

## Clinical research

# Gastrointestinal and hepatobiliary disorders of patients from countries with low to middle income: a retrospective observational study in a Swiss emergency department

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## Abstract

**Introduction:** The composition of Europe has changed drastically in recent decades, and a major contributing factor is the increasing wave of migrants and refugees from countries with low and middle income (LMIC). Switzerland's resident foreigners make up about a quarter of its citizens. Gastrointestinal (GI)-hepatobiliary pathologies seen in emergency departments include a wide spectrum of interesting conditions, some of which are potentially fatal. The aim of this study was to investigate and analyze all records of adult patients from LMIC admitted to the emergency department (ED) of Bern University Hospital with alleged symptoms of the GI and hepatobiliary systems.

**Material and methods:** An observational retrospective study was conducted in a single center from 1 January 2013 to 31 December 2016 in LMIC adults who presented at the ED of Bern University with GI-hepatobiliary problems.

**Results:** After reviewing a total of 10,308 cases, 176 cases were found to have GI and hepatobiliary problems. Thirty-six percent ( $n = 63$ ) of the urgent problems of LMIC patients were hepatobiliary disorders, and acute pancreatitis was the commonest disorder ( $n = 30$ , 17%). Female patients were 5.14 times more prone to cholecystolithiasis (gallstones) than male patients ( $p < 0.01$ ). Likelihood of cholecystolithiasis was significantly higher for European than non-European patients ( $p < 0.05$ ). Moreover, with increasing age there was an annual 6.0% decrease in likelihood of appendicitis ( $p < 0.01$ ). Liver cirrhosis was also commoner in non-European patients ( $p < 0.001$ ).

**Conclusions:** To our knowledge, this is the first analytical study of the epidemiological aspects of patients from LMIC who presented to a Swiss ED with GI-hepatobiliary problems. Validation from larger studies is warranted to reveal the actual burden of disease.

**Key words:** emergency department, gastrointestinal, hepatobiliary, low income migrants, middle income migrants.

## Introduction

In recent decades, large-scale immigration has affected the composition of the European population. This has impacted the demands for emergency medical care and the workloads of emergency departments (ED). In 2015, about 54 million migrants were estimated to live and work within the European Union, accounting for 10% of its population. Of these, only 18.5 million were European migrants from another European country [1]. This phenomenon is accompanied by sustained population growth and is anticipated to increase pressure on EDs [2]. The majority of migrants and refugees or even asylum seekers stem from countries with low to middle income (LMIC), since poverty and cultural differences or war encourage them to strive for a more favorable future abroad [3, 4]. Previous studies have indicated that immigrants maintain a low threshold in ED use [5, 6]. This is particularly the case for those who do not master the host language.

Switzerland is registered as one of the European countries with the highest rates of permanently resident foreigners. According to the information of the Swiss Federal Statistical Office for the end of 2017, the Swiss population of 8,482,200 citizens included a high proportion of immigrants (2,108,001) [7], corresponding to 23.5% of the population [8]. This is much greater than the mean value for Europe of 7.3 to 8.6%.

Gastrointestinal (GI) and hepatobiliary pathologies seen in the ED represent a wide range of conditions of various severity. These may all lead to functional compromise of the GI tract plus the hepatobiliary system and may ultimately jeopardize the patient's life [8–10]. Clinical presentation may vary widely and clinicians should be alerted, as well-known abdominal morbidities present an atypical clinical picture, which is misleading even to experienced doctors. The problem is greater in populations with linguistic and cultural differences from the general population, since such patients do not express their complaints in the same way. Thus, multidisciplinary cooperation for an early diagnosis is mandatory, so potential pitfalls may be identified on time and appropriate therapy can be offered.

The aim of this retrospective observational study was to investigate and analyze all medical and surgical records of LMIC adult patients admitted between 2013 and 2016 to the ED of Bern University Hospital (commonly known as the "Inselspital") claiming symptoms of the GI tract plus the hepatobiliary system.

## Material and methods

### Study design

We carried out an electronic retrospective observational study for the time frame 1 January

2013 to 31 December 2016 and included adult patients (more than 16 years of age) presenting at the ED of Inselspital Bern with signs and/or symptoms suggestive of a GI and/or hepatobiliary pathology. The Inselspital ED consists of both a Level 1 (tertiary) referral center and an institute for primary care and offers its medical services to an area of about two million citizens; about 46,000 adults were admitted as emergencies to our ED in 2017 [11].

### Inclusion and exclusion criteria

We included patients from LMICs subject to the limitations of time and age. Exclusion criteria were the absence of a gastrointestinal pathology or scarcity of relevant data.

### Data collection and extraction

Upon admission to the university ED, all records of patients were integrated into the clinical application E.care for Windows (E.care BVBA, ED 2.1.3.0, Turnhout, Belgium). This medical database offers the advantage of instantly recalling previous diagnostic or consulting reports, and other relevant medical data. Moreover, multiple filters for E.care management were applied: dates, age, medical/surgical cases, LMIC. Country of origin and information on resident status were retrieved separately by the hospital administration and recorded in the hospital information system (SAP).

The following parameters were extracted (once available) from the charts of included patients: demographics (gender, age), type of transport to the ED (e.g. privately), triage, date of admission and discharge, medical history, symptoms and their duration, laboratory and radiologic findings (including ultrasound, abdominal computed tomography and/or magnetic resonance, where needed), treatment, type of discharge from the ED (e.g., inpatient admission, outpatient therapy) and outcome (e.g., complications, death).

Patients were typically triaged in the ED of Inselspital using the Swiss Emergency Triage Scale [12]. The latter is a shortened version of the validated Manchester Triage System [13]. This triage system stratifies the urgency of treatment for patients presenting to an ED by categorizing them into five levels, as previously described [14]. Once a new patient had been admitted to the ED, a specially trained nurse assigned the patient's reported symptoms according to a predefined algorithm and then determined the priority of treatment with the aid of fixed rules that also consider the vital signs.

All patients who presented to the ED during the aforementioned time frame were extracted from E.care to an Excel sheet (Microsoft Excel for

Mac 2019, Microsoft Corporation, Redmond, WA, US) for further analysis. Patients with a relevant abdominal pathology were initially identified using the following two search strings in the patient column for “diagnosis list”: “abdomen” (also used in German) and “Bauch” (stomach in English). Of note, under the aforementioned terms all the hepatobiliary disorders were also included, and a separate search with the term “Leber” (liver) yielded only a subgroup of the previous cases. The results were further investigated by three authors (M.D. C.K. and A.P.), as explained in Figure 1. An additional detailed investigation was performed by M.D. and C.K., including retrieval of detailed information such as radiologic or endoscopic findings, as necessary. Findings which were not available to our Inselspital’s internal database system were not recalled from external private clinics or other hospitals. Data extraction was validated by D.S.S. In cases of discrepancy, a consensus was achieved by intervention of a senior author (A.E.).

### Definition

Low and middle income economies were defined according to the World Bank [15] for the current 2019 fiscal year, as previously reported [14].

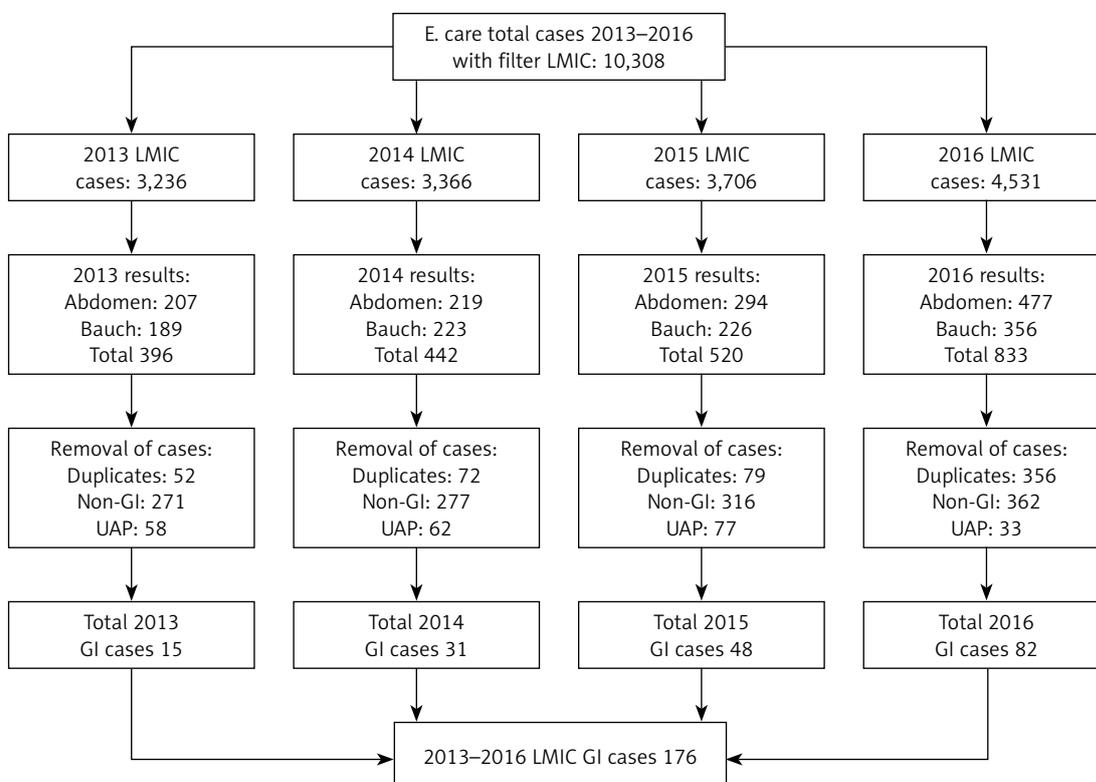
The nations of origin were categorized as defined by the United Nations [16].

### Ethical considerations

Our study complied fully with the most recent revision of the principles of the Declaration of Helsinki [17], as well as Swiss law. It was approved by the cantonal (district) ethics committee in Bern (Kantonale Ethikkommission Bern, Ref. No. KEK-BE: 010/ 2016). As our patients were fully anonymized prior to analysis, informed consent was not mandatory.

### Statistical analysis

SPSS v23 was used for the statistical analyses, which included descriptive parameters (mean ± standard deviation for continuous variables and frequencies for categorical variables) and analytical statistics. A set of 10 binary logistic regression models was set up to ascertain the effects of gender, region of origin and age on the likelihood that the GI patients with the most prevalent pathologies ( $\geq 10$  cases) diagnosed in the studied population, as described in Model 1:  $GIP = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3$ , where, GIP = the probability of a patient being diagnosed with one of the 16 most prevalent GI and hepatobiliary pathologies (e.g. pancreatitis, cholecystitis, liver cirrhosis, liver pathology, gastroenteritis, gastritis, diverticulitis, appendicitis, cholelithiasis, acute hepatitis), where  $\alpha$  = overall mean,  $\beta_1$ ,  $\beta_2$  and  $\beta_3$  are the regression coefficients of gender ( $X_1$ , 2 levels, 0 =



**Figure 1.** Flow chart with case selection steps

LMIC – low-middle income countries, UAP – unclear abdominal pain, GI – gastrointestinal. Bauch should be stomach.

female, 1 = male), region of origin [ $X_2$ , 2 levels, 0 = non-European, 1 = European) and age ( $X_3$ , continuous, expressed in years), respectively. Statistical significance of independent variables was tested using the Wald  $X^2$  statistic of their regression coefficients ( $\beta$ s). Goodness-of-fit was assessed using the Hosmer-Lemeshow (H-L) test, as well as Cox and Snell  $R^2$  and Nagelkerke  $R^2$  indices, for each individual model. Bootstrapping was used to provide extra power for the estimation of the regression coefficients of the independent variables used in the models (a thousand samples were randomly selected with replacement from the initial data set). Significance was set at  $p < 0.05$  (two tailed).

## Results

Out of a total number of 10,308 records from the ED during the studied period, 176 patients were finally included in our study (Figure 1) with a male to female ratio of 1.25 : 1 ( $n = 98$  and  $76$ , respectively). The vast majority of patients ( $n = 125$ , 85.6%) were of non-European descent with age ranging between 17 and 79 years (mean: 44.4). Hepatobiliary morbidities were collectively grouped under the term “Liver pathology” and represented a large percent of the urgent problems of the LMIC patients (36%,  $n = 63$ ); “acute pancreatitis” was the most common condition ( $n = 30$ , 17%). Upon diagnosis, initial resuscitation and prescription of treatment, about one third of the admitted patients were discharged ( $n = 55$ , 31.3%), whereas more than half were hospitalized ( $n = 101$ , 57.4%). As regards triage, the majority of patients ( $n = 126$ , 71.6%) were evaluated as category 3. Pie chart with the origin of patients and relevant percentages and geographical classification according to United Nations presented Figure 2. Figure 3 illustrates graphically some of the major parameters in our population. Table I also summarizes the sample’s general characteristics.

Gender had no specific effect on any of the GI (Table I) or hepatobiliary conditions, with the exception of cholecystolithiasis (gallstones), which was 5.14 times more common for female patients than for male patients (Table I:  $p < 0.01$ , 95% CI: 1.55 to 17.04 times); nevertheless, there was no difference in acute cholecystitis. Additionally, the likelihood of cholecystolithiasis for patients stemming from the European area was significantly higher ( $p < 0.05$ ) than for non-European patients (ca. 3.3 times, 95% CI: 1.1 to 10.0 times). Moreover, although four times as many non-European patients were diagnosed with acute pancreatitis, the odds ratio for Europeans was not statistically significant (OR = 1.77,  $p = 0.248$ ).

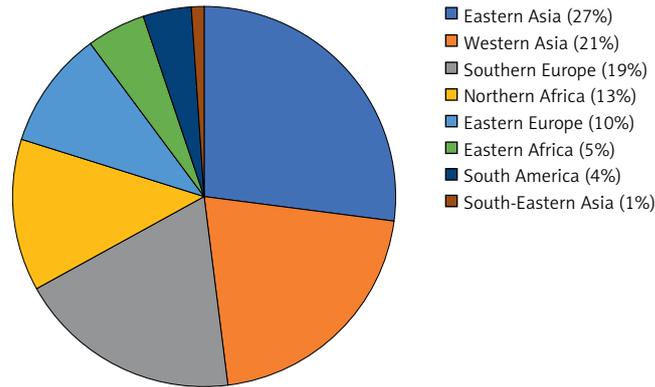
As regards GI diseases, none of the independent variables used in the model affected gas-

troenteritis, colitis or GI bleeding cases. Female patients were more frequently hospitalized than male patients, although not significantly (factor of 3.32;  $p = 0.099$ , 95% CI: 0.80 to 13.83 times). Patients from European countries were more frequently hospitalized due to diverticulitis than those from non-European countries, although not significantly (factor of 3.57;  $p = 0.067$ , 95% CI: 0.92 to 14.29 times). There was a 5.0% annual increase in the likelihood of diverticulitis ( $p = 0.053$ , 95% CI: 0.0 to 10.0%) and a 6.0% annual decrease in the likelihood of appendicitis ( $p < 0.01$ , 95% CI: 2.0 to 11.0%).

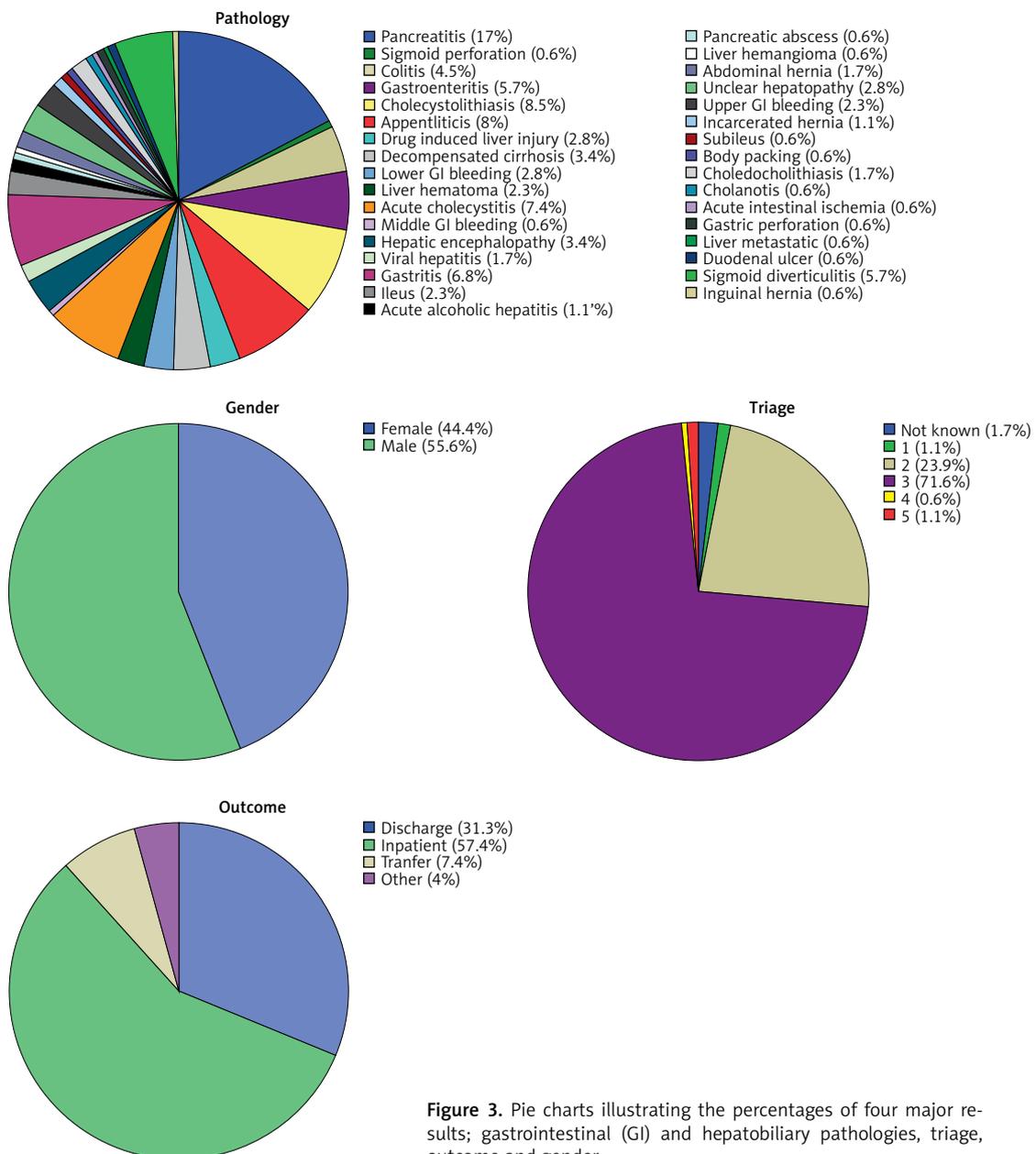
Finally, ten immigrants from non-European regions experienced acute hepatitis in contrast to one European, though this was not statistically significant. No cases of liver cirrhosis, hepatic encephalopathy or ileus were found among patients of European origin. Bootstrap analysis showed that there was a statistically significant difference between European and non-European individuals for liver cirrhosis ( $p < 0.001$ , Table II).

## Discussion

To our knowledge, this observational retrospective study is the first epidemiological characterization of GI and hepatobiliary disorders in immigrants from LMIC who settle in a host ED. After the removal of duplicates and cases of unclear etiology, GI and hepatobiliary emergencies made up 12.5% of all ED LMIC cases during this time period. This should be compared with other studies in developed countries that found that 6.8–16.7% of asylum seekers or refugee cases were diagnosed with a GI and hepatobiliary disorder [18–22]. This percentage might be under-reported, due to the numerous cases of unclear etiology, which were not fully investigated due to the special features of the population. Thus, many of the unclear cases might be attributed, for instance, to unidentified functional GI or biliary disorders such as functional gallbladder disorder, or sphincter of Oddi dysfunction [23]. Hepatobiliary disorders were the most common pathologies, even more than acute gastroenteritis and colitis. A possible interpretation of this finding could be attributed, at least partly, to the wide spectrum of disorders covered by the general term of hepatobiliary diseases, including, for instance, abnormal liver function tests (LFTs) of any cause, such as abnormal LFTs observed in systematic disorders or drug hepatotoxicity [24–26]. Moreover, LMIC residents and refugees from LMIC live under conditions of poor hygiene and permanent crowding, and are therefore at increased risk of infections, including hepatitis, and this is potentially endemic [27]; international migrants have high levels of infectious disease, which has important implications for public health



**Figure 2.** Pie chart with the origin of patients and relevant percentages. Geographical classification according to United Nations



**Figure 3.** Pie charts illustrating the percentages of four major results; gastrointestinal (GI) and hepatobiliary pathologies, triage, outcome and gender

**Table I.** Regression coefficients of the independent variables used in the binary regression models to assess the likelihood of 9 GI plus hepatobiliary pathologies (with  $\geq 10$  cases). The studied patient population consisted of 125 non-European and 51 European citizens and 78 female and 98 male individuals

GI pathology	Independent variable	Number of patients	B	SE	Wald	P-value	Odds ratio	95% CI for EXP(B)	
								Lower	Upper
Acute pancreatitis	Female	10	-0.631	0.429	2.17	0.141	0.53	0.23	1.23
	Male	20				Ref.			
	Non-European	24	0.573	0.496	1.33	0.248	1.77	0.67	4.69
	European	6				Ref.			
	Age	-	-0.016	0.015	1.14	0.286	0.98	0.96	1.01
	Constant	-	-1.054	0.827	1.63	0.202	0.35		
Cholecystitis	Female	8	0.733	0.595	1.52	0.218	2.08	0.65	6.68
	Male	5				Ref.			
	Non-European	9	-0.203	0.639	0.10	0.751	0.817	0.23	2.86
	European	4				Ref.			
	Age	-	-0.016	0.022	0.53	0.466	0.98	0.94	1.03
	Constant	-	-2.093	1.169	3.20	0.073	0.12		
Liver pathology	Female	30	0.208	0.317	0.43	0.512	1.23	0.66	2.29
	Male	33				Ref.			
	Non-European	46	0.153	0.353	0.19	0.665	1.17	0.58	2.33
	European	17				Ref.			
	Age	-	0.003	0.011	0.05	0.817	1.00	0.98	1.03
	Constant	-	-0.905	0.637	2.02	0.155	0.41		
Gastroenteritis	Female	7	1.158	0.709	2.66	0.103	3.18	0.79	12.78
	Male	3				Ref.			
	Non-European	7	-0.052	0.730	0.01	0.943	0.95	0.23	3.97
	European	3				Ref.			
	Age	-	0.009	0.023	0.16	0.692	1.01	0.96	1.06
	Constant	-	-3.841	1.398	7.55	0.006	0.02		
Gastritis	Female	6	0.277	0.601	0.21	0.644	1.32	0.41	4.29
	Male	6				Ref.			
	Non-European	7	-0.589	0.617	0.91	0.340	0.56	0.17	1.86
	European	5				Ref.			
	Age	-	0.008	0.021	0.13	0.719	1.01	0.97	1.05
	Constant	-	-2.709	1.177	5.29	0.021	0.07		
Diverticulitis	Female	7	1.200	0.728	2.72	0.099	3.32	0.80	13.83
	Male	3				Ref.			
	Non-European	4	-1.270	0.694	3.35	0.067	0.28	0.07	1.09
	European	6				Ref.			
	Age	-	0.047	0.024	3.73	0.053	1.05	1.00	1.10
	Constant	-	-5.043	1.461	11.91	0.001	0.01		
Appendicitis	Female	4	-0.958	0.639	2.25	0.133	0.38	0.11	1.34
	Male	10				Ref.			
	Non-European	10	-0.092	0.647	0.02	0.886	0.91	0.26	3.24
	European	4				Ref.			
	Age	-	-0.068	0.026	6.89	0.009	0.94	0.89	0.98
	Constant	-	0.657	1.146	0.33	0.566	1.93		

Table I. Cont.

GI pathology	Independent variable	Number of patients	B	SE	Wald	P-value	Odds ratio	95% CI for EXP(B)	
								Lower	Upper
Cholecystolithiasis	Female	13	1.638	0.611	7.18	0.007	5.14	1.55	17.04
	Male	4				Ref.			
	Non-European	9	-1.198	0.564	4.51	0.034	0.30	0.10	0.91
	European	8				Ref.			
	Age	-	-0.030	0.020	2.17	0.141	0.97	0.93	1.01
	Constant	-	-1.191	1.060	1.26	0.261	0.30		
Acute hepatitis	Female	5	-0.118	0.643	0.03	0.854	0.89	0.25	3.13
	Male	6				Ref.			
	Non-European	10	1.374	1.069	1.65	0.199	3.95	0.49	32.10
	European	1				Ref.			
	Age	-	-0.034	0.025	1.82	0.177	0.97	0.92	1.02
	Constant	-	-2.377	1.490	2.55	0.111	0.09		

B – regression coefficient, SE – standard error, CI – confidence interval, Ref. – reference category, GI – gastrointestinal.

Table II. Bootstrap estimates for regression coefficients of the independent variables used in the binary regression model of liver cirrhosis, which was not found in European patients. The studied patient population consisted of 125 non-European and 51 European citizens as well as 78 female and 98 male individuals

GI pathology	Independent variable	Number of patients	B	Bootstrap (1,000 samples randomly selected by replacement)				
				Bias	SE	P-value	95% CI for B	
Liver cirrhosis	Female	3	-0.81	-0.951	4.018	0.275	-18.53	0.77
	Male	9				Ref.		
	Non-European	12	19.33	0.014	0.696	0.001	18.18	20.74
	European	0				Ref.		
	Age	-	0.13	0.011	0.044	0.001	0.081	0.229
	Constant	-	-27.90	-0.680	2.826	0.002	-34.79	-25.01

B – regression coefficient, SE – standard error, CI – confidence interval, Ref. – reference category, GI – gastrointestinal.

services [28]. Nevertheless, our department's previous data indicated that migrants, especially of those from southeast Europe, tend to visit the ED for mild complaints [29]. Thus, symptoms caused by functional GI and biliary disorders may overlap with liver steatosis or alcoholic liver disease and be recorded as a random finding. Future studies could determine and classify such cases and help to describe the exact epidemiology of specific liver pathologies in the ED.

Gallstones were more common in women, in accordance with the epidemiology in the general population [30]. It should be noted that migrants from other European countries were more vulnerable to gallstones than non-Europeans. This probably reflects differences in dietary habits, as the Western lifestyle may lead to obesity, high caloric nutrition and the metabolic syndrome and may therefore predispose to stone formation [31]. Nevertheless, recent data illustrate that the frequency of gallstones differs between LMICs, perhaps due to genetic differences; South Americans have the

highest risk (> 50%), whereas fewer than 10% of Africans and Asians are diagnosed with cholecystolithiasis [30]. The prevalence of acute pancreatitis was high among the recruited patients (17%) and more non-European patients were affected, although not significantly. Epidemiology from the patients' homelands could help us to understand the etiology of pancreatitis, as this is heterogeneous; although the main cause is (micro-)lithiasis, alcohol, infections, drugs and toxins and tropical pancreatitis may be important [32, 33].

An age-related increase of 5% per year in the prevalence of diverticulitis was calculated for our sample of migrants. Other studies have found relatively high numbers of ED admissions due to diverticulitis, which may be associated with the relatively high numbers of young males in the migrant sample [34–37]; some data indicate that the rates of both hospitalization for complicated acute diverticulitis and surgery due to peritonitis and abscess are greater for younger patients [38]. However, a recent meta-analysis compared the

natural history of diverticulitis in young versus elderly patients, and did not find an association between young age and recurrent diverticulitis and no lower age threshold for surgery [28]. As acute diverticulitis is connected with increasing age, it is inevitable that advanced age is a risk factor for diverticulitis; the number of ED admissions to hospital – and the related costs – continue to increase, as does the estimated mortality [37, 39].

Female and European patients were more likely to be admitted to hospital because of diverticulitis. The observed sex difference confirmed previously published studies which indicate female vulnerability in diverticula inflammation, especially when age increases, although no pathophysiological pathways have been suggested [40–43]; complicated colonic diverticulitis is more common in women [44].

Wheat *et al.* [40] demonstrated that white patients were more prone to develop diverticulitis, whereas black patients were the only patients for whom diverticular bleeding was more common than diverticulitis. Our non-European subjects had a worldwide distribution, but most were African or Asian.

In German asylum seekers ( $n = 2,753$ ) [18], the GI pathologies were among the most prevalent ( $n = 427$ , 6.8%). It has to be noted, however, that GI infections such as gastroenteritis/colitis ( $n = 114$ ) were classified as infections. The median age was 25 and only 786 (28.6%) patients were female, while 1,967 (71.5%) were male. GI pathologies were as follows: constipation ( $n = 95$ , 22.3%), unspecified gastritis ( $n = 65$ , 15.2%), other specified dental problems ( $n = 53$ , 12.4%), followed by hemorrhoids ( $n = 44$ , 10.3%), inguinal hernia ( $n = 14$ , 3.28%), anal fissure ( $n = 10$ , 2.34%), gastroesophageal reflux disease ( $n = 9$ , 2.11%); and melena ( $n = 8$ , 1.87%).

A study from Israel [45] attempted to stratify the illnesses from asylum seekers and undocumented migrant workers. Digestive diseases ranked among the most common diagnoses with a percentage of 12.7% for adults and 10% for children. A detailed distribution of GI disorders with percentages was not available. Most patients were adults (18–35, 41.2%) or children < 2 years old (23.7%). Only 3% of visits were from patients older than 50 years.

In a similar Danish study, Ehmsen *et al.* [19] demonstrated the diverse health issues that confront undocumented immigrants. In a sample of 830 patients, GI issues ranked among the five most frequent problems, with a percentage of 9.4%. A further GI classification was not reported. Our own previous study [20] – in a sample of 880 refugees/asylum seekers from the Middle East – revealed that the most common problems were

GI, with a percentage of 15% ( $n = 132$ ). One of the most common listed pathologies of outpatient visits was peptic ulcer disease. Six hundred and twenty-five (71.0%) of the patients were male and 255 (29.0%) female. The median age was 34. At the Greek-Turkish borders, 6899 immigrants were screened within a period of five months [21]. Most of them (6278) (91%) were male and 621 (9%) female. Their mean age was 25.3 years. Among the most frequently recorded physical conditions was epigastric pain, with a percentage of 9.9% ( $n = 297$ ). Gastroenteritis was also reported, but with a lower frequency (2.8%,  $n = 51$ ). In a second Greek study [22], a total of 528 refugees were prospectively consulted in 13 different refugee camps. Three hundred and six patients were male and the median age was 19 years. The third most common group of symptoms were GI ( $n = 88$ , 16.7%). The symptoms included vomiting, hemorrhagic or non-hemorrhagic, fever, and dehydration.

Furthermore, the health issues in newly arrived African refugees in Melbourne have been documented [46]. The information was collected from a database of 258 patient files, which were registered in a general practice clinic. Half of the patients were children and the most common GI diseases that were recorded included GI infections, schistosomiasis and dental problems. Eight percent of the subjects were asymptomatic carriers of hepatitis B. In another study conducted in Spain [47], five infectious diseases (hepatitis B, C, tuberculosis, syphilis and human immunodeficiency virus infection) were screened in a population coming from LMIC. A total of 3,132 patients were included. The majority of them (58.2%) were men. Most men were aged 25 to 34 years, whereas women were predominantly aged < 25 or  $\geq 40$  years.

Our study had some limitations. Its retrospective character did not allow a detailed investigation and determination of any possible parameter that could affect the results, such as personal, family and detailed relevant medical history, but also lifestyle (including the dietary customs and domestic sanitation), income and wealth of respondents, period of residence in host country, religion and further factors that probably affect the post-migration life; for instance, one an additional factor that could affect the rate of immigrants coming to the ED is the access (or lack of) to preventative or primary care. That is usually not a problem for the native population but depending on the circumstances of migration, the immigrants may not have the means or ability to access primary care/outpatient care for minor complaints [48]. Moreover, the reason for ED admission or the main complaint is the mainstay of triage, and knowledge of the initial approach in the ED could enrich our analysis. As refugees and

migrants overload EDs, it would be necessary to correlate final diagnoses and outcomes with the initial complaints and specifically with their intensity. The spoken language consists a significant barrier to achieve this evaluation, but self-assessment tools, such as visual analogue scales, could contribute to the results. In addition, the interpretation of GI and hepatobiliary disorders lacks the etiological description and final outcome, at least for hospitalized patients. Furthermore, relapses of inflammatory bowel diseases, for instance, are not clearly stated in our study, but are probably included in the broad group of colitis cases. Therefore, it would be interesting for future studies to investigate specific characteristics of those diseases, such as the cause of pancreatitis among subgroups, the kind of colitis, the pathogens of gastroenteritis or the cause of acute hepatitis. Another limitation is the small number of cases for specific GI and hepatobiliary disorders. Bootstrapping techniques were used to measure the intrinsic reliability of the models and overcome this limitation, but larger scale studies and more extended recording and assessment of risk factors would be of value to externally validate the results.

In conclusion, the current and increasing multicultural character of modern European societies is a challenging hazard for migrant patients and ED personnel, due to the epidemiological, cultural and linguistic contrasts between the countries. GI and hepatobiliary emergencies encompass a wide spectrum of pathologies, with varying degrees of severity and often atypical and insidious presentations. Further large-scale prospective studies that elucidate the actual extent of the acute GI and hepatobiliary problems of LMIC patients are warranted, including detailed assessment of possible independent variables that could affect GI and hepatobiliary disorders in ED, and could enhance the interpretation of the incoming populations' epidemiology.

### Conflict of interest

The first author has received a travel grant from Gilead Sciences Switzerland Sàrl. The rest of the authors declare no conflict of interest.

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