Original Article

Migrants rescued on the Mediterranean Sea route: nutritional, psychological status and infectious disease control

Silvia Angeletti1*, Giancarlo Ceccarelli2,3*, Riccardo Bazzardi4*, Marta Fogolari1, Serena Vita2,3, Francesca Antonelli1,5, Lucia De Florio1, Yeganeh Manon Khazrai6, Vincenza De Noia7,8, Maurizio Lopalco7, Domenico Alagia7, Claudio Pedone6, Gaetano Lauri10, Rosario Aronica11, Elisabetta Riva6, Ayse Banu Demir12, Hakan Abacioglu13, Massimo Ciccozzi14, The Sanitary Bureau of Extraordinary Reception Center (ERC) of Rocca di Papa

1 Unit of Clinical Laboratory Science, University Campus Bio-Medico of Rome, Italy
2 Migrant and Global Health Research Organization, Centro di ricerca sulla salute globale e delle popolazioni mobili (Mi-Hero) e Sanità di Frontiera Onlus
3 Department of Public Health and Infectious Diseases, University of Rome Sapienza, Italy
4 Controllo Microbiologico e Ispezione degli Alimenti, Istituto Zooprofilattico Sperimentale della Sardegna “G. Pegreffi”, Sassari, Italy
5 Unit of Virology, University Campus Bio-Medico of Rome, Italy
6 Unit of Food Science and Human Nutrition, University Campus Bio-Medico of Rome, Italy
7 ERC “Mondo Migliore”, Cooperativa Sociale San Filippo Neri, Rocca di Papa, Italy
8 Clinical Psychology Unit, University of Chieti “Gabriele D’Annunzio”, Italy
9 Unit of Geriatrics, University Campus Bio-Medico of Rome, Italy
10 Unit of Gastroenterology, University Campus Bio-Medico of Rome, Italy
11 Faculty of Psychiatry, Department of Systems Medicine, University of Rome Tor Vergata, Italy
12 Department of Medical Biology, İzmir University of Economics, İzmir, Turkey
13 Faculty of Medicine, İzmir University of Economics, İzmir, Turkey
14 Unit of Medical Statistics and Molecular Epidemiology, University Campus Bio-Medico of Rome, Italy

* These authors equally contributed and should be considered all first authors.

Abstract

Introduction: North Africa has become a key migratory hub where a large number of migrants attempt the journey by sea from the Libyan coastline to the south of Europe. In this humanitarian disaster scenario, the Mediterranean route has been one of the most used by illegal boats.

Methodology: In this report, the state of physical and psychological health of a cluster of Eritrean migrants, escaped from Libya and rescued in the Mediterranean Sea after a shipwreck, was described by epidemiological, clinical and laboratory investigations.

Results: Data suggest that despite the majority of the migrants being apparently in good health upon a syndromic surveillance approach, most of them suffered a decline in psychological status as well as severe malnutrition. The emergence of infectious diseases, related to poor living conditions during the journey, is not a rare event.

Conclusion: The present report highlights the risks of failures of the syndromic medical approach in the setting of the extremely challenging migration route and underlines migrant frailties consequent to a prolonged journey and long period of detention. These stressors, which can degrade the initial health condition of traveling migrants, can lead to a premature "exhausted migrant effect" that should be carefully investigated in order to avoid the early emergence of diseases related to frailty.

Key words: Surveillance; laboratory blood screening; migrants; healthy migrant hypothesis; exhausted migrant effect.

J Infect Dev Ctries 2020; 14(5):454-462. doi:10.3855/jidc.11918

(Received 08 August 2019 – Accepted 26 October 2019)

Copyright © 2020 Angeletti et al. This is an open-access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Introduction

Since 2014, an unprecedented increase in the number of migrants, refugees and asylum seekers trying to enter Europe has been observed [1,2]. In this period, North Africa has become a key migratory hub characterized by a large number of inter-regional movements of migrants. Many of them are fleeing protracted conflicts in the Middle East and Africa, and looking to attempt the journey by sea from the Libyan coastline to the south of Europe.
In this humanitarian disaster scenario, the central Mediterranean route (which refers to the sea journey from North Africa to Italy) has been one of the most consistently used by illegal boats carrying migrants [3,4]. According to Frontex data, from 2014 to 2018, more than 648,000 migrants arrived to Italy through this route; the top three nationalities involved in this migration flux were Nigerians, Eritreans and Guineans. [4]

The danger of the journey is documented by the frequent shipwrecks and daily rescue operations conducted by coastal guards, non-governmental organizations and commercial ships that cross on the same route. Moreover, before attempting to cross the Mediterranean Sea, migrants often stay for long periods in Libyan detention camps, victims of mistreatment and torture. Although most migrants leave their countries of origin in apparent good health, all these factors can contribute to a condition of vulnerability and fragility that can significantly compromise health assets [5,6].

This concept is partially summarized in the so-called “healthy migrant hypothesis”, stating that a self-selection of subjects better prepared to confront stressful situations takes place within the native community before departure in order to increase the probability of success of the migration project.

In this perspective, it is reasonable to assume that people in better health conditions have an advantage and therefore the state of health at the start of the journey can be considered a determinant of success.

In agreement, the so-called “exhausted migrant effect” describes that the healthy condition at the departure might decrease with time and after arriving at the destination of the migration route. This effect can probably be due to a combination of environmental and behavioural changes: different climate and eating habits, unemployment and lack of income, degraded housing, absence of community support, psychological discomfort, and finally difficulty in accessing both social and health services [7-8]. A bias against the “exhausted migrant effect” hypothesis is the possibility that the deterioration of the state of health occurred already before the arrival in the host country, as a result of the geographical, climatic, environmental, social, and political obstacles encountered during the journey.

For these reasons, the knowledge of the health status of migrants departing from the Libyan coasts is of fundamental importance for setting up policies that facilitate reception and the protection of public health. However, currently few medical data and no systematic studies are available. In this report, we describe, for the first time to the best of our knowledge, the state of health of a cluster of Eritrean migrants who had embarked in Libya and were rescued in the Mediterranean Sea while trying to reach the Italian coasts.

**Description of the events**

In August 2018, an international rescue operation by the Italian Coast Guard ship “Ubaldo Diciotti”, saved 190 migrants (almost all from Eritrea) who had embarked on an overcrowded boat, attempting to cross the Mediterranean Sea from Libya, between the islands of Lampedusa and Malta (Figure 1). This rescue operation, similar to many others in recent years, Jumped to the headlines and was followed by international mass media as the migrants were held on board the military vessel for about ten days as a result of a diplomatic crisis between Italy and the European Union (EU). In order to solve the divergent views on the reception modalities and on the redistribution plan of the rescued persons among the EU member states, the Vatican State, Albania and Ireland offered their willingness to take care of the migrants.
While waiting for resolution of the diplomatic crisis, the migrants remained on board the ship, first sailing towards Sicily and then anchored in Catania’s harbour. The medical evaluation of the migrants’ state of health, carried out on board the ship, identified 30/190 (15.8%) people who were immediately disembarked and hospitalized for suspected transmissible pathologies or acute diseases. Besides these, a further 27/190 (14.2%) unaccompanied minors left the vessel early. The other migrants remained on board until the crisis was solved, having been judged to be in sufficiently good health by the syndromic evaluation [9-11]. The syndromic surveillance protocol used, created by the Italian Ministry of Health in collaboration with the National Centre for Epidemiology, Surveillance and Health Promotion of the National Institute of Health, was based on a total of 13 syndromes defined as potentially indicative of infectious diseases and/or unusual adverse health events (syndromes under surveillance included: respiratory tract disease, suspected tuberculosis, bloody diarrhoea, watery diarrhoea, fever and rash, meningitis/encephalitis or encephalopathy/delirium, lymphadenitis with fever, botulism-like illness, sepsis with or without shock, or unexplained shock, haemorrhagic illness, acute jaundice, parasitic skin infection, unexplained death) [12].

Ten days after arriving in Catania, all migrants on board were disembarked and temporarily hosted at the Asylum Seekers Center (ASC) of Messina; of these, 100 (52.6%) Eritrean migrants welcomed by the Italian Catholic Church were transferred to the Extraordinary Reception Center (ERC) "Mondo Migliore" of Rocca di Papa. The other 31.6% were hosted in reception centres outside of Italy, in European Countries.

Methodology

Epidemiological and clinical data collection

At their arrival at the ERC Mondo Migliore, all migrants received medical and psychological evaluation by individual interview with the support of a cultural mediator. Clinical data were recorded at the medical ambulatory clinic managed by a team of physicians accredited in internal medicine and infectious diseases, psychologists, nurses and cultural mediators. A medical screening visit was performed on arrival for all migrants [13-16].

Tuberculosis screening

A specific interview for tuberculosis (TB) included information on the following eight items: history of previous TB, contact with TB, cough in the last 3 weeks, fever in the last 7 days, night sweats, loss of weight > 10%, haemoptysis in the last 3 months, and thoracic pain. Moreover, the Mantoux skin test and interferon-gamma release assay (IGRA) were used to screen for tuberculosis. Tuberculosis screening was conducted by a two-stage process beginning with a test for tuberculosis infection. The second stage, consisting of the chest radiography (X-ray), was performed only among migrants with Mantoux skin test inductions > 5 mm in diameter, and/or a positive IGRA and/or on the basis of a positive results of TB questionnaire and physical examination [17].

Psychological screening

The psychologist team administered the Refugee Health screener-15 (RH-15), a new approach based on a fifteen-item screen for symptoms of depression, anxiety, and post-traumatic stress disorder (PTSD) [18-20].

Items 1–14 ask respondents to rate the frequency of psychological and somatic symptoms on a 4-point Likert scale scored 0 (‘not at all’) to 4 (‘extremely’) and diagrammatically annotated with a beaker filled to varying degrees. Item fifteen is a distress thermometer (DT), which asks respondents to rate their level of distress from 0 (‘no distress’) to 10 (‘extreme distress’). A total score ≥ 12 on items 1–14 and/or a score of ≥ 5 on the DT are considered to be a positive screen requiring further assessment.

Laboratory blood screening

Besides medical and psychological evaluation, in 70/100 Eritrean migrants laboratory blood screening was also carried out, including biochemical and hematologic exams. Written informed consent was obtained from all the subjects in presence of cultural-linguistic mediators. After collection, blood samples were received and analyzed at the Laboratory Unit of the University Hospital Campus Bio-Medico of Rome. The laboratory screening included blood cell count, C-Reactive Protein (CRP); Aspartate Aminotransferase (AST) and Alanine Aminotransferase (ALT); blood urea nitrogen (BUN) and creatinine; lactate dehydrogenase (LDH); serum total protein (TP), albumin; folic acid; cobalamin and vitamin D-25OH. For laboratory screening, normal reference intervals validated for the Eritrean population were used [21,22]. These blood tests allowed us to detect issues related to anaemia, iron deficiency, inflammation, malnutrition, renal and liver function. Furthermore, serological screening for hepatitis B/C and HIV was performed [23].
Results

Migrants hospitalized early for acute diseases or suspected transmissible pathologies

As previously reported, 30 (15.8%) migrants were disembarked early and hospitalized for suspected transmissible pathologies or acute diseases. Among these, 13 people were initially landed in Lampedusa and Porto Empedocle in Sicily to attend to their clinical conditions: three children with scabies together with their family, a woman who had a miscarriage, and three men, one with lymphedema, one with severe abdominal pain and one in a hypotensive state due to dehydration. When the ship reached Catania’s harbour, an additional six men and seven women were ordered off the boat by the medical staff and taken to Catania’s Garibaldi hospital. The women were admitted for the treatment of trauma caused by repeated rapes. Three men were isolated for suspected tuberculosis, five for suspected scabies, two for pneumonia and one for urinary infection. After preliminary medical evaluation, two migrants were admitted to the Infectious Diseases Department for pulmonary tuberculosis, and one to the Pneumology Department for community acquired pneumonia.

The syndromic surveillance did not reveal signs and/or symptoms compatible with emerging pathologies.

State of health of migrants assessed in good clinical condition by syndromic evaluation

About two weeks after the rescue operations, all the migrants who had at first been assessed as being in good health through the syndromic evaluation carried out on board the ship, were landed. Of these, one hundred Eritrean migrants were transferred to and hosted by the Italian Catholic Church at the ERC "Mondo Migliore" of Rocca di Papa near Rome where the medical team had the opportunity to evaluate their state of health in more depth, as described in the following section.

Medical history and clinical evaluation

The demographic characteristics and data from the clinical examination on arrival at the ERC are reported in Table 1. Migrants had a median age of 24 years and were mostly men (92%) of Christian religion (99%) with good school education (10 years of education on average); the most common occupations were students (52%) and soldiers (35%). They declared to have left their country of origin between 11 and 21 months before their arrival at the ERC. This period was mostly spent in Libya as prisoners, where they were held in the dark, eating once a day a shared meal divided among many, and being repeatedly beaten.

Regarding their past medical histories, one person had visual impairment due to childhood trauma, two had gunshot wounds, one had gastritis, and two, malaria episodes. In their recent medical histories, 55% had had scabies treatment, one underwent chest X-ray for cough (which was negative), one person had had treatment for impetigo and one for tonsillitis when they arrived at the first aid and reception center in Messina. At the first medical evaluation performed upon migrants’ arrival at the ERC, there were no patients with alteration of vital parameters nor symptoms or signs indicating heart, respiratory, hepatic or renal diseases (Table 1).

Half of the migrants were underweight (BMI < 18.5); among these, 62% had a moderate/severe thinness (BMI < 17) of which 16% severe thinness (BMI < 16).

TB screening

The BCG immunization history was evaluated in all migrants, but reliable data were not obtained from the majority of subjects; for this reason, we assumed that all were potentially immunized with BCG at birth. None of the migrants resulted positive in the 8 item-interview specific for TB. The Mantoux skin test and IGRA were positive respectively in 43% and 36% of migrants hosted in the ERC, but none of the subsequent chest radiographs were suggestive of tuberculosis.

Table 1. Demographic Characteristics and Clinical Parameters of the “Diciotti” Eritrean Migrants on their arrival at the Extraordinary Reception Centre (ERC) "Mondo Migliore".

| Demographic characteristics | Values |
|----------------------------|--------|
| Age, median (min-max)      | 24 (18-50) |
| Male gender n (%)          | 92 (92%)  |
| Christian religion n (%)   | 99 (99%)  |
| Year of education, median (min-max) | 10 (0-16) |
| Unmarried n (%)            | 67 (67%)  |
| Occupational status n (%)  |        |
| Students                   | 52 (52%)  |
| Soldiers                   | 35 (35%)  |
| Farmers                    | 9 (12%)   |
| Workers                    | 2 (3%)    |
| Unemployed                 | 2 (2%)    |
| Clinical parameters        |        |
| Systolic arterial pressure mmHg, median (min-max) | 100 (90-160) |
| Diastolic arterial pressure mmHg, median (min-max) | 60 (50-90) |
| Heart rate                 | 72 (53-100) |
| BMI                        |        |
| > 18.5                     | 50 (50%)  |
| < 18.5                     | 50 (50%)  |
| Scabies rash               | 55 (55%)  |
Nevertheless, one young male, two days after his arrival in the ERC (before the screening results), presented with high fever and cough requiring hospitalization. A computed tomographic scan of the thorax revealed coarse mediastinal and hilar solid tissue of lymph node origin, plural parietal thickening, blurred bilateral apical parenchymal thickets and some pulmonary nodules. Sputum, urine and blood were all negative for bacteria and acid-fast bacilli on both smear and mycobacterial cultures; however, IGRA was positive. Concurrent orchitis and epididymitis were also diagnosed. The discharge diagnosis was “disseminated tuberculosis” in an immunocompetent patient with clinical improvement after starting the antituberculosis treatment.

Psychological screening

All migrants hosted at the ERC received a psychological evaluation by individual interview and the Refugee Health screener-15 (RH-15). Particular attention was paid to the mental health assessment with a special focus on experiences of torture, sexual abuse, post-traumatic stress and anxiety disorders, and on chronic diseases. All patients reported a RH-15 > 12 and/or > 5 on the Distress Thermometer, considered to be a positive screen requiring further psychological assessment (the scale Cronbach α was 0.95).

Laboratory blood screening

Results of the laboratory screening, reported in Table 2, confirmed the signs of malnutrition previously observed at the medical evaluation: folic acid, cobalamin, and vitamin D-25OH levels were significantly lower than normal, and albumin levels were also at the lowest limits of normality. Even though the median values of the laboratory markers resulted within the normal range [21,22] in 50/70 people (71%), transaminases elevation and/or alteration of the leukocyte proportions (leukocytosis, neutropenia and eosinophilia) were observed. Thus, further serological screening for hepatitis B/C and HIV was performed. All subjects tested were negative for anti-HIV1-2 serological screening. Among 50 subjects screened for Hepatitis B and C, five resulted positive for both anti-HBs and total anti-HBc antibodies (resolved infection) while another 5 migrants presented with total anti-HBc

Table 2. Biochemical and hematologic screening for participants of the study.

| Parameter | Sex | N | Arithmetic mean | SD | Median | 95% CI for the median | 25th -75th percentile | Caucasian normal Reference Range | Normal reference intervals validated for Eritrean population (2) |
|-----------|-----|---|----------------|----|--------|-----------------------|-----------------------|-------------------------------|---------------------------------------------------------------|
| RBC (10^6/µL) | males |
|            |      | 63 | 4.54          | 0.515 | 4.47 | 4.38 to 4.72 | 4.13 - 4.87 | 4.50 - 5.50 | 4.2 - 6.07 |
| RBC (10^6/µL) | females | | 3.95 | 0.459 | 3.97 | 3.38 - 4.50 | 3.61 - 4.23 | 3.43 - 5.50 | 4.00 - 5.70 |
| WBC (10^3/µL) | | | 6.11 | 1.985 | 5.71 | 5.20 to 6.39 | 4.73 - 7.26 | 4.00 - 10.00 | 3.40 - 9.00 |
| Hb (g/dL) | males | | 13.62 | 1.238 | 13.50 | 13.30 to 13.90 | 12.75 - 14.40 | 13.50 - 17.50 | 12.60 - 17.80 |
| Hb females | | | 11.18 | 2.105 | 11.55 | 8.27 to 13.55 | 9.80 - 12.50 | 12.00 - 16.00 | 12.50 - 17.60 |
| MCV (fl) | | | 93.94 | 7.600 | 92.90 | 91.44 to 95.50 | 90.40 - 97.97 | 83.00 - 101.00 | 85.80 - 100.00 |
| PMN % | | | 56.69 | 11.414 | 58.50 | 55.60 to 61.86 | 48.75 - 65.22 | 41.30 - 87.00 | 32.40 – 72.60 |
| L % | | | 34.86 | 10.857 | 31.90 | 29.88 to 36.52 | 27.10 - 41.52 | 20.00 - 40.00 | 22.00 - 59.20 |
| PLT (10^3/µL) | | | 322.90 | 107.037 | 299.00 | 280.00 to 323.00 | 259.50 - 382.50 | 150.00 - 400.00 | 134.00 – 344.20 |
| CRP (mg/L) | | | 4.24 | 8.812 | 1.83 | 0.50 to 2.46 | 0.50 - 3.74 | ≤ 3 | - |
| AST (U/L) | | | 28.50 | 30.632 | 21.00 | 16.33 to 24.00 | 15.00 - 30.00 | ≤ 37 | 13.8 - 33.2 |
| ALT (U/L) | | | 37.96 | 38.807 | 25.00 | 23.00 to 32.00 | 19.00 - 43.00 | ≤ 78 | 9.0 - 35.4 |
| BUN (mg/dL) | | | 20.71 | 5.592 | 20.00 | 19.00 to 22.00 | 17.00 - 23.00 | 12.80 - 42.80 | 7.1 - 22 |
| Creatinine (mg/dL) | | | 0.65 | 0.101 | 0.64 | 0.61 - 0.66 | 0.59 - 0.71 | 0.67 - 1.17 | 0.7 - 1.9 |
| Creatinine (mg/dL) | females | | 0.53 | 0.107 | 0.51 | 0.43 - 0.69 | 0.46 - 0.53 | 0.51 - 0.95 | 0.6 - 1.5 |
| LDH (U/L) | | | 202.48 | 56.619 | 190.00 | 182.66 to 200.68 | 163.00 - 217.00 | 0 – 248 | NA |
| Albumin (g/dL) | | | 3.86 | 0.398 | 3.91 | 3.80 to 3.97 | 3.56 - 4.09 | 3.5 - 5.2 | 4.5 - 5.3 |
| TP (g/dL) | | | 8.09 | 0.523 | 8.05 | 7.90 to 8.20 | 7.70 - 8.40 | 6.40 - 8.30 | NA |
| Folic acid (ng/mL) | | | 1.66 | 0.572 | 1.55 | 1.40 to 1.70 | 1.30 - 1.90 | > 5.38 | NA |
| Cobalamin (pg/mL) | | | 287.82 | 128.930 | 264.50 | 223.64 to 303.68 | 206.00 - 348.00 | 300 – 1320 | NA |
| Vitamin D-25OH (ng/mL) | | | 23.83 | 6.638 | 23.25 | 21.23 to 25.97 | 19.20 - 28.00 | 30 – 100 | NA |

SD: standard deviation; RBC: Red Blood Cell; WBC: White blood cell; Hb: Hemoglobin; MCV: Mean Corpuscular Volume; PMN: Polymorphonuclear Leukocytes; L: Lymphocyte; PLT: platelet count; CRP: C-Reactive Protein; AST: Aspartate Aminotransferase; ALT: Alanine Aminotransferase; BUN: Blood Urea Nitrogen; LDH: Lactate dehydrogenase; TP: Serum total protein; NA: not-available, reference interval was not tested for the Eritrean population.
antibodies in the absence of anti-HBc IgM/anti-HBs and with undetectable plasma HBV DNA, suggesting a possible occult HBV infection. Only one migrant had detectable serum HBV-DNA levels (10^8 UI/mL) with positivity also for HBsAg, HBeAg and total anti-HBc [24]. Finally, one subject was positive for anti-HCV antibodies with undetectable viral genome (Table 3).

**Discussion**

Italian ports remain a primary gateway for thousands of migrants seeking asylum in Europe [3,4]. For this reason, the availability of appropriate health policies to facilitate the reception process while protecting public health, is considered a priority in the political and public health agenda. Since few medical data and no systematic studies are currently available on the topic, this report presents an interesting picture of the health status of migrants upon arrival on the coasts of southern Europe after detention in Libya and a sea journey.

Syndromic surveillance systems are generally used within national surveillance programmes to detect a wide variety of diseases in migrant populations on their arrival [25,26]. A possible bias of this approach is the health selection effect due to the demands of migration, so called “Healthy Migrant Effect” (HME), reported for a large number of migrants on departure from the country of origin [27-30]. Furthermore, HME has also been reported in migrants when they arrive in the host country: in fact, several studies describe that migrants arrive in Europe substantially in good health [7,8,31,32].

This report shows that, despite the fact that initially 30 of the 190 migrants (15.8%) were prudently hospitalized for acute or suspected transmissible infectious diseases, only 3/30 (10%) migrants remained in hospital for tuberculosis or pneumonia. This low rate of hospitalization apparently confirms the theory that migrants left Eritrea in good health status and did after all conserve it, despite the long travel, the imprisonment and the abuses suffered.

However, data from the present study suggest that this specific cluster of migrants, apparently in good health if evaluated with a syndromic surveillance approach, did suffer a decline in psychological status with significantly high scores on the psychometric tests (RH-15 > 12 and/or > 5 on the Distress Thermometer) suggesting a positive screen that requires further assessment [18]. Moreover, all migrants hosted at the ERC had malnutrition with abnormal levels of hemoglobin, serum creatinine, cobalamin, folic acid and vitamin D (Tables 2). Regarding their poor nutritional status, the data are consistent with the poor living conditions experienced during their travel and the long period of imprisonment when they reported living in the dark and eating poor meals. Since dark-skinned people require more exposure to sunlight than white-skinned people to maintain adequate vitamin D levels, refugees from Sub-Saharan Africa are considered particularly vulnerable to vitamin D deficiency due to inadequate sunlight exposure linked to staying indoors in the refugee and detention camps [33-36]. Interestingly, the majority of migrants from the “Diciotti” vessel reported a long period of detention in Libya in closed and dark spaces, which could explain the low levels of vitamin D found in these subjects. Finally, vitamin D levels appear to be closely related to health status and represent a potential marker of vulnerability in these populations [37].

In fact, an increasing body of evidence has shown that vitamin D plays a key role in modulating the immune response to infections; vitamin D deficiency increases the risk for susceptibility to several common infectious diseases (like pneumonia, tuberculosis,

| ID   | Age | Sex | HBsAg | Anti HBc IgG + IgM | Anti HBc IgM | Anti HBs | HBeAg | HBV DNA (UI/mL) | Anti HCV | HCV RNA (UI/mL) |
|------|-----|-----|-------|-------------------|--------------|---------|-------|----------------|----------|----------------|
| M013 | 28  | M   | -     | +                 | -            | +       | nd    | na             | -        | na             |
| M015 | 24  | M   | -     | +                 | -            | +       | nd    | na             | -        | na             |
| M043 | 21  | M   | -     | +                 | -            | +       | nd    | na             | -        | na             |
| M048 | 26  | M   | -     | -                 | nd           | -       | nd    | na             | +        | Undetectable   |
| M050 | 24  | M   | -     | -                 | +            | -       | nd    | na             | -        | na             |
| M060 | 26  | M   | -     | +                 | -            | -       | nd    | Undetectable   | -        | na             |
| M063 | 29  | M   | -     | -                 | +            | -       | nd    | Undetectable   | -        | na             |
| M066 | 34  | M   | -     | +                 | -            | -       | nd    | Undetectable   | -        | na             |
| M068 | 24  | M   | -     | -                 | +            | -       | nd    | Undetectable   | -        | na             |
| M083 | 21  | M   | -     | +                 | -            | -       | nd    | Undetectable   | -        | na             |
| M085 | 29  | M   | +     | +                 | -            | nd      | 10^8 UI/mL | -        | na             | -        |
| M090 | 22  | F   | -     | +                 | -            | +       | nd    | -              | -        | -              |

na: not applicable, nd: not determined.
influenza, and others) and to depression [37-40]. Moreover, if results of serological screening for HIV showed that there were no subjects suffering from secondary immunodepression, on the other hand screening for viral liver diseases showed that a proportion of the patients were suffering from hepatitis B requiring counseling and treatment.

Although many migrants leave their country of origin in good overall health, they can get sick because of the length and difficulty of the journey. For these reasons, the presented data show that the "healthy migrant" theory is not always applicable to those arriving in Europe by sea, even for people coming from countries where there are no humanitarian or environmental emergencies. For migrants with a history of a long journey and of transit in countries such as Libya, it is necessary to consider that the health status at the start of the travel can deteriorate because of several tragic events (length of travel and periods of forced rest, detentions, absence of health care, hunger, physical and psychological violence) [5-7].

In these cases, it should always be kept in mind the need to look carefully for severe diseases linked to the deterioration of the health condition to safeguard both individual and public health. Health strategies should take into account that in these cases the syndromic assessment may not be sufficient to show the actual level of health deterioration present in these people because of their medical history. We believe that the availability of these data may help to promote targeted interventions to protect the health of migrants and at the same time safeguard public health.

Finally, from an epidemiological point of view, the opportunity to examine a cluster of immigrants just landed from a ship that transported them to European shores was a unique opportunity. Furthermore, being all of the same nationality, they represented a homogeneous population sample. The data obtained from the interviews with the migrants made it possible to observe that all had followed a common migration route, making the group that we analyzed not only complete but also epidemiologically unique.

**Conclusions**

Currently, the health strategies at the time of reception are largely based on syndromic evaluation. However, this symptom-based approach does not take into account the frailties that may have been resulted from travel and detention. This dissipation of the initial strong health, although not yet transformed into a disease, could generate greater vulnerability to the development of subsequent health problems in this specific population [12-15,41-46]. This is confirmed by the severe malnutrition and significant decline in psychological status commonly detected in our study. Although syndromic evaluation remains the primary approach in the health care reception strategies, this report highlights the risks of failures of this type of approach and stresses that the migrant population experiences a deterioration of health and becomes fragile when subjected to the stress of a prolonged journey and the deprivation consequent to a long period of detention. These stressors, able to degrade the initial health patrimony of traveling migrants, can lead to a premature "exhausted migrant effect" that should be carefully investigated in order to avoid the possible early emergence of diseases significant related to frailty which are a threat both to the individual and to public health.

**Acknowledgements**

The Sanitary Bureau of Extraordinary Reception Center (ERC) of Rocca di Papa: Jarno Berardi, Lucia Scapaticci, Valentina Mazzoccatto, Cristina Seguiti, Francesca Schiavetti, Federica Giubilo, Nicoleta Andrei, Stefano Fricchione, Veronica Di Renzo, Francesca Fraschetti, Danislava Liutakova, Sabatino Lapata.

**References**

1. Human Rights Watch. (2019) World Report 2019. (ISBN-13: 978-1-60980-884-6). Available: https://www.hrw.org/sites/default/files/world_report_downloadd/hrw_world_report_2019.pdf. Last accessed: 1 August 2019.

2. Eurostat. (2019) Migration and migrant population statistics. (ISSN 2443-8219). Available: https://ec.europa.eu/eurostat/statistics-explained/index.php/Migration_and_migrant_population_statistics. Last accessed: 1 August 2019.

3. European Council. (2019) Central Mediterranean route. Available: https://www.consilium.europa.eu/en/policies/migratory-pressures/central-mediterranean-route/. Last accessed: 1 August 2019.

4. Frontex. European Border and Coast Guard Agency. Migratory Routes. 2019. Available: https://frontex.europa.eu/along-euborders/migratory-routes/central-mediterranean-route/. Last accessed: 1 August 2019.

5. UNHCR, The UN Refugee Agency. (2017) Libya. Available: https://www.unhcr.org/lybia.html. Last accessed: 1 August 2019.

6. Amnesty International, De Bellis M (2019) Europe’s shameful failure to end the torture and abuse of refugees and migrants in Libya. Available: https://www.amnesty.org/en/latest/news/2019/03/europe-shameful-failure-to-end-the-torture-and-abuse-of-refugees-and-migrants-in-libya/. Last accessed: 1 August 2019.
7. Domnich A, Panatto D, Gasparini R, Amicizia D (2012) The “healthy immigrant” effect: does it exist in Europe today? JPH 9: e7532-1537.

8. Bollini P, Pampallona S, Wanner P, Kupelnick B (2009) Pregnancy outcome of migrant women and integration policy: a systematic review of the international literature. Soc Sci Med 68: 452-461.

9. Camilli A (2019) Tutto quello che c’è da sapere sul caso Diciotti: Internazionale. Available: https://www.internazionale.it/bloc-notes/annalisa-camilli/2019/02/18/diciotti-matteo-salvini. Last accessed: 1 August 2019.

10. Ceccarelli G, Vita S, Lopalco M, Angeletti S, Ciccozzi M. (2019) The Italian “Diciotti” vessel case, out of political disputes: state of health of rescued Eritrean migrants. The Migration Conference 2019 - Book of Abstracts and Programme Abstract 674, 155-6.

11. Governo Italiano. Presidenza del Consiglio dei Ministri. (2019) Nave Diciotti, la dichiarazione del Presidente Conte. Available: http://www.governo.it/articolo/nave-diciotti-la-dichiarazione-del-presidente-conte/9874. Last accessed: 1 August 2019.

12. Riccardo F, Napoli C, Bella A, Rizzo C, Rota MC, Dente MG, De Santis S, Deelich S (2011) Syndromic surveillance of epidemic-prone diseases in response to an influx of migrants from North Africa to Italy, May to October 2011. Euro Surveill 17; pii: 20016.

13. Ciccozzi M, Cella E, Ceccarelli G, Vita S, Dicuonzo G, Lopalco M, Antonelli F, Conti A, Ottaviani R, De Cesaris M, Spoto S, Angeletti S (2018) Sentinel surveillance data from Eritrean migrants in Italy: The theory of “Healthy Migrants”. Travel Med Infect Dis 22: 58-65.

14. Ciccozzi M, Riva E, Vita S, Cella E, Fogolari M, Spoto S, Lopalco M, Ceccarelli G, Angeletti S (2018) An acute febrile outbreak in a refugee community of an Italian asylum seeker center: lessons learned. Public Health 163: 16-19.

15. Ceccarelli G, Vita S, Riva E, Cella E, Lopalco M, Antonelli F, De Cesaris M, Fogolari M, Dicuonzo G, Ciccozzi M, Angeletti S; Sanitary Bureau of the Asylum Seekers Center of Castelnuovo di Porto (2018). Susceptibility to measles in migrant population: implication for policy makers. J Travel Med, Jan 1;25(1).

16. Cella E, Ceccarelli G, Vita S, Lai A, Presti AL, Blasi A, Palco ML, Guarino MP, Zhender H, Angeletti S, Ciccozzi M; Sanitary Bureau of Asylum Seekers Center of Castelnuovo di Porto (2017) First epidemiological and phylogenetic analysis of Hepatitis B virus infection in migrants from Mali. J Med Virol 89: 639-646.

17. Painter JA, Graviss EA, Hai HH, Nhun DT, Nga TT, Ha NP, Wall K, Loan le TH, Parker M, Manangan L, O’Brien R, Maloney SA, Hoekstra RM, Reves R (2013) Tuberculosis screening by tuberculosis skin test or QuantiFERON-TB Gold In-Tube Assay among an immigrant population with a high prevalence of tuberculosis and BCG vaccination. PLoS One 8: e82727.

18. Holllifeld M, Verbillis-Kolp S, Farmer B, Toolson EC, Woldehaimanot T, Yamazaki J, Holland A, St Clair J, SooHoo J (2013) The Refugee Health Screener-15 (RHS-15): development and validation of an instrument for anxiety, depression, and PTSD in refugees. Gen Hosp Psychiatry 35: 202-209.

19. Pathways to Wellness. Integrating Refugee Health and Well-Being (2011) Refugee health screener - 15 (RHS-15) http://refugeehealthta.org/wp-content/uploads/2012/09/RHS15_Packet_PathwaysToWellness-s1.pdf. Last accessed: 1 August 2019.

20. Kaltenbach E, Härndter E, Hermenau K, Schauer M, Elbert T (2017) Efficient identification of mental health problems in refugees in Germany: the Refugee Health Screener. Eur J Psychotraumatol. Nov 7;(sup2):1389205.

21. Siraj N, Issac J, Anwar M, Mehari Y, Russom S, Kahsay S, Frezghi H (2018) Establishment of hematological reference intervals for healthy adults in Asmara. BMC Res Notes 11: 55.

22. Vita S, Miglietta A, Lopalco M, Terrazzini N, Sargentini V, Cella E, Bachetoni A, Dicuonzo G, Angeletti S, Ciccozzi M, Ceccarelli G Baseline haematological and biochemical reference values for healthy male adults from Mali. Pan African Medical Journal. 2019; 32:5. doi: 10.11604/pamj.2019.32.5.12797.

23. Krajden M, McNabb G, Petric M (2005) The laboratory diagnosis of hepatitis B virus. Can J Infect Dis Med Microbol 16: 65-72.

24. Ceccarelli G, Cella E, Vita S, Lai A, Ebranati E, Zhender G, Fogolari M, Antonelli F, Guarino MPL, Riva E, Angeletti S, Ciccozzi M (2019) A case of hepatitis B virus infection in Eritrean Diciotti migrant: phylogenetic analysis and ‘mirror effect’ Future Virology 14: 509-514.

25. European Centre for Disease Prevention and Control (ECDC). (2019) Syndromic surveillance in migrant centres tool, 2019. Available: https://www.ecdc.europa.eu/en/publications-data/syndromic-surveillance-migrant-centres-tool. Last accessed: 1 August 2019.

26. European Centre for Disease Prevention and Control. (2016) Handbook on implementing syndromic surveillance in migrant reception/detention centres and other refugee settings. Stockholm: ECDC, 2016. Available: https://ecdc.europa.eu/en/publications-data/handbook-implementing-syndromic-surveillance-migrant-reception-detention-centres. Last accessed: 1 August 2019.

27. Helgesson M, Johansson B, Nordquist T, Vingård E, Svartengren M (2019) Healthy migrant effect in the Swedish context: a register-based, longitudinal cohort study. BMJ Open 9: e026972.

28. Gimeno-Feliu LA, Calderón-Larrañaga A, Diaz E, Poblador-Plou B, Macipe-Costa R, Prados-Torres A (2015) The healthy migrant effect in primary care. Gac Sanit 29: 15-20.

29. Moullan Y, Just F (2014) Why is the ‘healthy immigrant effect’ different between European countries? Eur J Public Health 24: 80-86.

30. Fennelly K (2007) The "healthy migrant" effect. Minn Med 90: 51-53.

31. Kobori E, Maeda Y, Yamamoto T (2017) Mortality rates of foreign national residents in Japan: comparison with the Japanese population and a possible healthy migrant effect. Nihon Koshu Eisei Zasshi 64: 707-717.

32. Dodd W, Humphries S, Patel K, Majowicz S, Little M, Dewey Nihon Koshu Eisei Zasshi 64: 707-717.

33. Martin CA, Gowda U, Renzaho AM (2016) The prevalence of vitamin D deficiency among dark-skinned populations according to their stage of migration and region of birth: A meta-analysis. Nutrition 32: 21-32.

34. Nwosu BU, Maranda L, Berry R, Colocino B, Flores CD, Folkman K, Groblewski T, Rupe P. (2014) The vitamin D status of prison inmates PLoS One 9: e90623.
35. Jacobs ET, Mullany CJ (2015) Vitamin D deficiency and inadequacy in a correctional population. Nutrition 31: 659-663.
36. Doyle Z, Dearin JW, McGirr J (2018) Vitamin D deficiency and segregation status in prisoners. Int J Prison Health 14(1):16-25.
37. Watkins RR, Lemonovich TL, Salata RA (2015) An update on the association of vitamin D deficiency with common infectious diseases. Can J Physiol Pharmacol 93: 363-368.
38. Hayward S, Harding RM, McShane H, Tanner R (2018) Factors influencing the higher incidence of tuberculosis among migrants and ethnic minorities in the UK. Version 1. F1000 Res 7: 461.
39. Maceda EB, Gonçalves CCM, Andrews JR, Ko AI, Yeckel CW, Croda J (2018) Serum vitamin D levels and risk of prevalent tuberculosis, incident tuberculosis and tuberculin skin test conversion among prisoners. Sci Rep 8: 997.
40. Cheseaux M, Muselle A, Gravier B (2013) Depressive symptoms and widespread pains in a prisoner: think on vitamin D deficiency. Presse Med 42: 1565-1571.
41. Cella E, Foley BT, Riva E, Scolamacchia V, Ceccarelli G, Vita S, Iannetta M, Ciardi MR, D'Ettorre G, Angeletti S, Ciccozzi M (2018) HIV-2 Infection in a Migrant from Gambia: The history of the disease combined with phylogenetic analysis revealed the real source of infection. AIDS Res Hum Retroviruses 34: 1090-1094.
42. Angeletti S, Ceccarelli G, Vita S, Dicuonzo G, Lopalco M, Dedej E, Blasi A, Antonelli F, Conti A, De Cesaris M, Farchi F, Lo Presti A, Ciccozzi M; Sanitary Bureau of Asylum Seekers Center of Castelnuovo di Porto (2016) Unusual microorganisms and antimicrobial resistances in a group of Syrian migrants: Sentinel surveillance data from an asylum seekers centre in Italy. Travel Med Infect Dis 14: 115-122.

43. Fontanelli Sulekova L, Ceccarelli G, Pomba M, Esvan R, Lopalco M, Vita S, Mattiucci S, Gabrielli S; Sanitary Bureau of the Asylum Seekers Center of Castelnuovo di Porto (2019) Occurrence of intestinal parasites among asylum seekers in Italy: A cross-sectional study. Travel Med Infect Dis 27: 46-52.
44. Ceccarelli G, d'Ettorre G, Riccardo F, Ceccarelli C, Chiaretti M, Picciarella A, Pacifici LE, Vullo V (2013) Urinary schistosomiasis in asylum seekers in Italy: an emergency currently undervalued. J Immigr Minor Health 15:846-850.
45. Ceccarelli G, Sulekova LF, Milardi GL, Lopalco M, Vita S, Gabrielli S (2018) Prevalence of intestinal parasitic infections among asylum seekers. Can Fam Physician 64: 88.
46. Vairo F, Di Bari V, Panella V, Quintavalle G, Torchia S, Serra MC, Sinopoli MT, Lopalco M, Ceccarelli G, Ferraro F, Valle S, Bordi L, Capobianchi MR, Puro V, Scognamiglio P, Ippolito G; The Outbreak Investigation Group (2017) The outbreak investigation group. An outbreak of chickenpox in an asylum seeker centre in Italy: outbreak investigation and validity of reported chickenpox history, December 2015-May 2016. Euro Surveill Nov;22(46).

Corresponding author
Prof. Silvia Angeletti, MD
Unit of Clinical Laboratory Science
University Campus Bio-Medico of Rome,
Via Alvaro del Portillo 20, 00128 Roma, Italy.
Tel.: +3906225411461
Fax: +3906225411461
Email: s.angeletti@unicampus.it

Conflict of interests: No conflict of interests is declared.