.58
<i>TOP requests<sup>2</sup></i>	8	1.40
<i>TOP referrals<sup>2</sup></i>	6	1.05
<b>Referrals</b>	<b>1,575</b>	<b>12.66</b>
<i>Urgent - Medevac (fast boat/helicopter)</i>	23	1.46
<i>Not urgent (upon arrival)</i>	1,552	98.54

201 Note:

202 <sup>1</sup>Number of SRH and SGBV consultations recorded between May 2016 and December 2019. Percentages calculated over the  
203 total number of consultations in the same period

204 <sup>2</sup>Number of ANC consultations, TOP requests and TOP referrals recorded between September 2017 and December 2019.

205 Percentage calculated over the total number of SRH consultations in the same period

206 <sup>3</sup>Number of SGBV consultations that took place within and after 72 hours recorded between December 2016 and December  
207 2019. Percentages calculated over the total number of SGBV consultations in the same period

208 <sup>4</sup>Number of women pregnant due to rape recorded between January 2018 and December 2019. Percentage calculated over  
209 total number of pregnant women during the same period

210

211 Among all diagnoses for children under five, 46.8% (51/109) were related to skin conditions. The

212 most frequently diagnosed health conditions among children aged five years or older and adults

213 were skin conditions (30.6%, 5,475/17,869), motion sickness (28.6%, 5,116/17,869), headache

214 (15.4%, 2,748/17,869) and acute injuries (5.7%, 1,013/17,869). Of acute injuries, 44.7% were non-

215 violence related injuries (453/1,013), 30.1% were fuel burns (297/1,013) and 25.4% were violence-

216 related injuries (257/1,013) (Table 3).

217 *Table 3. Health conditions of migrants, refugees and asylum seekers on MSF's search and rescue*  
218 *vessels on the Mediterranean Sea, 2016-2019: MSF outpatient department consultations*

Diagnosis	<5 years		≥5 years		Total	Proportional morbidity (%)
	Male	Female	Male	Female		
<b>Acute injuries</b>	<b>4</b>	<b>0</b>	<b>834</b>	<b>179</b>	<b>1,017</b>	<b>5.66</b>
<i>Fuel burn</i>	0	0	212	85	297	1.65
<i>Non-violence related injury</i>	3	0	399	54	456	2.54
<i>Resuscitation</i>	1	0	3	3	7	0.04
<i>Violence-related injury</i>	0	0	220	37	257	1.43
<b>Chronic diseases</b>	<b>0</b>	<b>0</b>	<b>58</b>	<b>13</b>	<b>71</b>	<b>0.39</b>
<b>Dehydration</b>	<b>2</b>	<b>1</b>	<b>503</b>	<b>35</b>	<b>541</b>	<b>3.01</b>
<b>Hypothermia</b>	<b>0</b>	<b>2</b>	<b>153</b>	<b>22</b>	<b>177</b>	<b>0.98</b>
<b>Infectious diseases</b>	<b>8</b>	<b>8</b>	<b>740</b>	<b>101</b>	<b>857</b>	<b>4.77</b>
<i>Acute bloody diarrhea</i>	0	0	30	6	36	0.20
<i>Acute flaccid paralysis</i>	0	0	0	0	0	0.00
<i>Acute lower respiratory tract infection</i>	1	1	58	10	70	0.39
<i>Acute upper respiratory tract infection</i>	6	6	373	41	426	2.37
<i>Acute watery diarrhea</i>	1	1	194	26	222	1.23
<i>Malaria (confirmed)</i>	0	0	2	1	3	0.02
<i>Measles (suspected)</i>	0	0	0	0	0	0.00
<i>Meningitis (suspected)</i>	0	0	0	0	0	0.00
<i>Sexually transmitted infection</i>	0	0	51	13	64	0.36
<i>Tuberculosis (suspected)</i>	0	0	32	4	36	0.20
<i>Typhoid fever</i>	0	0	0	0	0	0.00

<b>Gynecological conditions</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>575</b>	<b>575</b>	<b>3.20</b>
<i>Gynecological disease</i>	0	0	0	93	93	0.52
<i>Pregnancy related</i>	0	0	0	482	482	2.68
<b>Skin conditions</b>	<b>24</b>	<b>27</b>	<b>4,839</b>	<b>636</b>	<b>5,526</b>	<b>30.74</b>
<i>Scabies</i>	7	9	1,401	210	1,627	9.05
<i>Skin disease</i>	14	18	3,259	421	3,712	20.65
<i>Skin infection</i>	3	0	179	5	187	1.04
<b>Mental health</b>	<b>0</b>	<b>0</b>	<b>14</b>	<b>12</b>	<b>26</b>	<b>0.14</b>
<i>Common Psychiatric Disorders</i>	0	0	9	11	20	0.11
<i>Severe Psychiatric Disorders</i>	0	0	5	1	6	0.03
<b>Motion sickness</b>	<b>2</b>	<b>3</b>	<b>4,344</b>	<b>772</b>	<b>5,121</b>	<b>28.48</b>
<b>Other conditions</b>	<b>15</b>	<b>13</b>	<b>2,987</b>	<b>561</b>	<b>3,576</b>	<b>19.89</b>
<i>Anaemia</i>	0	0	8	3	11	0.06
<i>Fever without identified cause</i>	4	3	80	19	106	0.59
<i>Headache</i>	0	0	2,363	385	2,748	15.29
<i>Urinary tract infection</i>	0	0	28	21	49	0.27
<i>Eye infection</i>	1	1	73	15	90	0.50
<i>Other</i>	10	9	435	118	572	3.18
<b>Severe acute malnutrition</b>	<b>0</b>	<b>0</b>	<b>7</b>	<b>2</b>	<b>9</b>	<b>0.05</b>
<b>Sexual violence</b>	<b>0</b>	<b>0</b>	<b>30</b>	<b>452</b>	<b>482</b>	<b>2.68</b>
<b>Total</b>	<b>55</b>	<b>54</b>	<b>14,509</b>	<b>3,360</b>	<b>17,978</b>	<b>100</b>

Note:

<sup>1</sup>Number of times disease or condition was diagnosed at the outpatient department between January 2016 and December 2019. One patient could have multiple diagnoses during a consultation, therefore the total number of diagnoses exceeds the total number of consultations

## Sexual and Gender Based Violence

MSF documented a total of 482 consultations for Sexual and Gender Based Violence (SGBV), of which 30 were for male and 452 were for female survivors (Table 3). Of the 482 consultations for SGBV, 95 were first consultations for rape specifically in 2018 (78) and 2019 (17). Of these first consultations, 99% (94/95) took place more than 72 hours after the incident. The majority of survivors were female (91.6%, 87/95) and 15 years or older (99%, 94/95). Most survivors of rape came from Nigeria (36.8%, 35/95), followed by Cameroon (21.1%, 20/95) and Ivory Coast (19%, 18/95) (Table 4).

Table 4. Consultations for rape of migrants, refugees and asylum seekers on MSF's search and rescue vessels on the Mediterranean Sea, 2018-2019

	2018		2019		Total	
	N	%	n	%	n	%
<b>Number of first consultations for rape</b>	<b>78</b>		<b>17</b>		<b>95</b>	

<b>Time since incident</b>							
<72 hours	1	1.28	0	0	1	1.05	
>72 hours	77	98.72	17	1.00	94	98.95	
<b>Age</b>							
<5 yo	0	0	0	0	0	0	
5-14 yo	1	1.28	0	0	1	1.05	
≥15	77	98.72	17	1.00	94	98.95	
<b>Gender</b>							
Female	71	91.03	16	0.94	87	91.58	
Male	7	8.97	1	0.06	8	8.42	
<b>Country of origin</b>							
Cameroon	15	19.23	5	29.41	20	21.05	
Eritrea	2	2.56	0	0	2	2.11	
Ghana	1	1.28	0	0	1	1.05	
Guinea Conakry	1	1.28	0	0	1	1.05	
Ivory Coast	13	16.67	5	29.41	18	18.95	
Liberia	1	1.28	0	0	1	1.05	
Mali	1	1.28	0	0	1	1.05	
Morocco	3	3.85	0	0	3	3.16	
Nigeria	31	39.74	4	23.53	35	36.84	
Senegal	1	1.28	0	0	1	1.05	
Sierra Leone	5	6.41	1	5.88	6	6.32	
Somalia	3	3.85	2	11.76	5	5.26	
Sudan	1	1.28	0	0	1	1.05	

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## 234 Mortality on board

235 Between January 2016 and December 2019 five deaths occurred on MSF's search and rescue vessels.

236 Probable causes of death included compressive asphyxiation due to human crushes and stampedes

237 on the wooden boats or dinghies or while getting on the boat, and severe hypothermia. In addition

238 to these five deaths, the search and rescue vessels frequently onboarded people who had already

239 died on their journey prior to reaching the MSF vessels.



## 240 Discussion

241 We were able to present data from onboard consultations that were systematically offered to all  
242 22,966 rescued people on one of the largest and longest running rescue vessels on the  
243 Mediterranean Sea. Over the course of three years (November 2016 - December 2019).

244 The number of rescues varied per month due to the constantly changing 'search and rescue  
245 landscape', including restrictions on search and rescue activities of NGOs and the increased  
246 involvement of the Libyan Coast Guard (LCG) in rescues, returning large numbers of migrants,  
247 refugees and asylum seekers to Libya (19)(20). Additionally, the number of migrants, refugees and  
248 asylum seekers attempting to make the crossing also fluctuated per month depending on weather  
249 conditions (20).

250 Between January 2016 and December 2019, MSF conducted 12,438 outpatient consultations. MSF  
251 situational reports showed that the length of stay of migrants, refugees and asylum seekers on the  
252 search and rescue vessels varied, with increasingly long standoffs on sea in 2019. At times, the ship  
253 needed to stay off-coast for weeks with rescued people onboard whilst waiting to be assigned a  
254 place of safety for disembarkation. This had a direct impact on the volume of OPD consultations and  
255 medical and psychological complaints, as crowded living conditions and confined spaces onboard  
256 were causing discomfort and rescued people needed multiple consultations while awaiting non-  
257 urgent referrals.

258 Women represented 14.9% of the rescued migrants, refugees and asylum seekers. While this  
259 percentage is lower than the percentage of women seeking asylum in the European Union, the  
260 demographic breakdown was similar on other search and rescue vessels on the central  
261 Mediterranean route (13)(21). The percentage of children under five and unaccompanied minors was  
262 also lower than expected compared to the percentages seeking asylum in the European Union. The  
263 central Mediterranean route is considered relatively difficult and might be less often attempted by

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3 264 women and children. Moreover, in critical rescues, which occur frequently on this part of the sea,  
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5 265 there is oftentimes much loss of life which impacts women and children disproportionately (2).  
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8 266 The high proportional morbidity of skin conditions has been noted on other search and rescue  
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10 267 vessels as well, frequently with superinfection (13)(14). Scabies is typically associated with long  
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12 268 permanence in conditions of poor hygiene, crowd, poverty and detentions (22)(23)(24). Therefore,  
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14 269 the high burden of skin conditions among migrants, refugees and asylum seekers included in this  
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16 270 study, like scabies, could be linked to the living conditions on the migrants' journey and while they  
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18 271 are in Libya (9).  
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22 272 Almost 6% of the diagnoses on board (n=1,017) were fuel burn wounds, violent and non-violent  
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24 273 trauma. Similar chemical burns due to benzene were found on other search and rescue vessels, due  
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26 274 to the mixture of salt water with fuel that is often spilled inside the boats and stays attached to the  
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28 275 clothing and body, causing deep burns due to prolonged skin contact (13)(25). Women appear to be  
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30 276 disproportionately affected by fuel burn wounds. An explanation could be that women often sit in  
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32 277 the middle of the boat to be protected from the waves as they often cannot swim. If there is any fuel  
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34 278 leakage, this often accumulates in the middle of the boat where the women sit. Some non-violent  
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36 279 injuries may have been sustained on the dinghies or during the rescue operations. The long journey  
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38 280 to Libya and often prolonged stay in Libya, during which people on the move often face and  
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40 281 exploitation, contributed to the violence-related injuries that were diagnosed.  
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45 282 Non-communicable diseases (NCD) only made up for 0.4% of all diagnoses. Similarly, complications  
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47 283 from NCDs were identified in 0.7% of migrants, refugees and asylum seekers on the search and  
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49 284 rescue vessel of NGO Open Arms on the Mediterranean Sea (n=4,516)(13). The lack of testing  
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51 285 equipment, the short length of stay and the prioritization of urgent medical care on the rescue  
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53 286 vessels could lead to an underestimation of NCDs in rescued people. The young age and initially  
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55 287 relatively good health of migrants that take the central Mediterranean route could also play a role.  
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3 288 Time and space constraints on board make it not feasible or desirable to conduct systematic mental  
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5 289 health screening on board. Only self-reported mental health complaints were recorded at the  
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7 290 outpatient clinic. Migrant reception centers and health facilities in Europe that are implementing  
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9 291 mental health services have found a high burden of mental health conditions (26)(15)(27). Similar  
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11 292 mental health conditions following trauma have been seen along other migratory routes, such as the  
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13 293 western Balkan corridor to Northern Europe. A study showed that nearly one-in-three migrants seen  
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15 294 at MSF mental health clinics experienced physical or psychological trauma along their journey, many  
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17 295 of which reporting anxiety and mental trauma (28). Considering the treacherous journey that the  
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19 296 migrants, refugees and asylum seekers will have had to endure, including the attempt to cross on  
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21 297 oftentimes overcrowded dinghies or wooden boats with lacking hygiene conditions and food and  
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23 298 water availability, and in combination with underlying trauma, the psychological first aid offered by  
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25 299 MSF is essential. Especially with the increasingly longer stand offs on sea, keeping migrants, refugees  
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27 300 and asylum seekers on board of the search and rescue vessels for weeks. However, the limitations of  
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29 301 space, capacity and lack of interpreters, as also noted on search and rescue vessels in Greece, will  
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31 302 continue hinder the medical team's ability to provide more in-depth mental health support on the  
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33 303 ships (25)(29).

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35 304 Out of the 482 SGBV consultations, there were 95 first consultations specifically for rape. The MSF  
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37 305 medical team attempted to have systematic consultations with all rescued women and carefully ask  
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39 306 about SGBV and any support they may need. However, this was difficult to implement due to space  
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41 307 and time constraints and the hesitance of SGBV survivors to speak out due to fear of stigmatization.  
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43 308 Only 30 consultations were conducted for male survivors of SGBV in general, of which seven  
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45 309 consultations were conducted for male survivors of rape specifically, which is a likely  
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47 310 underestimation of the true number of male survivors. Additional male survivors of SGBV have been  
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49 311 identified by non-medical staff on board, and is confirmed by testimonies given by rescued people,  
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51 312 but they refused medical consultation and were therefore not included in the analysis.  
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## 313 Limitations

314 The need for services was high and onboard staff were often overwhelmed with sudden influxes of  
315 rescued people. This impacted the ability of the medical team to collect accurate data and properly  
316 document diagnoses and demographic characteristics. Therefore, we do not have reliable population  
317 counts, which could be used as denominators for the calculation of disease incidence or assess  
318 whether the length of stay had an effect on the number of OPD consultations or diagnosed  
319 morbidities.

320 Due to the limited testing and diagnoses capacity of the outpatient department, space limitations  
321 and the generally short length of stay of migrants, refugees and asylum seekers on the ship, it was  
322 not feasible to provide in-depth medical and psychological treatment and support, which has likely  
323 led to an underestimation of actual morbidities including mental health conditions and SGBV.

324 All data presented was collected as routine MSF program data, that needed to be recorded quickly so  
325 as not to create further delays for migrants awaiting medical care. Therefore, some of the data was  
326 incomplete and could only be partly used for this analysis. While case definitions stayed the same  
327 throughout the observation period, staff turnover lead to variation in procedures, documentation  
328 and measurements. For example, for some months the deck management of motion sickness,  
329 headache and deck inspection of scabies were included in the OPD consultations, while other months  
330 they were excluded from the total OPD consultation counts. The recording of skin diseases, skin  
331 infections and scabies also varied over time, which resulted in three diagnosis categories that are  
332 difficult to disentangle retrospectively.

333

## 334 Conclusion

335 MSF's access to the rescue areas in the central Mediterranean Sea has varied over the past three  
336 years and has been unpredictable. In line with findings from other studies of morbidities on search  
337 and rescue vessels, the main diagnoses on board where MSF teams have operated were non-severe

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3 338 and directly related to the migration journey on the boat and previously on the way to and in Libya  
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5 339 such as overcrowding, lack of drinking and washing water, extreme sun exposure, heat or cold.  
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7 340 Approximately 1/3 of total diagnosis were scabies, 1/3 motion sickness and 1/6 headache. However,  
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9 341 of the diseases on board, we also identified potentially severe conditions related to the journey in  
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11 342 about 10% of the population, namely dehydration, hypothermia and acute injuries. Additionally, we  
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13 343 identified survivors of sexual and gender-based violence and violence-related injuries, which most  
14  
15 344 likely are only the top of the iceberg. The number of diagnoses of infectious diseases was very low  
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17 345 compared to other diagnoses (13)(14)(15). We conclude that this population may be relatively young  
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19 346 and healthy but displays significant journey-related illnesses and includes migrants, refugees and  
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21 347 asylum seekers who have suffered significant violence during their transit and need urgent and direct  
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23 348 access to essential services and protection in a place of safety on land.  
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## 32 350 Contributorship statement

33  
34  
35 351 EVB and AK conceptualized the study and drafted the manuscript. EVD was responsible for the data  
36  
37 352 analysis. All co-authors reviewed and contributed to the final version of the manuscript.  
38  
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## 40 353 Competing interests

41  
42  
43  
44 354 There are no competing interests to declare  
45  
46

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48  
49  
50 356 There is no funding to report for this submission.  
51  
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53

## 54 357 Data sharing agreement

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56  
57 358 Data are available upon reasonable request  
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## 359 Ethics statement

360 This research fulfilled the exemption criteria set by the Médecins Sans Frontières Ethics Review  
361 Board for a posteriori analyses of routinely collected clinical data and thus did not require MSF ERB  
362 review. It was conducted with permission from Melissa McRae, Medical Director, Operational Centre  
363 Amsterdam, Médecins Sans Frontières.

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366 asylum seekers on search and rescue vessels and beyond every day.

## 367 Figure legends

368 *Figure 1. Number of migrants, refugees and asylum seekers rescued by MSF's search and rescue*  
369 *vessels on the Mediterranean Sea and number of consultations at MSF's Outpatient Department by*  
370 *month*

371 Blue: number of rescued males

372 Grey: number of rescued females

373 Red: number of outpatient department consultations

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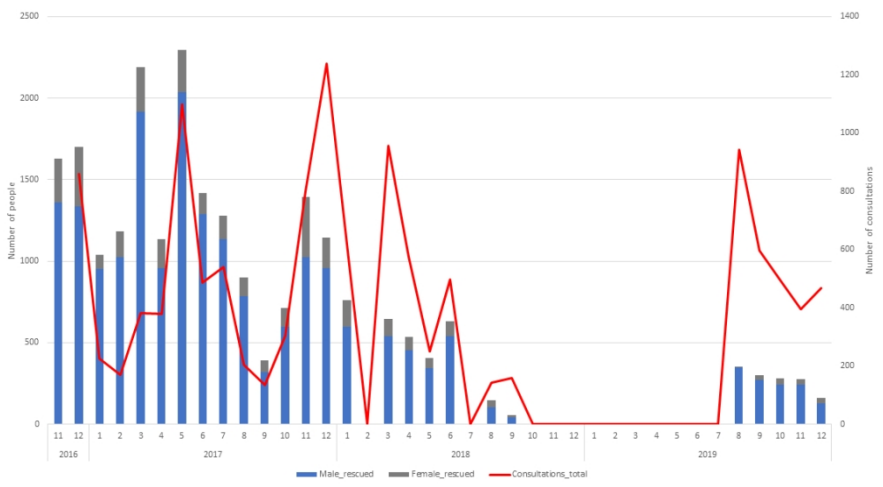
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# BMJ Open

## Health conditions of migrants, refugees and asylum seekers on search and rescue vessels on the central Mediterranean Sea, 2016-2019: a retrospective analysis.

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5 1 Health conditions of migrants, refugees and asylum seekers on  
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9 2 search and rescue vessels on the central Mediterranean Sea,  
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14 3 2016-2019: a retrospective analysis.  
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47 19 **Abstract**  
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50 20 **Objectives:** This study will contribute to the systematic epidemiological description of morbidities  
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52 21 among migrants, refugees and asylum seekers when crossing the Mediterranean Sea.  
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54

55 22 **Setting:** Since 2015, Médecins sans Frontières (MSF) has conducted search and rescue activities on  
56  
57 23 the Mediterranean Sea to save lives, provide medical services, to witness, and to speak out.  
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3 24 **Participants:** Between November 2016 and December 2019, MSF rescued 22,966 migrants, refugees  
4  
5 25 and asylum seekers.

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8 26 **Primary and secondary outcome measures:** We conducted retrospective data analysis of data  
9  
10 27 collected between January 2016 and December 2019 as part of routine monitoring of the MSF's  
11  
12 28 health care services for migrants, refugees and asylum seekers on two search and rescue vessels.

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14  
15 29 **Results:** MSF conducted 12,438 outpatient consultations and 853 sexual and reproductive health  
16  
17 30 consultations (24.9% of female population, 853/3,420) and documented 287 consultations for Sexual  
18  
19 31 and Gender Based Violence (SGBV). The most frequently diagnosed health conditions among children  
20  
21 32 aged five years or older and adults were skin conditions (30.6%, 5,475/17,869), motion sickness  
22  
23 33 (28.6%, 5,116/17,869), headache (15.4%, 2,748/17,869) and acute injuries (5.7%, 1,013/17,869). Of  
24  
25 34 acute injuries, 44.7% were non-violence related injuries (453/1,013), 30.1% were fuel burns  
26  
27 35 (297/1,013) and 25.4% were violence-related injuries (257/1,013).

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31  
32 36 **Conclusion:** The limited testing and diagnostics capacity of the outpatient department, space  
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34 37 limitations, stigma and the generally short length of stay of migrants, refugees and asylum seekers on  
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36 38 the ships, has likely led to an underestimation of morbidities including mental health conditions and  
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38 39 SGBV. The main diagnoses on board were directly related to journey on land and sea and stay in  
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40 40 Libya. We conclude that this population may be relatively young and healthy but displays significant  
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42 41 journey-related illnesses and includes migrants, refugees and asylum seekers who have suffered  
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44 42 significant violence during their transit and need urgent access to essential services and protection in  
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46 43 a place of safety on land.

#### 47 48 49 50 51 44 **Strengths and limitations of this study**

- 52 45 • Unlike previous studies, we will present data from onboard outpatient consultations  
53  
54 46 (n=12,438) that were systematically offered to all rescued people on one of the largest and  
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56 47 longest running rescue vessels on the Mediterranean Sea.

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3 48 • This study will contribute to the systematic epidemiological description of morbidities among  
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5 49 migrants, refugees and asylum seekers when crossing the Mediterranean Sea.  
6  
7 50 • Due to the limited testing and diagnoses capacity of the outpatient department, space  
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9 51 limitations and the generally short length of stay of migrants, refugees and asylum seekers  
10 52 on the ship, it was not feasible to provide in-depth medical and psychological treatment and  
11  
12 53 support, which has likely led to an underestimation of actual morbidities including mental  
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14 54 health conditions and sexual and gender based violence.  
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16 55 • All data presented was collected as routine MSF program data, that needed to be recorded  
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18 56 quickly so as not to create further delays for migrants awaiting medical care, therefore, some  
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20 57 of the data was incomplete and could only be partly used for this analysis.  
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## 60 Background

61 Since 2014, a large number of migrants, refugees and asylum has attempted to cross the  
62 Mediterranean Sea to reach Europe. Between 2014 and 2019, 1,995,651 migrants, refugees and  
63 asylum seekers arrived in Italy, Spain, Malta, Greece and Cyprus by boat (1). The total number of  
64 deaths and missing people on the central Mediterranean Sea route is unknown. UNHCR has reported  
65 15,946 deaths and missing people between 2014 and 2020, which is likely an underestimation (2).  
66 The underestimation is due to the occurrence of invisible migrant shipwrecks that remain unreported  
67 and the number of victims unknown (3). The most frequently recorded countries of origin varied over  
68 time as well as by destination (4)(5)(6), and include Eritrea, Ethiopia, Guinea, Chad, Gambia, Ivory  
69 Coast, Libya, Mali, Nigeria, Senegal, Sudan and South Sudan (6).

70 Many migrants, refugees and asylum seekers are fleeing protracted humanitarian emergencies in  
71 their countries of origin, embarking on long inter-regional travel prior to arriving in North Africa (5).  
72 Some migrants, refugees and asylum seekers set out to reach Europe, while others initially plan to  
73 find employment and a place to live in Libya and later might decide to travel onwards to Europe. The  
74 central Mediterranean Sea route, often via Libya to Italy, has been consistently used (1). In addition  
75 to Libya's strategic location, conflicts and instability in the country have hindered border control and  
76 created an environment where smuggling networks can flourish (5). Prior to attempting the crossing  
77 of the central Mediterranean Sea, migrants, refugees and asylum seekers often spend long periods in  
78 unofficial and official places of captivity in Libya (5). Several reports have documented unhygienic  
79 and extremely unhealthy conditions in these detention centers, characterized by overcrowding, lack  
80 of ventilation, insufficient quantities and quality of food and lacking water and sanitation facilities  
81 (7)(8). Recently, MSF published data on health conditions of migrants, refugees and asylum seekers  
82 detained in eight official detention centers where MSF has provided medical services. This report  
83 documented the dire living circumstances and adverse health effects of arbitrary detention on  
84 migrants, refugees and asylum seekers at official detention centers in Libya (9). Even prior to arriving

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3 85 in Libya, many migrants, refugees and asylum seekers have experienced violence including extortion,  
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5 86 ill-treatment, trafficking, forced labor and sexual exploitation in their country of origin, or along the  
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7 87 way (5).  
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10 88 Since 2015, Médecins sans Frontières (MSF) has conducted search and rescue activities on the  
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12 89 central Mediterranean Sea to save lives, to provide medical services, to witness, and to speak out.  
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14 90 Between 2015 and 2018, MSF has operated the ship “Aquarius” in partnership with non-  
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16 91 governmental organization SOS Mediterranee. Between December 2018 and July 2019, MSF had to  
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18 92 halt their search and rescue activities on the ship “Aquarius”. In July 2019, search and rescue  
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20 93 operations were resumed with SOS Mediterranee on the ship “Ocean Viking” (10).  
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24 94 On these vessels, MSF has been providing outpatient medical consultations, screening and triage,  
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26 95 referrals, sexual and reproductive health services including support for survivors of sexual and  
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28 96 gender-based violence. MSF does not provide systematic mental health screening for migrants,  
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30 97 refugees and asylum seekers, but psychological first aid. Treatment and diagnoses were performed  
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32 98 by physicians and nurses based on clinical assessment and routine tests (body temperature, blood  
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34 99 pressure, pulse oximetric, hemoglobin test, blood sugar, urine dipstick, malaria rapid test, pregnancy  
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36 100 test). Treatment options were limited to basic wound care, oxygen and a limited number of  
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38 101 pharmaceuticals. Any patient requiring more complex treatment needed medical evacuation. As on  
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40 102 other search and rescue vessels, the MSF medical teams are working under constant pressure of the  
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42 103 urgent assessment and treatment and support of hundreds of rescued persons in distress when a  
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44 104 rescue is completed, complex logistical arrangements, and depending on the season, harsh  
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46 105 meteorological circumstances (11)(12)(13).  
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51  
52 106 There have been publications on the health conditions of migrants, refugees and asylum seekers in  
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54 107 migrant reception centers in Italy, Spain and Greece (14)(15)(16)(17). These studies show that the  
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56 108 majority of the diagnoses at migration reception centers were dermatological, such as scabies, skins  
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3 109 infections and dermatitis of various origins. Respiratory infections and varicella were the most  
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5 110 frequent infectious diseases, commonly related to the conditions experienced during the journey.  
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8 111 Limited quantitative data is available on the health of migrants, refugees and asylum seekers while  
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10 112 they are on search and rescue vessels (11)(13). Unlike previous studies, we will present data from  
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12 113 onboard consultations that were systematically offered to all rescued people on one of the largest  
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14 114 and longest running rescue vessels on the Mediterranean Sea. This study will contribute to the  
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16 115 systematic epidemiological description of morbidities among migrants, refugees and asylum seekers  
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18 116 when crossing the Mediterranean Sea.  
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## 23 117 **Methods**

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25  
26 118 We conducted retrospective data analysis of data collected between January 2016 and December  
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28 119 2019 as part of the routine monitoring of the MSF's outpatient health care services for migrants,  
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30 120 refugees and asylum seekers on two search and rescue vessels on the central Mediterranean Sea. We  
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32 121 analyzed data that was collected on the "Aquarius" between January 2016 and December 2018 and  
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34 122 on the "Ocean Viking" between January and December 2019.  
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## 39 123 **Study population**

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41 124 The study population consists of all migrants, refugees and asylum seekers who were rescued by MSF  
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43 125 search and rescue vessels ("Aquarius" and "Ocean Viking") on the central Mediterranean Sea  
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45 126 between January 2016 and December 2019.  
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## 49 127 **Data sources and data collection**

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52 128 *Routine program data:* The total number of migrants, refugees and asylum seekers is established and  
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54 129 recorded by the medical team at the start of each rescue in a register. Some basic demographic  
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56 130 information is also captured, including sex, numbers of children under five years old, unaccompanied  
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3 131 minors and pregnant women, and the country of origin of the migrants, refugees and asylum  
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5 132 seekers.

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8 133 *Routine medical data:* Clinical data collection took place as a routine medical activity. The datasets  
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10 134 contain data from all migrants, refugees and asylum seekers who presented at the MSF outpatient  
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12 135 department (OPD) on the search and rescue vessels with a medical complaint. The medical data  
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14  
15 136 collection includes the number of new and follow-up OPD consultations and sexual and reproductive  
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17 137 health consultations, including consultations for Sexual and Gender Based Violence (SGBV). Medical  
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19 138 evacuation and ambulatory referrals upon disembarkation were made based on case severity as  
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21 139 assessed by the medical team and were captured in the routine medical data. The medical data bases  
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23  
24 140 also contain data on the diagnoses of patients seen at the OPD, aggregated per week.

## 25 26 27 141 **Data analysis**

28  
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30 142 Following data cleaning and transfer to STATA version 16 (Stata corporation, Texas, USA), we  
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32 143 conducted descriptive analysis of the available program and medical data. Indicators were calculated  
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34 144 as proportions (e.g. morbidities).

## 35 36 37 38 145 **Ethical considerations**

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41 146 This is a retrospective analysis of routinely collected data. Therefore, it has been exempted from full  
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43 147 ethical review by MSF Holland's research committee. The data in the utilized datasets did not contain  
44  
45 148 individual identifiers. The data sets were password protected and only accessible by the first and last  
46  
47 149 author.

## 48 49 50 51 150 **Patient and Public Involvement**

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54 151 For this study, we retrospectively analyzed aggregated routine data from the outpatient department  
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56 152 on two search and rescue vessels. Patients were not involved in the study design or implementation.

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3 153 Due to the short length of stay of patients on the search and rescue vessels, we are unable to  
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5 154 disseminate the study findings to the patients.  
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## 11 156 Results

### 15 157 Demographic characteristics

18 158 Over the course of three years (November 2016 - December 2019), 22,966 migrants, refugees and  
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20 159 asylum seekers were rescued by MSF's search and rescue vessels on the central Mediterranean Sea.  
21  
22 160 UNHCR reported that during this same period 176,278 crossed the central Mediterranean Sea to Italy  
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24 161 (18). Among rescued migrants, refugees and asylum seekers were 3,420 women (14.9%,  
25  
26 162 3,420/22,966). A total of 12,438 medical consultations were conducted between January 2016 and  
27  
28 163 December 2019. Due to the number of rescued people and the characteristics of the intervention,  
29  
30 164 the number of outpatient consultations fluctuated per month (Figure 1).  
31  
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33

34 165 *Figure 1. Number of migrants, refugees and asylum seekers rescued by MSF's search and rescue*  
35 166 *vessels on the Mediterranean Sea and number of consultations at MSF's Outpatient Department by*  
36 167 *month*

38 168 Note: No rescues took place in February and July 2018 and between October 2019 and July 2019. Data on number of  
39 169 outpatient department consultations missing for June, 2017.

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44 171 Between November 2017 and December 2019, 4,261 unaccompanied minors were rescued (18.6%,  
45  
46 172 4,261/22,966). Of the total number of rescued people, 328 were children under five (1.4%,  
47  
48 173 328/22,966). Of the female population, 2,205 women were travelling alone (59.2%, 2,205/3,420) and  
49  
50 174 346 of the rescued women were pregnant (10.1%, 346/3,420). The countries of origin of migrants,  
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52 175 refugees and asylum seekers were Nigeria (18.0%, 4,140/22,966), followed by Eritrea (10.4%,  
53  
54 176 2,395/22,966), Guinea Conakry (8.3%, 1,916/22,966), Ivory Coast (7.2%, 1,656/22,966) and  
55  
56 177 Bangladesh (6.2%, 1,432/22,966) (Table 1).  
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178

179 *Table 1. Demographic characteristics and country of origin of migrants, refugees and asylum seekers*  
 180 *rescue by MSF's search and rescue vessels on the Mediterranean Sea, November 2016- December*  
 181 *2019*

	n	% <sup>1</sup>
<b>Number of rescued people</b>	22,966	
<i>Male</i>	19,546	85.1
<i>Female</i>	3,420	14.9
<i>Women traveling alone</i>	2,025	59.2 <sup>2</sup>
<i>Pregnant women</i>	346	10.1 <sup>2</sup>
<i>Unaccompanied minors</i>	4,261	18.6
<i>Children &lt; 5 yo</i>	328	1.4
<b>Country of origin</b>		
<b>Sub-Saharan Africa</b>		
<i>Nigeria</i>	4,140	18.0
<i>Eritrea</i>	2,395	10.4
<i>Guinea Conakry</i>	1,916	8.3
<i>Ivory Coast</i>	1,656	7.2
<i>Sudan</i>	1,195	5.2
<i>Senegal</i>	1,166	5.1
<i>Gambia</i>	1,128	4.9
<i>Ghana</i>	857	3.7
<i>Cameroon</i>	593	2.6
<i>Somalia</i>	436	1.9
<i>Sierra Leone</i>	351	1.5
<i>Ethiopia</i>	167	0.7
<i>Guinea Bissau</i>	155	0.7
<i>Mali</i>	129	0.6
<i>Burkina Faso</i>	118	0.5
<i>Togo</i>	102	0.4
<i>Niger</i>	99	0.4
<i>South Sudan</i>	59	0.3
<i>Chad</i>	49	0.2
<i>Benin</i>	31	0.1
<i>Democratic Republic of Congo</i>	9	0.0
<i>Uganda</i>	9	0.0
<i>Central African Republic</i>	4	0.0
<i>Liberia</i>	2	0.0
<b>Asia</b>		
<i>Bangladesh</i>	1,432	6.2
<i>Syria</i>	334	1.5
<i>Pakistan</i>	273	1.2
<i>Palestina</i>	41	0.2
<i>Yemen</i>	22	0.1
<i>Iraq</i>	5	0.0
<i>Afghanistan</i>	3	0.0
<b>North Africa</b>		
<i>Egypt</i>	199	0.9
<i>Algeria</i>	126	0.5
<i>Tunesia</i>	57	0.2
<i>Morocco</i>	21	0.1
<i>Libya</i>	18	0.1
<b>Other / Unknown</b>		
<i>Other</i>	96	0.4
<i>Unknown</i>	3573	15.6

182 Note:

183 <sup>1</sup>Percentage of total number of rescued people

184 <sup>2</sup>Percentage of total number of rescued women

185

186 **Health conditions**

187 Between January 2016 and December 2019, MSF conducted 12,438 outpatient consultations, of  
 188 which 9,811 were new consultations (78.9%, 9,811/12,438). Additionally, MSF performed 143 ante-  
 189 natal care consultations (41.3% of self-reported female pregnant population, 143/346) and  
 190 conducted 853 sexual and reproductive health consultations (24.9% of female population,  
 191 853/3,420).

192 In addition, MSF documented 287 consultations for SGBV, of which the vast majority (99.7%,  
 193 286/287) took place 72 hours or more after the incident occurred. Five women were recorded who  
 194 were pregnant after a rape. There were eight women recorded who requested termination of  
 195 pregnancy (TOP), of which six were referred upon disembarkation in Europe.

196 MSF organized 23 urgent medical referrals which required immediate transport to referral health  
 197 facilities by fast boat or by helicopter. An additional 1,552 non-urgent medical referrals were  
 198 organized who were referred to non-MSF clinics upon arrival on the mainland (Table 2).

199 *Table 2. MSF consultations and referrals of migrants, refugees and asylum seekers on MSF's search*  
 200 *and rescue vessels on the Mediterranean Sea, 2016-2019*

	N	%
<b>All consultations</b>	<b>12,438</b>	
<i>Number of new consultations</i>	<i>9,811</i>	<i>78.88</i>
<i>Other follow-up</i>	<i>211</i>	<i>1.70</i>
<i>Number of dressings New</i>	<i>772</i>	<i>6.21</i>
<i>Number of dressings Follow-up</i>	<i>334</i>	<i>2.69</i>
<i>Number of injections</i>	<i>1,310</i>	<i>10.53</i>
<b>SRH consultations<sup>1</sup></b>	<b>853</b>	<b>6.86</b>
<i>ANC consultations<sup>2</sup></i>	<i>143</i>	<i>25.04</i>
<b>SGBV consultations<sup>1</sup></b>	<b>287</b>	<b>2.31</b>
<i>SGBV consultations &lt;72hrs<sup>3</sup></i>	<i>1</i>	<i>0.35</i>
<i>SGBV consultations &gt;72 hours<sup>3</sup></i>	<i>286</i>	<i>99.65</i>
<i>Pregnant due to rape<sup>4</sup></i>	<i>5</i>	<i>6.58</i>
<i>TOP requests<sup>2</sup></i>	<i>8</i>	<i>1.40</i>
<i>TOP referrals<sup>2</sup></i>	<i>6</i>	<i>1.05</i>

<b>Referrals</b>	<b>1,575</b>	<b>12.66</b>
<i>Urgent - Medevac (fast boat/helicopter)</i>	23	1.46
<i>Not urgent (upon arrival)</i>	1,552	98.54

Note:

<sup>1</sup>Number of SRH and SGBV consultations recorded between May 2016 and December 2019. Percentages calculated over the total number of consultations in the same period

<sup>2</sup>Number of ANC consultations, TOP requests and TOP referrals recorded between September 2017 and December 2019.

Percentage calculated over the total number of SRH consultations in the same period

<sup>3</sup>Number of SGBV consultations that took place within and after 72 hours recorded between December 2016 and December 2019. Percentages calculated over the total number of SGBV consultations in the same period

<sup>4</sup>Number of women pregnant due to rape recorded between January 2018 and December 2019. Percentage calculated over total number of pregnant women during the same period

211 Among all diagnoses for children under five, 46.8% (51/109) were related to skin conditions. The  
 212 most frequently diagnosed health conditions among children aged five years or older and adults  
 213 were skin conditions (30.6%, 5,475/17,869), motion sickness (28.6%, 5,116/17,869), headache  
 214 (15.4%, 2,748/17,869) and acute injuries (5.7%, 1,013/17,869). Of acute injuries, 44.7% were non-  
 215 violence related injuries (i.e. injuries that were not caused by violence) (453/1,013), 30.1% were fuel  
 216 burns (297/1,013) and 25.4% were violence-related injuries (257/1,013) (Table 3).

217 *Table 3. Health conditions of migrants, refugees and asylum seekers on MSF's search and rescue*  
 218 *vessels on the Mediterranean Sea, 2016-2019: MSF outpatient department consultations*

Diagnosis	<5 years		≥5 years		Total	Proportional morbidity (%)
	Male	Female	Male	Female		
<b>Acute injuries</b>	<b>4</b>	<b>0</b>	<b>834</b>	<b>179</b>	<b>1,017</b>	<b>5.66</b>
<i>Fuel burn</i>	0	0	212	85	297	1.65
<i>Non-violence related injury</i>	3	0	399	54	456	2.54
<i>Resuscitation</i>	1	0	3	3	7	0.04
<i>Violence-related injury</i>	0	0	220	37	257	1.43
<b>Chronic diseases</b>	<b>0</b>	<b>0</b>	<b>58</b>	<b>13</b>	<b>71</b>	<b>0.39</b>
<b>Dehydration</b>	<b>2</b>	<b>1</b>	<b>503</b>	<b>35</b>	<b>541</b>	<b>3.01</b>
<b>Hypothermia</b>	<b>0</b>	<b>2</b>	<b>153</b>	<b>22</b>	<b>177</b>	<b>0.98</b>
<b>Infectious diseases</b>	<b>8</b>	<b>8</b>	<b>740</b>	<b>101</b>	<b>857</b>	<b>4.77</b>
<i>Acute bloody diarrhea</i>	0	0	30	6	36	0.20
<i>Acute flaccid paralysis</i>	0	0	0	0	0	0.00
<i>Acute lower respiratory tract infection</i>	1	1	58	10	70	0.39
<i>Acute upper respiratory tract infection</i>	6	6	373	41	426	2.37
<i>Acute watery diarrhea</i>	1	1	194	26	222	1.23
<i>Malaria (confirmed)</i>	0	0	2	1	3	0.02
<i>Measles (suspected)</i>	0	0	0	0	0	0.00
<i>Meningitis (suspected)</i>	0	0	0	0	0	0.00

<i>Sexually transmitted infection</i>	0	0	51	13	64	0.36
<i>Tuberculosis (suspected)</i>	0	0	32	4	36	0.20
<i>Typhoid fever</i>	0	0	0	0	0	0.00
<b>Gynecological conditions</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>575</b>	<b>575</b>	<b>3.20</b>
<i>Gynecological disease</i>	0	0	0	93	93	0.52
<i>Pregnancy related</i>	0	0	0	482	482	2.68
<b>Skin conditions</b>	<b>24</b>	<b>27</b>	<b>4,839</b>	<b>636</b>	<b>5,526</b>	<b>30.74</b>
<i>Scabies</i>	7	9	1,401	210	1,627	9.05
<i>Skin disease</i>	14	18	3,259	421	3,712	20.65
<i>Skin infection</i>	3	0	179	5	187	1.04
<b>Mental health</b>	<b>0</b>	<b>0</b>	<b>14</b>	<b>12</b>	<b>26</b>	<b>0.14</b>
<i>Common Psychiatric Disorders</i>	0	0	9	11	20	0.11
<i>Severe Psychiatric Disorders</i>	0	0	5	1	6	0.03
<b>Motion sickness</b>	<b>2</b>	<b>3</b>	<b>4,344</b>	<b>772</b>	<b>5,121</b>	<b>28.48</b>
<b>Other conditions</b>	<b>15</b>	<b>13</b>	<b>2,987</b>	<b>561</b>	<b>3,576</b>	<b>19.89</b>
<i>Anaemia</i>	0	0	8	3	11	0.06
<i>Fever without identified cause</i>	4	3	80	19	106	0.59
<i>Headache</i>	0	0	2,363	385	2,748	15.29
<i>Urinary tract infection</i>	0	0	28	21	49	0.27
<i>Eye infection</i>	1	1	73	15	90	0.50
<i>Other</i>	10	9	435	118	572	3.18
<b>Severe acute malnutrition</b>	<b>0</b>	<b>0</b>	<b>7</b>	<b>2</b>	<b>9</b>	<b>0.05</b>
<b>Sexual violence</b>	<b>0</b>	<b>0</b>	<b>30</b>	<b>452</b>	<b>482</b>	<b>2.68</b>
<b>Total</b>	<b>55</b>	<b>54</b>	<b>14,509</b>	<b>3,360</b>	<b>17,978</b>	<b>100</b>

Note:

<sup>1</sup>Number of times disease or condition was diagnosed at the outpatient department between January 2016 and December 2019. The total number of diagnoses exceeds the total number of consultations due to staff turnover that lead to variation in procedures, documentation and measurements. For example, for some months the deck management of motion sickness, headache and deck inspection of scabies were included in the OPD consultations, while other months they were excluded from the total OPD consultation counts.

## Sexual and Gender Based Violence

MSF documented a total of 482 consultations for Sexual and Gender Based Violence (SGBV), of which 30 were for male and 452 were for female survivors (Table 3). Of the 482 consultations for SGBV, 95 were first consultations for rape specifically in 2018 (78) and 2019 (17). Of these first consultations, 99% (94/95) took place more than 72 hours after the incident. The majority of survivors were female (91.6%, 87/95) and 15 years or older (99%, 94/95). Most survivors of rape came from Nigeria (36.8%, 35/95), followed by Cameroon (21.1%, 20/95) and Ivory Coast (19%, 18/95) (Table 4).

Table 4. Consultations for rape of migrants, refugees and asylum seekers on MSF's search and rescue vessels on the Mediterranean Sea, 2018-2019

	2018		2019		Total	
	N	%	n	%	n	%
<b>Number of first consultations for rape</b>	<b>78</b>		<b>17</b>		<b>95</b>	
<b>Time since incident</b>						
<72 hours	1	1.28	0	0	1	1.05
>72 hours	77	98.72	17	1.00	94	98.95
<b>Age</b>						
<5 yo	0	0	0	0	0	0
5-14 yo	1	1.28	0	0	1	1.05
≥15	77	98.72	17	1.00	94	98.95
<b>Gender</b>						
Female	71	91.03	16	0.94	87	91.58
Male	7	8.97	1	0.06	8	8.42
<b>Country of origin</b>						
Cameroon	15	19.23	5	29.41	20	21.05
Eritrea	2	2.56	0	0	2	2.11
Ghana	1	1.28	0	0	1	1.05
Guinea Conakry	1	1.28	0	0	1	1.05
Ivory Coast	13	16.67	5	29.41	18	18.95
Liberia	1	1.28	0	0	1	1.05
Mali	1	1.28	0	0	1	1.05
Morocco	3	3.85	0	0	3	3.16
Nigeria	31	39.74	4	23.53	35	36.84
Senegal	1	1.28	0	0	1	1.05
Sierra Leone	5	6.41	1	5.88	6	6.32
Somalia	3	3.85	2	11.76	5	5.26
Sudan	1	1.28	0	0	1	1.05

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## 236 Mortality on board

237 Between January 2016 and December 2019 five deaths occurred on MSF's search and rescue vessels.

238 Probable causes of death included compressive asphyxiation due to human crushes and stampedes

239 on the wooden boats or dinghies or while getting on the boat, and severe hypothermia. In addition

240 to these five deaths, the search and rescue vessels frequently onboarded people who had already

241 died on their journey prior to reaching the MSF vessels.



## 242 Discussion

243 We were able to present data from onboard consultations that were systematically offered to all  
244 22,966 rescued people on one of the largest and longest running rescue vessels on the  
245 Mediterranean Sea. Over the course of three years (November 2016 - December 2019).

246 The number of rescues varied per month due to the constantly changing 'search and rescue  
247 landscape', including restrictions on search and rescue activities of NGOs and the increased  
248 involvement of the Libyan Coast Guard (LCG) in rescues, returning large numbers of migrants,  
249 refugees and asylum seekers to Libya (19)(20). Additionally, the number of migrants, refugees and  
250 asylum seekers attempting to make the crossing also fluctuated per month depending on weather  
251 conditions (20).

252 Between January 2016 and December 2019, MSF conducted 12,438 outpatient consultations. MSF  
253 situational reports showed that the length of stay of migrants, refugees and asylum seekers on the  
254 search and rescue vessels varied, with increasingly long standoffs on sea in 2019. At times, the ship  
255 needed to stay off-coast for weeks with rescued people onboard whilst waiting to be assigned a  
256 place of safety for disembarkation. This had a direct impact on the volume of OPD consultations and  
257 medical and psychological complaints, as crowded living conditions and confined spaces onboard  
258 were causing discomfort and rescued people needed multiple consultations while awaiting non-  
259 urgent referrals.

260 Women represented 14.9% of the rescued migrants, refugees and asylum seekers. While this  
261 percentage is lower than the percentage of women seeking asylum in the European Union, the  
262 demographic breakdown was similar on other search and rescue vessels on the central  
263 Mediterranean route (13)(21). The percentage of children under five and unaccompanied minors was  
264 also lower than expected compared to the percentages seeking asylum in the European Union. The  
265 central Mediterranean route is considered relatively difficult and might be less often attempted by

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3 266 women and children. Moreover, in critical rescues, which occur frequently on this part of the sea,  
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5 267 there is oftentimes much loss of life which impacts women and children disproportionately (2).  
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8 268 The high proportional morbidity of skin conditions has been noted on other search and rescue  
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10 269 vessels as well, frequently with superinfection (13)(14). Scabies is typically associated with long  
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12 270 permanence in conditions of poor hygiene, crowd, poverty and detentions (22)(23)(24). Therefore,  
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14 271 the high burden of skin conditions among migrants, refugees and asylum seekers included in this  
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16 272 study, like scabies, could be linked to the living conditions on the migrants' journey and while they  
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18 273 are in Libya (9).  
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22 274 Almost 6% of the diagnoses on board (n=1,017) were fuel burn wounds, violent and non-violent  
23  
24 275 trauma. Similar chemical burns due to benzene were found on other search and rescue vessels, due  
25  
26 276 to the mixture of salt water with fuel that is often spilled inside the boats and stays attached to the  
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28 277 clothing and body, causing deep burns due to prolonged skin contact (13)(25). Women appear to be  
29  
30 278 disproportionately affected by fuel burn wounds. An explanation could be that women often sit in  
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32 279 the middle of the boat to be protected from the waves as they often cannot swim. If there is any fuel  
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34 280 leakage, this often accumulates in the middle of the boat where the women sit. Some non-violent  
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36 281 injuries may have been sustained on the dinghies or during the rescue operations. The long journey  
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38 282 to Libya and often prolonged stay in Libya, during which people on the move often face and  
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40 283 exploitation, contributed to the violence-related injuries that were diagnosed.  
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45 284 Non-communicable diseases (NCD) only made up for 0.4% of all diagnoses. Similarly, complications  
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47 285 from NCDs were identified in 0.7% of migrants, refugees and asylum seekers on the search and  
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49 286 rescue vessel of NGO Open Arms on the Mediterranean Sea (n=4,516)(13). The lack of testing  
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51 287 equipment, the short length of stay and the prioritization of urgent medical care on the rescue  
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53 288 vessels could lead to an underestimation of NCDs in rescued people. The young age and initially  
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55 289 relatively good health of migrants that take the central Mediterranean route could also play a role.  
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3 290 Time and space constraints on board make it not feasible or desirable to conduct systematic mental  
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5 291 health screening on board. Only self-reported mental health complaints were recorded at the  
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7 292 outpatient clinic. Migrant reception centers and health facilities in Europe that are implementing  
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9 293 mental health services have found a high burden of mental health conditions (26)(15)(27). Similar  
10  
11 294 mental health conditions following trauma have been seen along other migratory routes, such as the  
12  
13 295 western Balkan corridor to Northern Europe. A study showed that nearly one-in-three migrants seen  
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15 296 at MSF mental health clinics experienced physical or psychological trauma along their journey, many  
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17 297 of which reporting anxiety and mental trauma (28). Considering the treacherous journey that the  
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19 298 migrants, refugees and asylum seekers will have had to endure, including the attempt to cross on  
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21 299 oftentimes overcrowded dinghies or wooden boats with lacking hygiene conditions and food and  
22  
23 300 water availability, and in combination with underlying trauma, the psychological first aid offered by  
24  
25 301 MSF is essential. Especially with the increasingly longer stand offs on sea, keeping migrants, refugees  
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27 302 and asylum seekers on board of the search and rescue vessels for weeks. However, the limitations of  
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29 303 space, capacity and lack of interpreters, as also noted on search and rescue vessels in Greece, will  
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31 304 continue hinder the medical team's ability to provide more in-depth mental health support on the  
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33 305 ships (25)(29).

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39 306 Out of the 482 SGBV consultations, there were 95 first consultations specifically for rape. The MSF  
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41 307 medical team attempted to have systematic consultations with all rescued women and carefully ask  
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43 308 about SGBV and any support they may need. However, this was difficult to implement due to space  
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45 309 and time constraints and the hesitance of SGBV survivors to speak out due to fear of stigmatization.  
46  
47 310 Only 30 consultations were conducted for male survivors of SGBV in general, of which seven  
48  
49 311 consultations were conducted for male survivors of rape specifically, which is a likely  
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51 312 underestimation of the true number of male survivors. Additional male survivors of SGBV have been  
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53 313 identified by non-medical staff on board, and is confirmed by testimonies given by rescued people,  
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55 314 but they refused medical consultation and were therefore not included in the analysis.  
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## 315 Limitations

316 The need for services was high and onboard staff were often overwhelmed with sudden influxes of  
317 rescued people. This impacted the ability of the medical team to collect accurate data and properly  
318 document diagnoses and demographic characteristics. Therefore, we do not have reliable population  
319 counts, which could be used as denominators for the calculation of disease incidence or assess  
320 whether the length of stay had an effect on the number of OPD consultations or diagnosed  
321 morbidities.

322 Due to the limited testing and diagnoses capacity of the outpatient department, space limitations  
323 and the generally short length of stay of migrants, refugees and asylum seekers on the ship, it was  
324 not feasible to provide in-depth medical and psychological treatment and support, which has likely  
325 led to an underestimation of actual morbidities including mental health conditions and SGBV.

326 All data presented was collected as routine MSF program data, that needed to be recorded quickly so  
327 as not to create further delays for migrants awaiting medical care. Therefore, some of the data was  
328 incomplete and could only be partly used for this analysis. While case definitions stayed the same  
329 throughout the observation period, staff turnover lead to variation in procedures, documentation  
330 and measurements. For example, for some months the deck management of motion sickness,  
331 headache and deck inspection of scabies were included in the OPD consultations, while other months  
332 they were excluded from the total OPD consultation counts. The recording of skin diseases, skin  
333 infections and scabies also varied over time, which resulted in three diagnosis categories that are  
334 difficult to disentangle retrospectively.

335

## 336 Conclusion

337 MSF's access to the rescue areas in the central Mediterranean Sea has varied over the past three  
338 years and has been unpredictable. In line with findings from other studies of morbidities on search  
339 and rescue vessels, the main diagnoses on board where MSF teams have operated were non-severe

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3 340 and directly related to the migration journey on the boat and previously on the way to and in Libya  
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5 341 such as overcrowding, lack of drinking and washing water, extreme sun exposure, heat or cold.  
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7 342 Approximately 1/3 of total diagnosis were scabies, 1/3 motion sickness and 1/6 headache. However,  
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9 343 of the diseases on board, we also identified potentially severe conditions related to the journey in  
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11 344 about 10% of the population, namely dehydration, hypothermia and acute injuries. Additionally, we  
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13 345 identified survivors of sexual and gender-based violence and violence-related injuries, which most  
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15 346 likely are only the top of the iceberg. The number of diagnoses of infectious diseases was very low  
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17 347 compared to other diagnoses (13)(14)(15). We conclude that this population may be relatively young  
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19 348 and healthy but displays significant journey-related illnesses and includes migrants, refugees and  
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21 349 asylum seekers who have suffered significant violence during their transit and need urgent and direct  
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23 350 access to essential services and protection in a place of safety on land.  
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## 352 Contributorship statement

353 AF, GH and RK were responsible for data acquisition. EVB and AK conceptualized the study. EVB was  
354 responsible for the data analysis. EVB and AK drafted the first version of the manuscript. EVB, AK, AF,  
355 GH, RK, IA, TT and HH were responsible for data interpretation. EVB, AK, AF, GH, RK, IA, TT and HH  
356 reviewed and contributed to the final version of the manuscript.

## 357 Competing interests

358 There are no competing interests to declare

## 359 Funding

360 There is no funding to report for this submission.

## 361 Data sharing agreement

362 Data are available upon reasonable request

## 363 Ethics statement

364 This research fulfilled the exemption criteria set by the Médecins Sans Frontières Ethics Review  
 365 Board for a posteriori analyses of routinely collected clinical data and thus did not require MSF ERB  
 366 review. It was conducted with permission from Melissa McRae, Medical Director, Operational Centre  
 367 Amsterdam, Médecins Sans Frontières.

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 370 asylum seekers on search and rescue vessels and beyond every day.

## 371 Figure legends

372 *Figure 1. Number of migrants, refugees and asylum seekers rescued by MSF's search and rescue*  
 373 *vessels on the Mediterranean Sea and number of consultations at MSF's Outpatient Department by*  
 374 *month*

375 Blue: number of rescued males

376 Grey: number of rescued females

377 Red: number of outpatient department consultations

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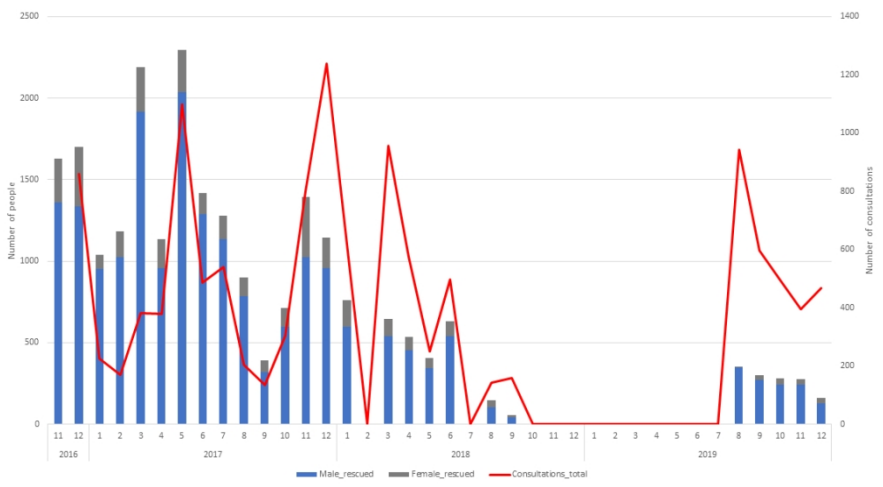
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## STROBE Statement—checklist of items that should be included in reports of observational studies

	Item No	Recommendation
<b>Title and abstract</b>	1	(a) Indicate the study's design with a commonly used term in the title or the abstract <i>Line 1-3</i> (b) Provide in the abstract an informative and balanced summary of what was done and what was found <i>Line 20-44</i>
<b>Introduction</b>		
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported <i>Line 107-117</i>
Objectives	3	State specific objectives, including any prespecified hypotheses <i>Line 112-117</i>
<b>Methods</b>		
Study design	4	Present key elements of study design early in the paper <i>Line 119-123</i>
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection <i>Line 124-141</i>
Participants	6	(a) <i>Cohort study</i> —Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up <i>Case-control study</i> —Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls <i>Cross-sectional study</i> —Give the eligibility criteria, and the sources and methods of selection of participants <i>Line 124-127</i> (b) <i>Cohort study</i> —For matched studies, give matching criteria and number of exposed and unexposed <i>Case-control study</i> —For matched studies, give matching criteria and the number of controls per case
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable <i>Line 128-141</i>
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group <i>Line 128-141</i>
Bias	9	Describe any efforts to address potential sources of bias <i>We discussed this in the limitations session and identified that there were potentially different documentation styles of MSF staff, and that it is possible that certain conditions were less likely to be recorded.</i>
Study size	10	Explain how the study size was arrived at <i>N/A – retrospective analysis of routine medical program data</i>
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why <i>We calculated proportions of all variables and did not group any variables.</i>
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding <i>N/A</i>

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(b) Describe any methods used to examine subgroups and interactions

Only descriptive epidemiological methods were used.

(c) Explain how missing data were addressed

See footnotes to Tables

(d) *Cohort study*—If applicable, explain how loss to follow-up was addressed

*Case-control study*—If applicable, explain how matching of cases and controls was addressed

*Cross-sectional study*—If applicable, describe analytical methods taking account of sampling strategy

NA

(e) Describe any sensitivity analyses

Line 142-145

Continued on next page

**Results**

Participants	13*	(a)	Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed
			Line 158-165
		(b)	Give reasons for non-participation at each stage
		(c)	Consider use of a flow diagram
Descriptive data	14*	(a)	Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders
			Line 158-165
		(b)	Indicate number of participants with missing data for each variable of interest
			N/A
		(c)	<i>Cohort study</i> —Summarise follow-up time (eg, average and total amount)
Outcome data	15*		<i>Cohort study</i> —Report numbers of outcome events or summary measures over time
			<i>Case-control study</i> —Report numbers in each exposure category, or summary measures of exposure
			<i>Cross-sectional study</i> —Report numbers of outcome events or summary measures
			Line 187-242
Main results	16	(a)	Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included
			N/A
		(b)	Report category boundaries when continuous variables were categorized
			N/A
		(c)	If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period
			N/A
Other analyses	17		Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses
			N/A
<b>Discussion</b>			
Key results	18		Summarise key results with reference to study objectives
			Line 243-315
Limitations	19		Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias
			Line 316-335
Interpretation	20		Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence
			Line 243-315
Generalisability	21		Discuss the generalisability (external validity) of the study results
			N/A

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60**Other information**

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Funding 22 Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based

Line 358

\*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

**Note:** An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at [www.strobe-statement.org](http://www.strobe-statement.org).