2016

ECFS Patient Registry
Annual Data Report

European Cystic Fibrosis Society
Kastanieparken 7
7470 Karup
Denmark
www.ecfs.eu/ecfspr

ECFS Patient Registry

Annual Data Report

2016 data

Table of contents

Published: June 2018

Preface

We are pleased to share with you the 2016 Annual Report from the European Cystic Fibrosis Society Patient Registry (ECFSPR). This 12th report contains demographic and clinical data of 44,719 consenting CF patients from 31 countries. The epidemiological data is provided by national cystic fibrosis (CF) registries and individual CF centres throughout Europe and neighbouring countries.

The ECFSPR's primary goal is to provide a clear and comprehensive picture of CF clinical outcomes across Europe. The analyses presented in this report have been carried out by the ECFSPR statisticians using all the raw data, anonymised, submitted by the participating countries. In merging this data, the results of analysis for some countries as presented in the ECSFPR report may differ from the data published in their national annual registry report. Differences can originate from variation in patient inclusion criteria, the definitions used for disease complications and the employment of different reference values. Further details on how this occurs and is dealt with can be found in the report and in the List of ECFSPR Variables and Definitions in Appendix 2 (page 136).

During the past years national registries have been working to align their variables and definitions with the ones used by the ECFSPR. In this report, for the first time, all countries report the best FEV_1 recorded throughout the year.

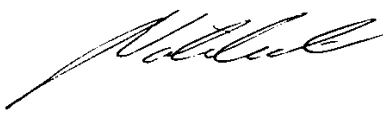
The Registry has grown considerably in the last few years and it is now the largest CF database in the world, thanks mostly to the essential support received from the contributing centres and national registries in Europe and neighbouring countries. In the coming years we will focus on improving and monitoring data quality, and increasing the use of the data in the scientific domain, in published manuscripts and for investigation of the long-term safety and efficacy of new therapies. Complete longitudinal data-sets of high quality data and a coverage in each participating country of 80% or more are both essential if the data is to be employed for research, and in clinical trials and pharmacovigilance studies.

We will also continue the invaluable collaboration with groups such as CF Europe, the ECFS Pharmacovigilance Group and the ECFS Data Quality Management Group which has led to the implementation of a number of important projects.

The management of the ECFSPR and the development of this report take a considerable amount of work. I would like to thank the national registries and individual centres, as well as the country representatives, for their participation in the ECFSPR, and the ECFSPR staff for their hard work in producing this report. Managing the Registry comes with a cost and we are also indebted to our sponsors whose unrestricted grants have helped support the running and expansion of the ECFSPR.

Finally, I would like to thank all the people with CF throughout Europe for their willingness to participate in the ECFSPR. Without them this Registry would not exist. We hope that the ECFSPR information is useful for people with CF, their families and caregivers and that it will lead to improved CF care throughout Europe.

Sincerely,



Lutz Naehrlich, MD
ECFSPR Director

To the people with cystic fibrosis

This report is about you and how cystic fibrosis (CF) affects you and other people all over Europe. The report is based on information collected by individual CF centres and the national CF registries that participate in the European Cystic Fibrosis Society Patient Registry (ECFSPR). We have tried to make the presentation of this data as clear as possible and hope that you will find the report interesting and easy to understand.

We will continue to publish a separate At-a-Glance report, containing key information from the ECFSPR Report relevant for people with CF and their families, www.ecfs.eu/projects/ecfs-patient-registry/annual-reports. Interactive maps with country-relevant information are available on our website www.ecfs.eu/ecfspr.

Together with the patient organisations, we pursue to develop tools to increase awareness of the Registry amongst patients, such as posters with information and basic statistics from the Registry for display in CF-clinics, and an increased presence on social media.

If you have any suggestions on how we can improve the information or if something is unclear you are welcome to contact us by sending an email to: ecfs-pr@uzleuven.be.

For discussions about the results in your country we encourage you to contact your CF centre.

For more detailed information about the ECFSPR we invite you to visit the patient-dedicated page on our website: www.ecfs.eu/projects/ecfs-patient-registry/information-about-ecfspr-cf-patients. To keep up to date with the latest ECFSPR news, and join in the conversation, please follow us on Twitter @ECFSRegistry.

List of centres and national registries that provided the data

List of individual centres and national registries that contributed to the ECFSPR.

In large print: the name of the country representative in the ECFSPR Steering Group;
Underlined: the name of the database manager for the national registry;
In Italics: new participants since the report with 2015 data.

Country	Centre/National Registry name	Contact
Austria	12 individual centres:	Andreas Pfleger
	Medizinische Universität Graz, Universitätsklinik für Kinder- und Jugendheilkunde, Klinische Abteilung für Pädiatrische Pulmonologie und Allergologie und CF Zentrum für Kinder, Jugendliche und Erwachsene, Graz	Ernst Eber Maria Wagenhofer
	Medizinische Universität Innsbruck, Departement für Kinder- und Jugendheilkunde, CF Zentrum für Kinder, Jugendliche und Erwachsene, Innsbruck	Helmut Ellemunter Johannes Eder
	Klinikum Klagenfurt am Wörthersee, Abteilung für Kinder- und Jugendheilkunde, Pädiatrische Pulmologie/ Allergologie, Klagenfurt	Franz Hubert Wadlegger
	Kepler Universitätsklinikum, Kinder- und Jugendheilkunde, Abteilung Mucoviszidose, Linz	Maria Bauer
	Kardinal Schwarzenberg'sches Krankenhaus, Abteiling für Kinder- und Jugendmedizin, Schwarzach	Christoph Seelbach
	Landeskrankenhaus Steyr, Abteilung für Kinder- und Jugendheilkunde und Abteilung für Lungenheilkunde, Steyr	Josef Emhofer Alexander Ebner
	Medizinische Universität, Allgemeines Krankenhaus Wien, Universitätsklinik für Chirurgie, Klinische Abteilung für Thoraxchirurgie, Vienna	Peter Jaksch Sabine Obermair Ramp
	Universitätsklinik für Kinder- und Jugendheilkunde, Cystische Fibrose Ambulanz, Vienna	Sabine Renner Brigitte Mersi
	Wilhelminenspital, Abteilung für Kinder- und Jugendheilkunde mit Ambulanz, Vienna	Thomas Frischer Kerstin Tiringer
	Krankenhaus Hietzing, Abteilung für Atmungs- und Lungenerkrankungen, Vienna	Ingrid Kaluza Andreas Renner
	Klinikum Wels-Grieskirchen, Abteilung für Kinder- und Jugendheilkunde, Wels	Vera Bauer Beatrix Wintersteiger Nadine Raffler
	Klinikum Wels-Grieskirchen, Abteilung für Lungenkrankheiten, Wels	Helmut Feizelmeier
Belgium	Belgian Cystic Fibrosis Registry	Muriel Thomas Simeon Wanyama
Bulgaria	1 Individual Centre	Guergana Petrova
	Alexansdrovska University Hospital, Pediatric Clinic, Sofia, Bulgaria	Guergana Petrova

Country	Centre/National Registry name	Contact
Czech Republic	Cystic Fibrosis Registry of the Czech Republic	Pavel Drevinek Milan Macek Alena Bilkova Marek Turnovec
Denmark	Cystic Fibrosis Registry Denmark	Hanne Vebert Olesen Tania Pressler
France	Registre Français de la Mucoviscidose	Anne Farge Lydie Lemonnier Clémence Dehillotte
Germany	Qualitätssicherung Mukoviszidose	Lutz Naehrlich Birgitt Wiese
Greece	3 individual centres:	Elpis Hatziagorou
	Aghia Sophia Children's Hospital, CF Centre, Athens	Athanasios Kaditis Ioanna Loukou Argyri Petrocheilou
	Sismanoglio General Hospital of Attica, Adult Cystic Fibrosis Unit, Athens	Filia Diamantea Kostas Kotsifas
	Aristotle University of Thessaloniki, Hippokration General Hospital, Cystic Fibrosis Centre, Thessaloniki	John Tsanakas Elpis Hatziagorou Maria Fotoulaki John Kioumis
Hungary	Cystic Fibrosis Registry of Hungary	Rita Ujhelyi Géza Marsal Attila Hornyák
Ireland	Cystic Fibrosis Registry of Ireland	Godfrey Fletcher Abaigeal Jackson Shijun Zhou
Israel	Cystic Fibrosis Registry of Israel	Meir Mei-Zahav
Italy	Cystic Fibrosis Registry of Italy	Rita Padoan Gianluca Ferrari Annalisa Amato Patrizia Iansa Marco Salvatore
Latvia	1 individual centre:	Zane Timpare
	Rīga Stradinš University, Children's Clinical University Hospital, Department of Pneumology, Riga	Vija Švabe Karina Mahlina Zane Timpare
Lithuania	1 individual centre:	Kęstutis Malakauskas
	Hospital of Lithuanian University of Health Sciences, Kaunas Clinics, Adult Cystic Fibrosis Centre, Kaunas	Kęstutis Malakauskas Virginija Kalinauskaitė-Žukauskė
Luxembourg	1 individual centre:	Marc Schlesser
	Centre Hospitalier de Luxembourg	Marc Schlesser Inesse Denine

Country	Centre/National Registry name	Contact
Republic of Macedonia	1 individual centre:	Stojka Fustik
	University Children's Hospital, Centre for Cystic Fibrosis, Skopje	Stojka Fustik
Republic of Moldova	Cystic Fibrosis Registry of Moldova	Oxana Turcu
Netherlands	Dutch Cystic Fibrosis Registry	Vincent Gulmans Domenique Zomer
Norway	*Cystic Fibrosis Registry of Norway*	*Egil Bakkeheim*
Portugal	Cystic Fibrosis Registry of Portugal	Luísa Pereira
Romania	1 individual centre:	Simona Mosescu
	Clinical Children's Hospital, Grigore Alexandrescu, Bukarest, Romania	Simona Mosescu
Russian Federation	Cystic Fibrosis Registry of the Russian Federation	Nataliya Kashirskaya Elena Amelina Alexander Chernyak Stanislav Krasovskiy Elena Kondratyeva Anna Voronkova Maria Afanaseva
Serbia	1 individual centre:	Milan Rodic
	National Centre for Cystic Fibrosis, Mother and Child Health Institute of Serbia "Dr Vukan Cupic", Belgrade	Milan Rodic
Slovakia	5 individual centres:	Hana Kayserova
	Childrens CF Centre, DFN Banská Bystrica, Banská Bystrica	Branko Takáč
	Centrum cystickej fibrozy pre dospelych FNSP FDR, Banská Bystrica	Eva Bérešova
	Centrum cystickej fibrozy pre dospelych, Klinika pneumologie l.SZU a Univerzitna nemocnica, Bratislava	Branislav Remis
	Klinika detskej pneumologie SZU UN Bratislava, pracovisko Podunajské Biskupice, Bratislava	Hana Kayserova Ingrid Mikulášová
	CF Adult centre, University Hospital L Pasteura, Košice	Lenka Kopčová
Slovenia	2 individual centres:	Uroš Krivec
	University Clinic of Pulmonary and Allergic Diseases, Golnik	Matjaž Fležar Andraz Jakelj
	University Children`s Hospital, Pulmonary Department, Ljubljana	Uroš Krivec Ana Kotnik Pirš

Country	Centre/National Registry name	Contact
Spain	22 individual centres:	Carlos Vazquez-Cordero
	Hospital de Sabadell, Corporació Sanitària Parc Taulí, Clinica Pediátrica, Unitat Clinica de Fibrosis Quística, Barcelona	Oscar Asensio de la Cruz Miguel Garcia Gonzalez
	Hospital Sant Joan de Déu, Unitat de Pneumologia Pediátrica i Fibrosi Quística, Barcelona	Jordi Costa i Colomer
	Hospital Vall d'Hebron, Unidad Fibrosis Quística e Neumologia Pediátrica, Barcelona	Silvia Gartner
	Hospital Universitario Reina Sofia, Dpto. Especialidades Médico-quirúrgicas, Área de Pediatría, Unidad de Alergia y Neumología Pediátricas, Unidad de Gestión Clínica de Pediatría y sus Especialidades, Cordoba	*Javier Torres Borrego* *Noelia Sancho Montero*
	Complejo Hospitalario Universitario Insular Materno Infantil, Las Palmas de Gran Canaria	*Antonio José Aguilar Fernández*
	Hospital Universitario La Paz, Unidad de Fibrosis Quìstica Adultos, Servicio de Neumología, Madrid	Concha Prados
	Hospital Infantil La Paz, Unidad de Neumologìa Pediàtrica, Madrid	Maria Isabel Barrio Gomez de Agüero Marta Ruiz de Valbuena
	Hospital Universitario La Princesa, Neumologia Adultos, Madrid	Rosa María Girón
	Hospital Niño Jesús, Sección de Neumologia Pediátrica, Unidad de Fibrosis Quística, Madrid	Jose R. Villa Asensi Maribel Gonzalez Alvarez
	Hospital Universitario de Ramón y Cajal, Unidad de Fibrosis Quística, Madrid	Adelaida Lamas Ferreiro Alejandro Lopez Neyra Veronica Sanz Santiago
	Hospital 12 de Octubre, Unidad de Fibrosis Quística, Madrid	Carmen Luna Paredes
	Hospital Regional Universitario de Málaga, Unidad Fibrosis Quística Adultos, Málaga	Casilda Olveira Fuster Gabriel Maria Olveira Fuster Nuria Porras Pèrez
	Hospital Regional Universitario de Málaga, Unidad de Fibrosis Quística Pediátrica, Málaga	Francisco Javier Perez-Frias Estela Perez-Ruiz
	Hospital Universitario Virgen de la Arrixaca, Unidad de Fibrosis Quística, Murcia	Pedro Mondéjar-López
	Hospital Universitario Central de Asturias, Unidad de Pediatría, Oviedo	Carlos Bousoño-García Ramon Gutierrez
	Hospital Universitario Virgen del Rocío, Unidad de Fibrosis Quística, Sevilla	Isabel Delgado Pecellín Esther Quintana Gallego
	Hospital Universitario Nuestra Señora de Candelaria, Santa Cruz de Tenerife, Tenerife	Alicia Callejon
	Hospital Clinico Universitario de Valencia, Unidad de Fibrosis Quística Pediátrica, Valencia	Amparo Escribano Montaner Silvia Castillo Corullon
	Hospital Universitario y Politécnico La Fe, Unidad de Trasplante Pulmonar y Fibrosis Quística, Valencia	Amparo Solé Jover Carmen Inés Perez Munoz

Country	Centre/National Registry name	Contact
	Hospital Universitario de Cruces, Unidad de Fibrosis Quística, Vizkaya	Carlos Vazquez Cordero Maria Dolores Pastor
	Hospital Universitario Miguel Servet, Unidad de Neumología Pediátrica y Fibrosis Quística, Zaragoza	Carlos Martín de Vicente
	Hospital Universitario Miguel Servet, Unidad de Neumología y Fibrosis Quística (Adultos), Zaragoza	*Maria Inés Herrero Labarga*
Sweden	Cystic Fibrosis Registry of Sweden	Isabelle de Monestrol Anders Lindblad
Switzerland	18 individual centres:	Andreas Jung
	Kantonsspital Aarau AG, Klinik für Kinder und Jugendliche, Abteilung pädiatrische Pneumologie, Allergologie und Immunologie, Klinik für Pneumologie und Schlafmedizin, Aarau	Dominik Müller-Suter Sarosh Irani
	Universitätsspital Basel, Klinik für Pneumologie, Adulte Cystische Fibrose, Basel	Michael Tamm Kathleen Jahn
	UKBB Universitäts-Kinderspital beider Basel, Abteilung Intensivmedizin & Pneumologie, Basel	Jürg Hammer Daniel Trachsel
	Inselspital, Universitätsklinik für Pneumologie, Abteilung Cystische Fibrose, Bern	Thomas Geiser Dagmar Lin
	Lindenhofspital Bern, Praxis für Pneumologie "Quartier Bleu", Bern	Reta Fischer Carlo Mordasini
	Universitätsklinik für Kinderheilkunde, Zentrum für Cystische Fibrose und Pulmonologie, Inselspital, Bern	Carmen Casaulta Philipp Latzin Romy Rodriguez
	Hôpital Cantonal Fribourg, Pädiatrie, Fribourg	Denise Herzog Johannes Wildhaber
	Hôpitaux Universitaires de Genève, Département de l'enfant et de l'adolescent, Unité de Pneumologie Pédiatrique, Genève	Constance Barazzone Anne Mornand
	Hôpitaux Universitaires de Genève, Département des spécialités de médecine, Service de Pneumologie, Consultation de mucoviscidose adulte, Genève	Paola Gasche Jean-Marc Fellrath Jérôme Plojoux
	Centre Hospitalier Universitaire Vaudois (CHUV), Départment Médico-Chirurgical de Pédiatrie, Pneumologie Pédiatrique et Mucoviscidose, Lausanne	Isabelle Rochat Laurence Mioranza
	Consultation adulte de Mucoviscidose Service de pneumologie, département de médecine, Centre Hospitalier Universitaire Vaudois (CHUV)	Laurent Nicod Marie Hofer
	Luzerner Kantonsspital, Zentrum für Zystische Fibrose für Kinder und Erwachsene, Abteilungen für Pneumologie, pädiatrische Pneumologie und pädiatrische Gastroenterologie, Luzern	Nicolas Regamey Bernhard Schwizer Johannes Spalinger
	Hôpital de Morges, Consultation de Mucoviscidose Adulte, Morges	Alain Sauty Marie Hofer
	Ostschweizer Kinderspital, Pädiatrische Pneumologie und CF-Zentrum, St. Gallen	Jürg Barben

Country	Centre/National Registry name	Contact
	Kantonsspital St. Gallen, Lungenzentrum, Spezialsprechstunde für adulte Cystische Fibrose, St. Gallen	Martin Brutsche Rebekka Kleiner
	Kantonsspital Winterthur, Klinik für Pneumologie und Klinik für Innere Medizin, Adulte Cystische Fibrose Winterthur	Markus Hofer Thomas Hess
	Universitäts-Kinderspital Zürich, Abteilung für Pneumologie, Zürich	Andreas Jung Romy Rodriguez Alexander Möller
	Universitätsspital Zürich, Klinik für Pneumologie, Adultes CF Zentrum, Zürich	Christian Benden Thomas Kurowski
Turkey	*Cystic Fibrosis Registry of Turkey*	*Deniz Dogru*
	Marmara University Faculty of Medicine, Division of Pulmonology, Istanbul	Bülent Karadağ Yasemin Gökdemir Ela Eralp
Ukraine	1 individual centre:	Halyna Makukh
	Cystic Fibrosis Centre of Western Ukrainian Specialized Children's Medical Centre, Lviv	Halyna Makukh Lyudmyla Bober
United Kingdom	UK Cystic Fibrosis Registry	Rebecca Cosgriff Elaine Gunn Siobhán Carr

Authors

For this report, the tables and graphs were written, commented and/or revised by:

Annalisa Orenti and **Anna Zolin**, Italy, ECFSPR Statisticians, Department of Clinical Sciences and Community Health, University of Milan;
Jacqui van Rens, Belgium, ECFSPR Executive Coordinator;
Alice Fox and **Patrizia Iansa**, Italy, ECFSPR Service Desk;
Andreas Jung, Switzerland, **Meir Mei-Zahav,** Israel, **Rebecca Cosgriff**, United Kingdom;
Elise Lammertyn, Belgium: CF Europe representative in the ECFSPR;
Contributing country managers and national representatives (the names are listed on page 5-10);
Lutz Naehrlich, Germany, ECFSPR Director.

Suggested citation for this report:

ECFSPR Annual Report 2016, Orenti A, Zolin A, Naehrlich L, van Rens J et al, 2018.

Introduction

The European Cystic Fibrosis Society Patient Registry (ECFSPR)

The ECFSPR collects demographic and clinical data of consenting cystic fibrosis (CF) patients from Europe and neighbouring countries. Data is collected using a common set of variables and definitions, and is sent to the ECFSPR in one of the following ways:

- National CF registries (or individual centres with local databases) extract patient data from their own database and import the data into the ECFSPR software;
- Individual centres enter patient data directly into the ECFSPR software.

Collection of data at a local level must be approved by local data protection authorities in accordance with European data protection legislation. Data stored in the central database is anonymous, and only year/ month of birth and randomised centre numbers are used as identifiers. Data is available for scientific purposes on application. All requests are reviewed by the ECFSPR Scientific Committee and, based on their recommendation, the country coordinators in the Steering Group (composed of national representatives of the countries that contribute data to the ECFSPR) decide if the data request is approved or not; this decision is final. Requests originating from the Industry are also reviewed by the ECFS Clinical Trials Network. All applications must meet the European and individual country data protection legislation regarding patient anonymity.

For more information, please visit our website www.ecfs.eu/ecfspr.

General Considerations

For the national registries it is possible that some of their definitions and data coding do not fully correspond to those employed by the ECFSPR, either because some types of information are not collected, or are collected by the national registry using a different method. When the national registries upload their data, they are also asked to state in a document whether their variables definitions meet those of the ECFSPR. Where major discrepancies between the definitions are present, those variables have been omitted from the annual report, and in the case of minor discrepancies a footnote has been added to the graphs and tables. For example, the ECFSPR collects information on the presence of chronic *Pseudomonas aeruginosa* infection according to the modified Leeds criteria and/or the presence of elevated *Pseudomonas* antibodies (see Appendix 2 on page 135). If a national registry collects such information as “at least one positive *Pseudomonas aeruginosa* culture this year”, this information would be too different from the ECFSPR definition of chronic *Pseudomonas aeruginosa*, and we would set this variable to “missing” for that particular country. If, instead, a country defines chronic *Pseudomonas aeruginosa* as “the presence of more than four positive cultures in 6 months”, the data of this variable would be included in the annual report since the definition is much closer to the ECFSPR definition. Where this is the case, a footnote has been added to the relevant tables and graphs.

If a country does not collect a certain variable (or if it is completely different from the ECFSPR definitions as described above), we have omitted that country from the relevant graphs in the report. The same applies for countries where the information for a variable is missing for more than 10% of the patients. All data, however, is presented in the tables. The number of missing values is important for the interpretation of the results, since it is impossible to know if a patient with a missing value for a given complication has

this complication or not, which makes the given frequencies less accurate. For example, in a country where 7% of the patients have liver disease but 20% of patients have unknown/missing information on liver disease, the true frequency of liver disease can be anything between 7 and 27%.

You will find some differences between the findings of the national registries' own reports and the ECFSPR report. This is because some variable values are recoded or computed in different ways. For example, some national registries compute the age at the annual visit and consider 16 years as the cut-off for adult age. The ECFSPR computes the age at FEV_1/height/weight measurement and the age at follow-up (the end of the year) and considers 18 years as the cut-off for adult age. Since clinical outcomes do not change very much over a 12-month period, we do not consider this to be a serious obstacle to interpretation. Another example: for lung function values such as FEV_1 the raw data values, reported in litres, are not informative unless they are expressed in relation to the age, sex and height of the patient. We therefore needed to transform the raw values into new variables in order to compare lung function between patients and countries. We used common reference populations for all data when calculating the values as a percentage of predicted from the raw data. Slightly different values can be obtained when using another reference population on the same raw data. It is important to use a common method of calculation when comparing different countries, just as the national registries choose a common method of calculation when they compare the individual centres in that country.

The estimated percentage of people with CF, per country, included in the national registry or national data presented by the country, varies; see table 1.1, page 16. These differences can influence how the data is interpreted, and we therefore advise comparisons to be made only between countries with a similar percentage coverage.

Glossary and Abbreviations

Country codes:

AT:	Austria
BE:	Belgium
BG:	Bulgaria
CH:	Switzerland
CZ:	Czech Republic
DE:	Germany
DK:	Denmark
ES:	Spain
FR:	France
GR:	Greece
HU:	Hungary
IE:	Ireland
IL:	Israel
IT:	Italy
LT:	Lithuania
LU:	Luxembourg
LV:	Latvia
MD:	Republic of Moldova
MK:	Republic of Macedonia
NL:	The Netherlands
NO:	Norway
PT:	Portugal
RO:	Romania
RS:	Serbia
RU:	Russian Federation
SE:	Sweden
SI:	Slovenia
SK:	Slovak Republic
TR:	Turkey
UA:	Ukraine
UK:	United Kingdom

Explanation of terms:

ABPA: allergic bronchopulmonary aspergillosis, an allergic reaction to the mould *Aspergillus fumigatus.*
BMI: body mass index: weight (kg) / [height (m)]^2.
Bronchodilator: medication that relaxes the muscles of the airways, used also for asthma.
CFRD: CF related diabetes.
CFTR: CF transmembrane conductance regulator, is a protein at the cell surface that controls the salt and water balance across a cell. The gene that causes CF is the blueprint for the CFTR protein. Everyone has two copies of the gene for CFTR, but to be born with CF, both CFTR genes must be affected by a CF-causing mutation.
FEV_1: forced expiratory volume in one second (lung function parameter).
FEV_1%: the FEV_1 as a percentage of the average value for healthy people of the same age, height and sex.
Haemoptysis: coughing up blood. This happens frequently in small amounts in CF, so the complication we asked for here is major bleeding (more than 250 ml).
Homozygous: CF is caused by mutations of the CFTR gene, one on each allele. One is inherited from the mother and one from the father. If both mutations are the same, the person is said to be homozygous for this mutation.
Heterozygous: CF is caused by mutations of the CFTR gene, one on each allele. One is inherited from the mother and one from the father. If these are two different mutations, the person is considered to be heterozygous.
Max: maximum. It is the highest value.
Mean: it is the average value of a set of measurements. For example, if the mean age at diagnosis is 3 years, it means that, on average, the patients are diagnosed when they are 3 years old.
Meconium ileus: congenital obstruction of the gut with thick, sticky faeces.
Median: the value that separates the set of measurements in two halves, so that 50% of measurements are below the median value and the other 50% of measurements are above the median value. For example, if median age at diagnosis is 5 months, it means that half of the patients are diagnosed before 5 months of age, and the other half of the patients are diagnosed after 5 months of age.
Min: minimum. It is the lowest value.
N: the number of patients in a group for whom the information is not missing.
N miss: number of missing values. It is the number of patients for whom the information was missing.
NaCl: sodium chloride. Here: inhaled hypertonic saline.
Pancreatic insufficiency: the absence of pancreatic enzymes in the gut leading to malnutrition if not treated (pancreatic insufficiency is therefore defined as the use of pancreatic enzyme supplementation).
25th Pctl: 25th percentile, also called first quartile. It is the value that separates the set of measurements in two parts, so that one quarter (25%) of the measurements is below it and the other three quarters are above it. For example, if the 25th percentile for age at diagnosis is 1 month, it means that a quarter of the patients were diagnosed before they were a month old, and the other three quarters were diagnosed after they were a month old.
50th Pctl: 50th percentile, also called second quartile or median (please refer to the definition for Median).
75th Pctl: 75th percentile, also called third quartile. It is the value that separates the set of measurements in two parts, so that three quarters (75%) are below it and the other quarter is above it. For example, if the 75th percentile for age at diagnosis is 3 years, it means that three quarters of the patients were diagnosed before they were 3 years old, and the remaining quarter was diagnosed after they reached 3 years of age.
Pneumothorax: collapsed lung, in CF usually because of severe lung damage.
Quartiles: The 25th percentile, the median (the 50th percentile) and the 75th percentile are collectively called quartiles, because they divide the set of measurements into quarters.
rhDNase: recombinant human DNase – marketed as Pulmozyme®.
Z-score: or standardised scores; are a way to compare results from a test to a "normal" population, to give scores (or data-values) a common standard: a mean of 0 and a standard deviation of 1 to indicate how far a value is from the mean value of a reference population (see Appendix 1 for details). Negative z-scores mean that the value is below the mean of values in the reference population, whereas positive z-scores mean that the value is above the mean. For example, a z-score for weight of -2 means that the weight is 2 standard deviations below the mean of subjects of the same age and sex of the reference population. For example, if the z-score for BMI of a 10 years old boy is -2, it means that the BMI for that boy is 2 standard deviations below the mean BMI of 10 years old boys of the reference population.

Summary of data report

Outcome		Females	Males	Total
Patients registered in the ECFSPR	n (%)	21220 (47.45)	23499 (52.55)	44719
Age at follow-up (in years; patients alive on 31/12/2016)	mean median	20.5 18.3	21.4 19.5	21.0 19.0
Patients ≥ 18 years (patients alive on 1/12/2016)	%	50.7	53.8	52.4
Age at diagnosis*	mean (years) median (months)	4.2 4.2	4.1 4.0	4.1 4.1
Patients with at least one F508del allele recorded*	%	82.4	82.3	82.4
Patients living with lung transplant*	n (%)	1152 (5.7)	1162 (5.2)	2314 (5.4)
Patients living with liver transplant*	n (%)	90 (0.4)	157 (0.7)	247 (0.6)
Patients deceased in 2016**	n (%)	254 (1.2)	225 (1.0)	479 (1.1)
Age at death (years)**	mean median	31.5 29.0	31.2 30.0	31.4 30.0

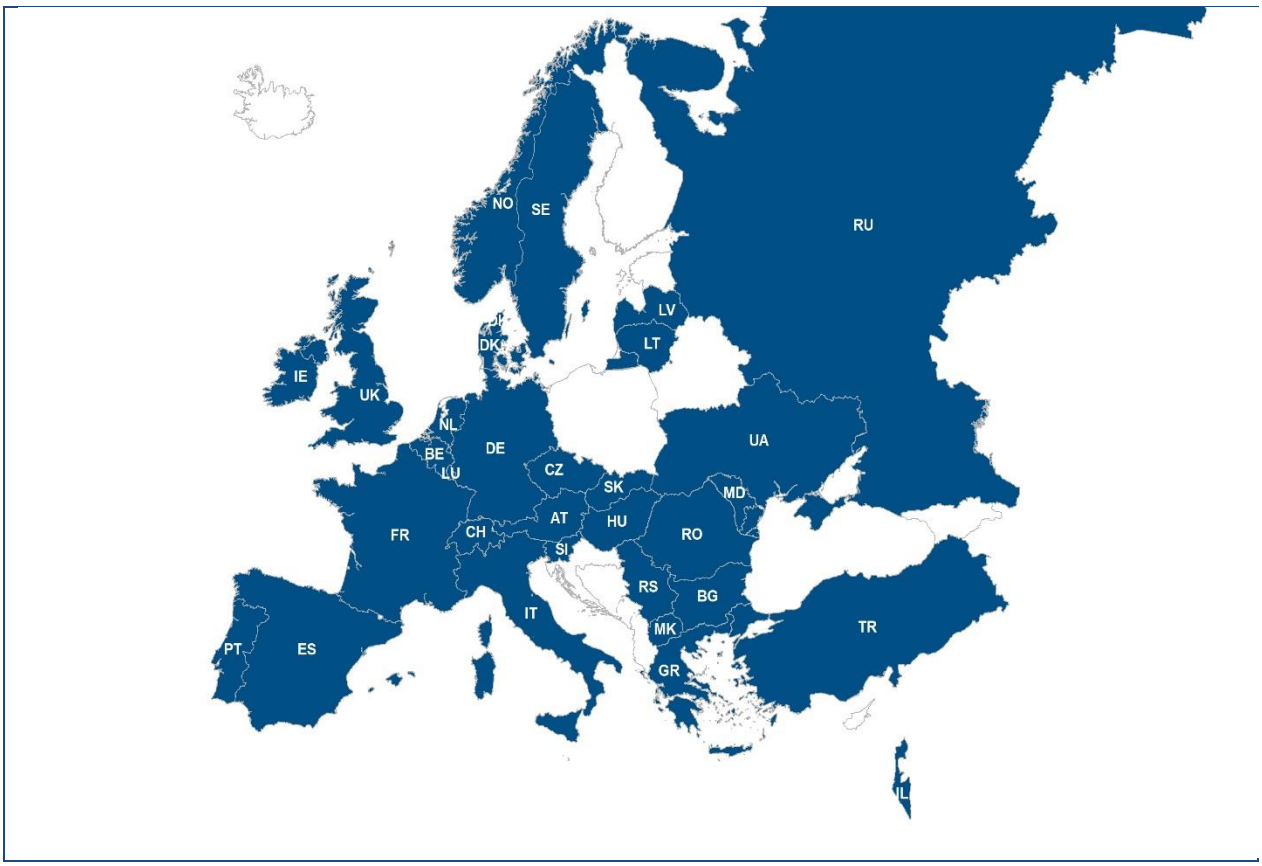
* Only patients seen during the year are presented. The total number of patients presented is 43,190.

** Only patients seen during the year are presented. For the United Kingdom, all patients with confirmed diagnosis of CF are included (N=10,465). The total number of patients presented is 43,956.

Data report

1. Demographics

Figure 1.1 Map of countries that contributed to the ECFSPR in year 2016.



Countries that contributed 2016 data are in blue.

Table 1.1 Number of patients in year 2016, by country.

Country	Patients registered, not lost to follow-up	Patients seen	Estimated coverage 2016
Austria	763	740	>90%
Belgium*	1282	1246	>90%
Bulgaria	140	140	66%
Czech Republic*	603	585	>95%
Denmark*	497	482	99%
France*	6713	6713	90%
Germany*	5738	5738	>80%
Greece**	611	594	>95%
Hungary*	507	507	95%
Ireland*	1276	1144	>90%
Israel**	663	538	>95%
Italy*	5384	5361	95%
Latvia	39	36	>90%
Lithuania[1]	14	12	20%[1]
Luxembourg	32	32	>95%
Rep of Macedonia	119	109	>90%
Rep of Moldova*	59	46	68-76%
The Netherlands*	1449	1412	98%
Norway*	230	230	72%
Portugal**	339	319	>95%
Romania	54	50	10%[2]
Russian Federation*	3108	3022	83%
Serbia	193	170	>90%
Slovak Republic**	263	247	>90%
Slovenia	108	102	>95%
Spain	1955	1898	70%
Sweden*	649	649	>95%
Switzerland**	966	906	>95%
Turkey	328	313	15%
Ukraine	172	150	21%
United Kingdom*[2]	10465	9695	99%
Total	44719	43186	

* Countries with an established national CF registry.

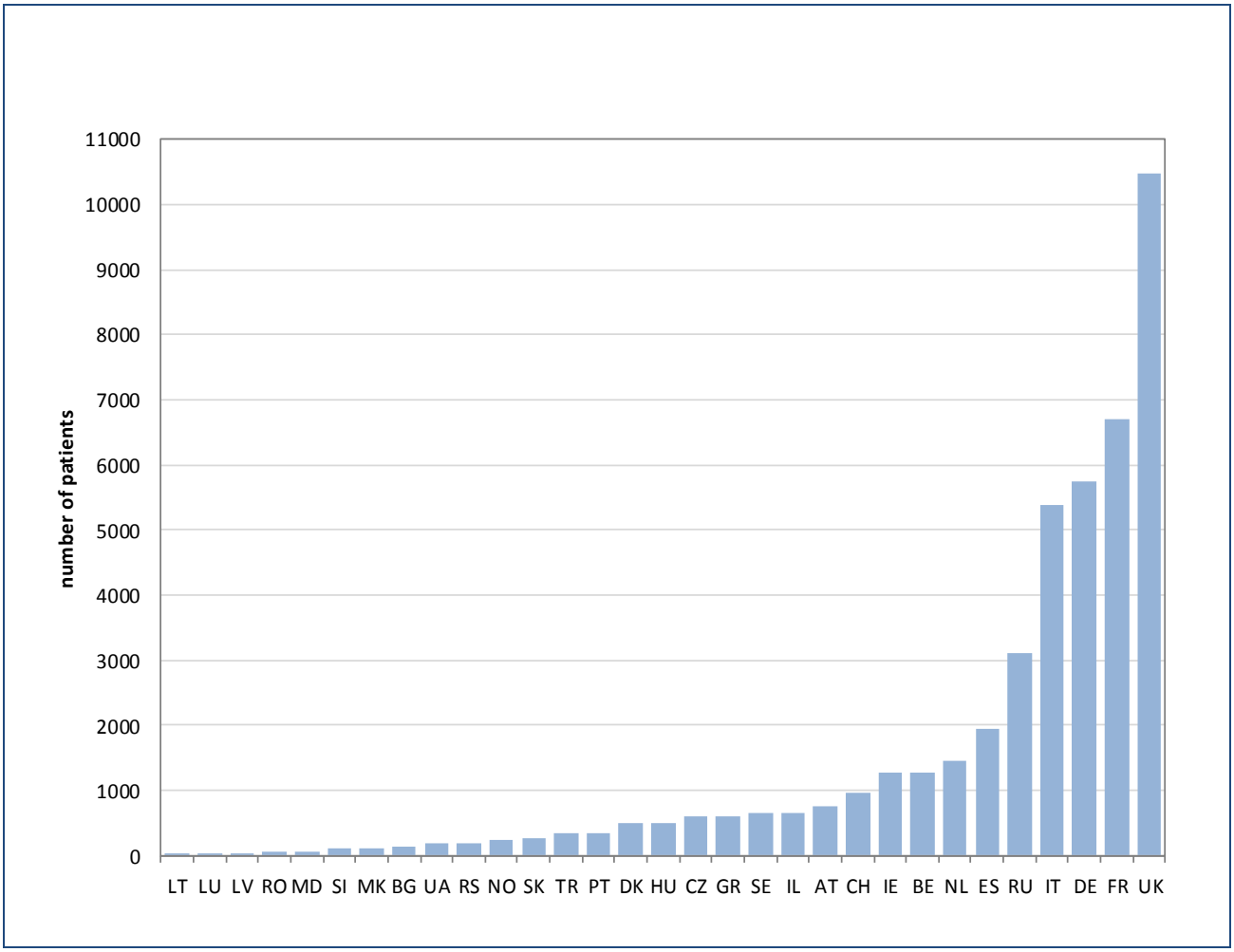
** These countries have a national registry, but use the direct data-entry function of ECFSTracker.

[1] Coverage is 100% for adults and 0% for children.

[2] The number of registered patients in this report differs from the number 10,461 reported in the UK 2016 annual data report, because additional data-cleaning was done.

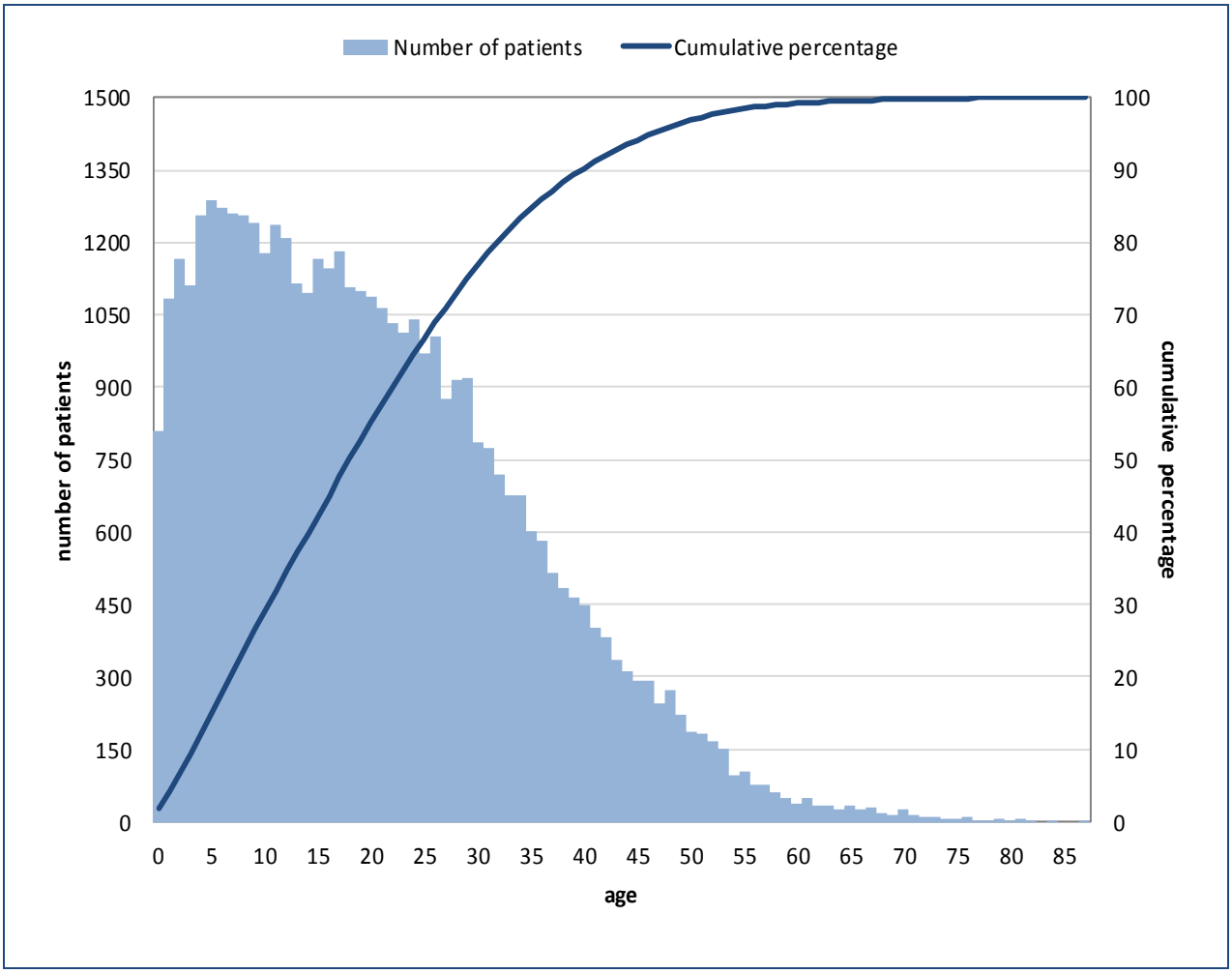
The column “Patients registered, not lost to follow-up” shows the patients that attend centres, and includes patients that have not been seen during the year but are known to be alive that year. The column “patients seen” presents only the patients who have attended the clinic during the year. The column “Estimated coverage 2016” shows the estimated percentage of CF patients living in that country who are included in the national registry/national data collection as reported by the country. For some countries one individual centre may include almost all patients, e.g. Latvia and Serbia.

Figure 1.2 Number of patients registered in the ECFSPR in year 2016, by country.



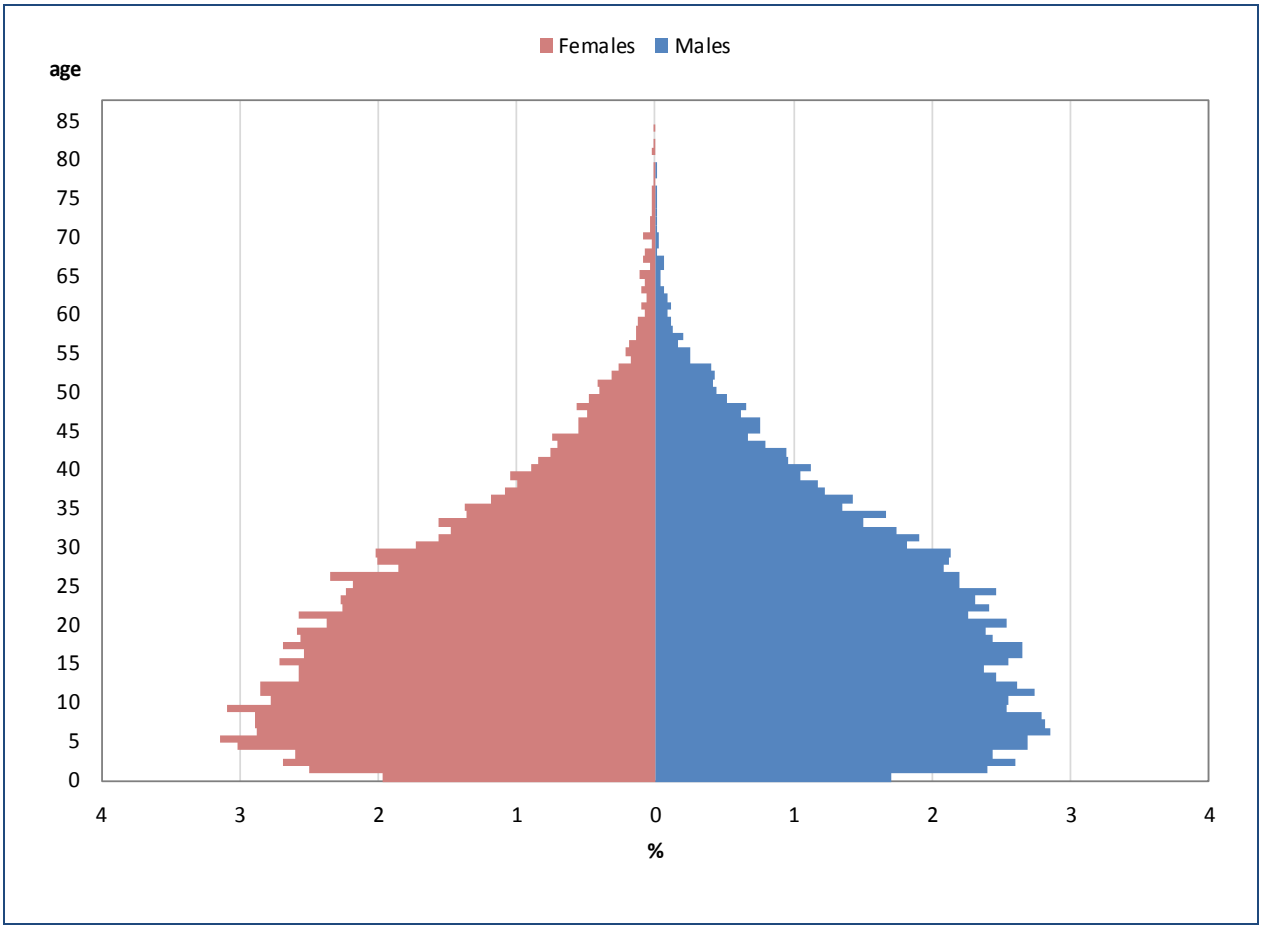
Each vertical bar shows the number of patients living in that country in 2016. Please refer to table 1.1 for the coverage in each country.

Figure 1.3 Age at follow-up distribution. Patients alive on 31/12/2016.



Each blue vertical bar represents the number of patients of that age alive in 2016. The cumulative percentage (the dark blue line) describes how many patients (as a percentage) are below a certain age (e.g. 50% of the patients are younger than 19 years of age).

Figure 1.4 Age at follow-up distribution by sex. Patients alive on 31/12/2016.



The pyramid shows the percentage of patients of different ages as horizontal bars. The right side of the pyramid (blue) shows, for males, how many patients (as a percentage) are a certain age, the left side (red) shows the same for females. The lower percentage of patients at the bottom of the pyramid is a result of the fact that some patients have not yet been diagnosed (mean age at diagnosis is 4.14 years, see table 2.1).

Table 1.2 Proportion of adults (≥18 years) and children (<18 years), by country. Patients registered, alive on 31/12/2016.

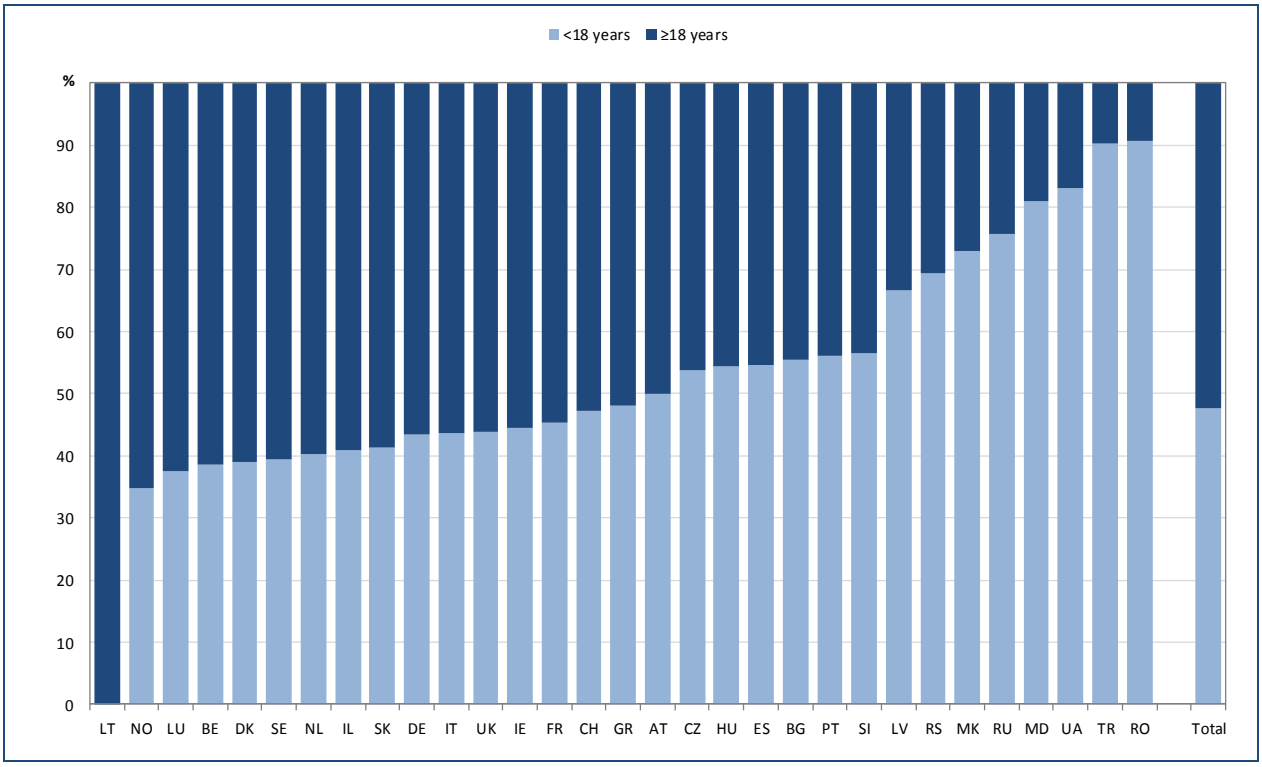
Country	Children (<18 years) number (%)	Adults (≥18 years) number (%)
Austria	377 (49.87)	379 (50.13)
Belgium	491 (38.57)	782 (61.43)
Bulgaria	77 (55.40)	62 (44.60)
Czech Republic	320 (53.69)	276 (46.31)
Denmark	191 (38.98)	299 (61.02)
France	3023 (45.38)	3639 (54.62)
Germany	2468 (43.48)	3208 (56.52)
Greece	292 (48.11)	315 (51.89)
Hungary	273 (54.38)	229 (45.62)
Ireland	563 (44.58)	700 (55.42)
Israel	269 (40.82)	390 (59.18)
Italy	2324 (43.63)	3002 (56.37)
Latvia	26 (66.67)	13 (33.33)
Lithuania	0 (0.00)	13 (100.00)
Luxembourg	12 (37.50)	20 (62.50)
Rep of Macedonia	86 (72.88)	32 (27.12)
Rep of Moldova	47 (81.03)	11 (18.97)
The Netherlands	577 (40.18)	859 (59.82)
Norway	80 (34.78)	150 (65.22)
Portugal	189 (56.08)	148 (43.92)
Romania	49 (90.74)	5 (9.26)
Russian Federation	2316 (75.76)	741 (24.24)
Serbia	131 (69.31)	58 (30.69)
Slovak Republic	108 (41.22)	154 (58.78)
Slovenia	60 (56.60)	46 (43.40)

Note: Lithuania has 100% coverage for adults and 0% coverage for children.

[table 1.2 continued]

Country	Children (<18 years) number (%)	Adults (≥18 years) number (%)
Spain	1059 (54.56)	882 (45.44)
Sweden	254 (39.50)	389 (60.50)
Switzerland	453 (47.19)	507 (52.81)
Turkey	296 (90.24)	32 (9.76)
Ukraine	142 (83.04)	29 (16.96)
United Kingdom	4517 (43.78)	5800 (56.22)
Total	21070 (47.63)	23170 (52.37)

Figure 1.5 Proportion of adults (≥18 years) and children (<18 years). Patients alive on 31/12/2016.



This graph shows the percentage of patients in each country who are adults (dark blue) or children (light blue). The percentage of adult patients varies considerably between the different countries, but this is partly an effect of the way the patients are included: for some countries only a few individual centres send data to the ECFSPR, and the proportion of children and adults may reflect the proportion of paediatric and adult centres in that country who participate in the ECFSPR. Please refer to table 1.1, page 16, for national coverage.

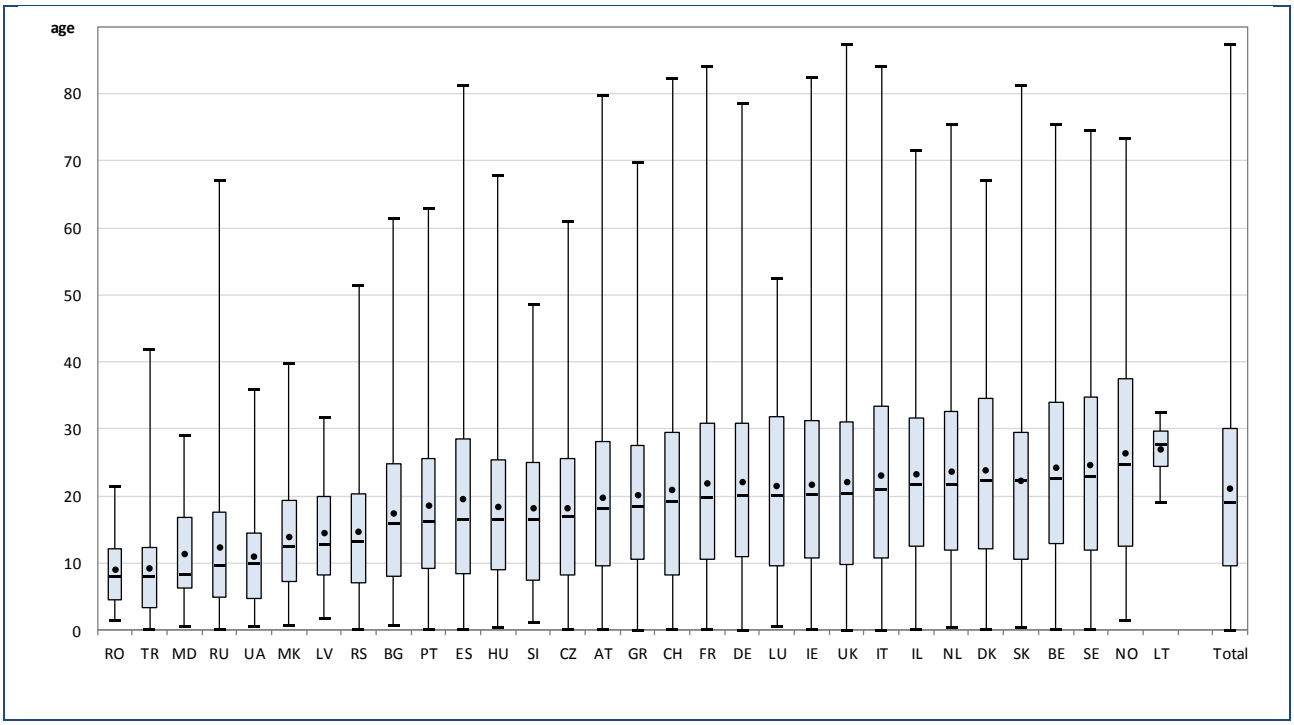
Table 1.3 Age at follow-up: descriptive statistics, by country and overall. Patients alive on 31/12/2016.

Country	N	Mean (average age)	Min (age of the youngest patient)	25th pctl (25% of the patients are younger than this age)	Median (half the patients are younger than this age)	75th pctl (75% of the patients are younger than this age)	Max (age of the oldest patient)
Austria	756	19.7	0.1	9.5	18.1	28.2	79.7
Belgium	1273	24.2	0.1	12.8	22.5	33.9	75.5
Bulgaria	139	17.2	0.7	8.0	16.0	24.8	61.3
Czech Republic	596	18.0	0.1	8.3	16.8	25.5	61.0
Denmark	490	23.8	0.2	12.2	22.3	34.5	67.0
France	6662	21.8	0.1	10.6	19.9	30.8	84.1
Germany	5676	21.9	0.0	11.0	20.0	30.8	78.5
Greece	607	20.0	0.0	10.5	18.5	27.6	69.8
Hungary	502	18.3	0.3	9.0	16.6	25.3	67.9
Ireland	1263	21.6	0.2	10.7	20.2	31.2	82.4
Israel	659	23.2	0.1	12.5	21.7	31.6	71.5
Italy	5326	23.0	0.0	10.8	20.9	33.3	84.1
Latvia	39	14.4	1.7	8.2	12.8	20.0	31.7
Lithuania	13	26.9	19.1	24.5	27.7	29.7	32.5
Luxembourg	32	21.3	0.5	9.6	20.0	31.9	52.5
Rep of Macedonia	118	13.8	0.7	7.2	12.5	19.3	39.8
Rep of Moldova	58	11.3	0.6	6.2	8.4	16.8	29.0
The Netherlands	1436	23.6	0.3	11.9	21.7	32.7	75.5
Norway	230	26.3	1.4	12.5	24.7	37.4	73.3
Portugal	337	18.4	0.2	9.2	16.2	25.6	63.0
Romania	54	8.8	1.4	4.5	8.0	12.1	21.4
Russian Federation	3057	12.2	0.1	4.8	9.6	17.5	67.0
Serbia	189	14.6	0.1	7.0	13.1	20.3	51.4
Slovak Republic	262	22.1	0.3	10.6	22.4	29.5	81.2
Slovenia	106	18.0	1.0	7.5	16.6	25.0	48.5
Spain	1941	19.4	0.1	8.4	16.5	28.5	81.2
Sweden	643	24.5	0.1	11.9	23.0	34.8	74.5
Switzerland	960	20.8	0.1	8.3	19.3	29.5	82.3
Turkey	328	9.0	0.1	3.4	8.0	12.4	41.8
Ukraine	171	10.8	0.6	4.7	9.8	14.5	35.8
United Kingdom	10317	21.9	0.0	9.8	20.5	31.0	87.4
Total	44240	21.0	0.0	9.5	19.0	30.0	87.4

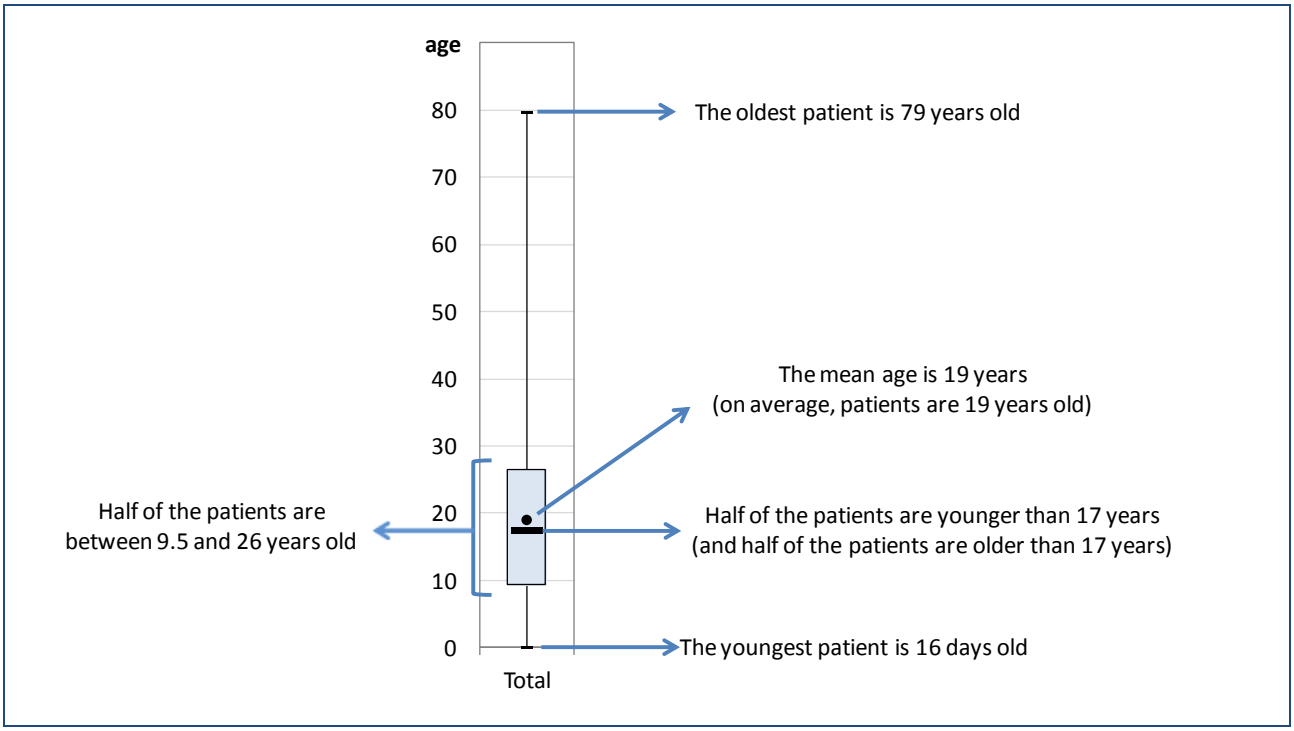
Note: Lithuania has 100% coverage for adults and 0% coverage for children.

This table shows the descriptive statistics for age at follow-up of the patients by country and overall. Only patients who were alive on December 31st 2016 are included.

Figure 1.6 Age at follow-up: box-plot, by country and overall. Patients alive on 31/12/2016.

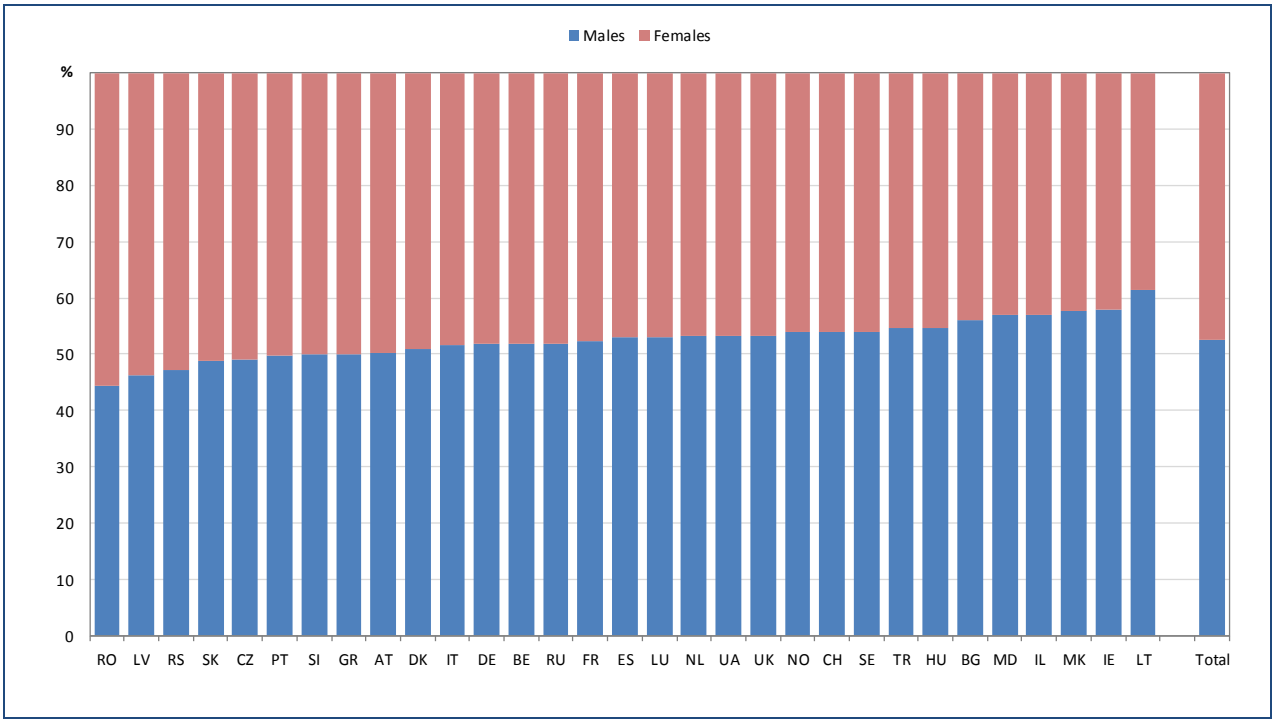


This box-plot is a graphic representation of the age detailed in table 1.3. For each country the dash (black line crossing the blue box) is the median, the black dot is the mean and the whiskers (vertical lines with a T-shaped end) are the minimum and the maximum. The following figure explains how to read the box-plot.



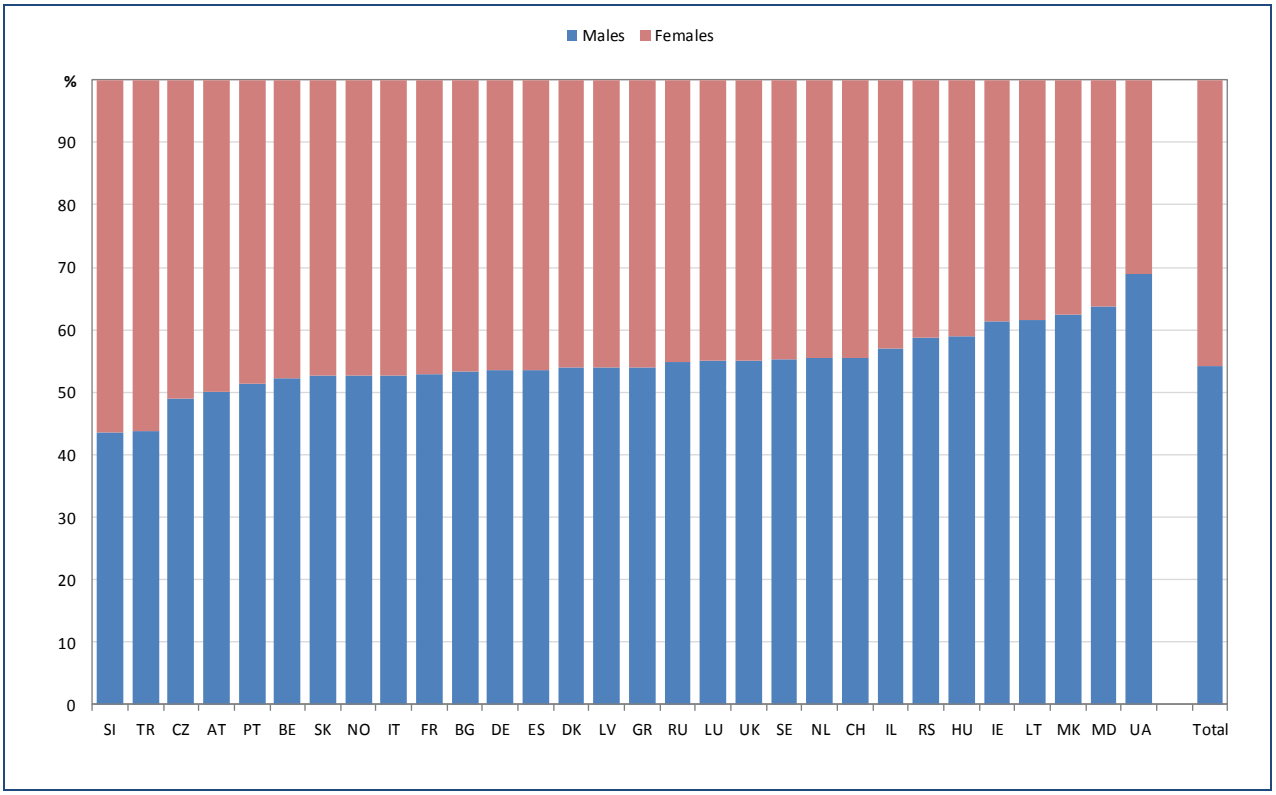
Note: This is an example of how to read a box-plot. The numbers used in this figure are not real and do not refer to figure 1.6.

Figure 1.7 Sex distribution, by country and overall. Patients alive on 31/12/2016.



Sex distribution of all patients. Overall (see "Total"), in the ECFSPR there are more male than female patients, which could reflect higher mortality in female CF patients.

Figure 1.8 Sex distribution, by country and overall. Patients alive on 31/12/2016 and aged 18 years or more.



Note: Romania has only few patients of 18 years and is excluded from the graph.

Sex distribution for adult patients. The total proportion of females in the adult group is similar to the proportion of females in the whole population.

2. Diagnosis

Hereafter, only patients seen during the year are presented.

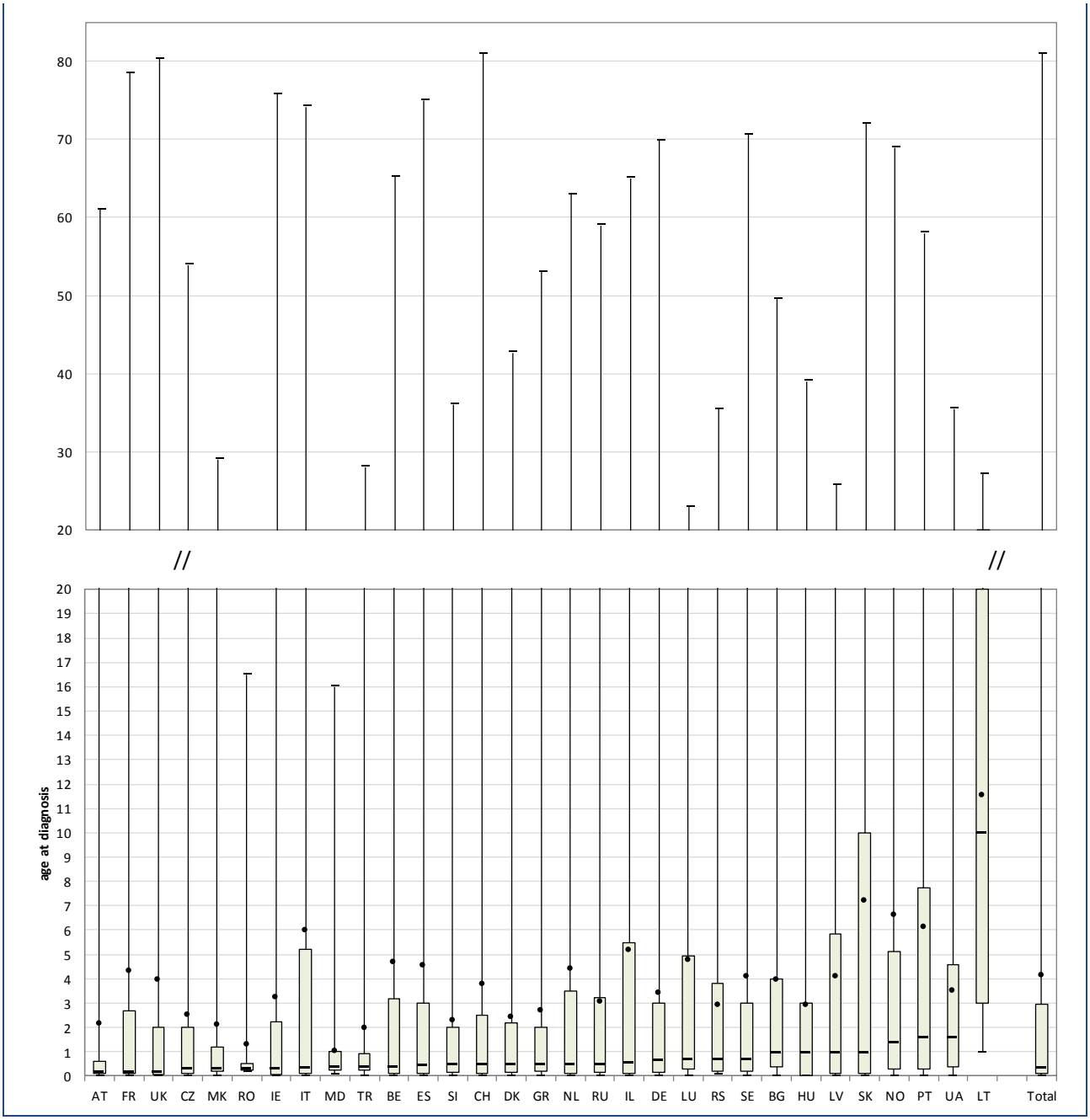
Table 2.1 Age at diagnosis (in years): descriptive statistics, by country and overall. All patients seen in 2016.

Country	N	N miss	Mean (average age at diagnosis)	Min (lowest age at diagnosis)	25th pctl (25 % of the patients were diagnosed before this age)	Median (half the patients were diagnosed before this age)	75th pctl (75% of the patients were diagnosed before this age)	Max (highest age at diagnosis)
Austria	688	52	2.18	0.00	0.10	0.20	0.61	61.00
Belgium	1239	7	4.67	0.00	0.09	0.42	3.19	65.24
Bulgaria	135	5	3.97	0.00	0.40	1.00	4.00	49.60
Czech Republic	585	0	2.54	0.00	0.10	0.30	2.00	53.90
Denmark	482	0	2.42	0.00	0.17	0.50	2.17	42.67
France	6639	74	4.35	0.00	0.10	0.20	2.70	78.50
Germany	5439	299	3.44	0.00	0.17	0.66	3.00	69.92
Greece	585	9	2.72	0.00	0.21	0.50	2.00	53.00
Hungary	423	84	2.94	0.00	0.00	1.00	3.00	39.00
Ireland	1142	<5	3.24	0.00	0.06	0.33	2.24	75.83
Israel	531	7	5.20	0.00	0.10	0.58	5.50	65.00
Italy	5312	49	6.02	0.00	0.11	0.35	5.21	74.15
Latvia	36	0	4.09	0.00	0.10	1.00	5.85	25.70
Lithuania	11	1	11.55	1.00	3.00	10.00	20.00	27.10
Luxembourg	32	0	4.77	0.00	0.30	0.70	4.95	22.90
Rep of Macedonia	109	0	2.10	0.00	0.20	0.30	1.20	29.00
Rep of Moldova	46	0	1.02	0.08	0.25	0.40	1.00	16.00
The Netherlands	1325	87	4.44	0.00	0.10	0.50	3.50	63.00
Norway	215	15	6.61	0.00	0.30	1.40	5.10	69.00
Portugal	308	11	6.15	0.00	0.28	1.60	7.75	58.00
Romania	50	0	1.30	0.20	0.25	0.30	0.50	16.50
Russian Federation	2986	36	3.08	0.00	0.16	0.50	3.23	58.95
Serbia	166	4	2.95	0.10	0.20	0.70	3.80	35.40
Slovak Republic	211	36	7.20	0.00	0.11	1.00	10.00	72.00
Slovenia	98	4	2.31	0.00	0.16	0.48	2.00	36.00
Spain	1856	42	4.57	0.00	0.12	0.47	3.00	75.00
Sweden	634	15	4.11	0.00	0.19	0.70	2.99	70.61
Switzerland	773	133	3.79	0.00	0.10	0.50	2.50	81.00
Turkey	255	58	1.97	0.00	0.25	0.40	0.91	28.00
Ukraine	150	0	3.52	0.00	0.40	1.60	4.60	35.50
United Kingdom	9620	75	3.98	0.00	0.06	0.20	2.00	80.28
Total	42081	1105	4.14	0.00	0.10	0.34	2.94	81.00

Note: For Hungary, Slovak Republic, Switzerland and Turkey the information on age at diagnosis is missing for more than 10% of the patients.
Lithuania has 100% coverage for adults and 0% coverage for children.

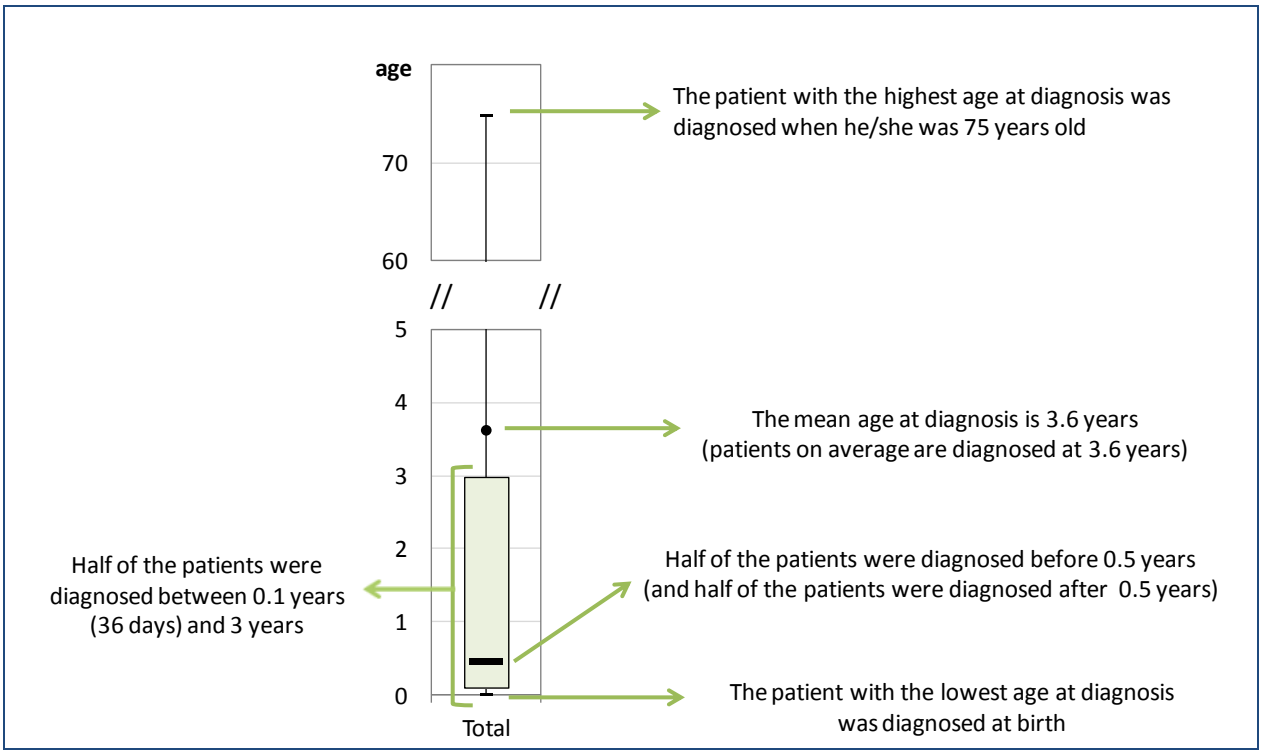
This table shows the descriptive statistics for age at diagnosis by country and overall. For prenatal diagnoses (children diagnosed before birth), the age at diagnosis has been set to 0.

Figure 2.1 Age at diagnosis (in years): box-plot, by country and overall. All patients seen in 2016.



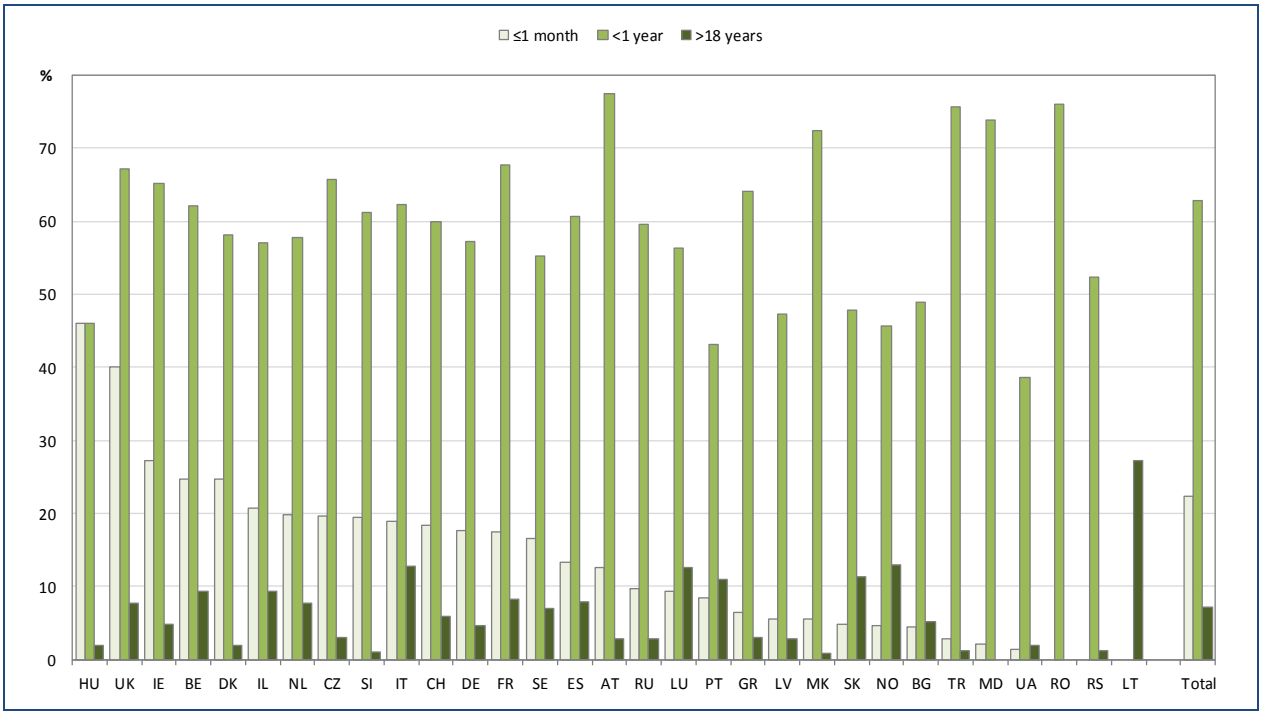
Note: For Hungary, Slovak Republic, Switzerland and Turkey the information on age at diagnosis is missing for more than 10% of the patients.
Lithuania has 100% coverage for adults and 0% coverage for children.

This box-plot is a graphic representation of age at diagnosis as detailed in table 2.1. For each country the dash (black line crossing the blue box) is the median, the black dot is the mean and the whiskers (vertical lines with a T-shaped end) are the minimum and the maximum. Please note that the vertical axis is interrupted to emphasise the change of scale in the upper part of the graph. The figure on the next page explains how to read the box-plot.



Note: This is an example of how to read a box-plot. The numbers used in this figure are not real and do not refer to figure 2.1.

Figure 2.2 Proportion of patients diagnosed at age 1 month or younger, younger than 1 year and older than 18 years, by country and overall. All patients seen in 2016.

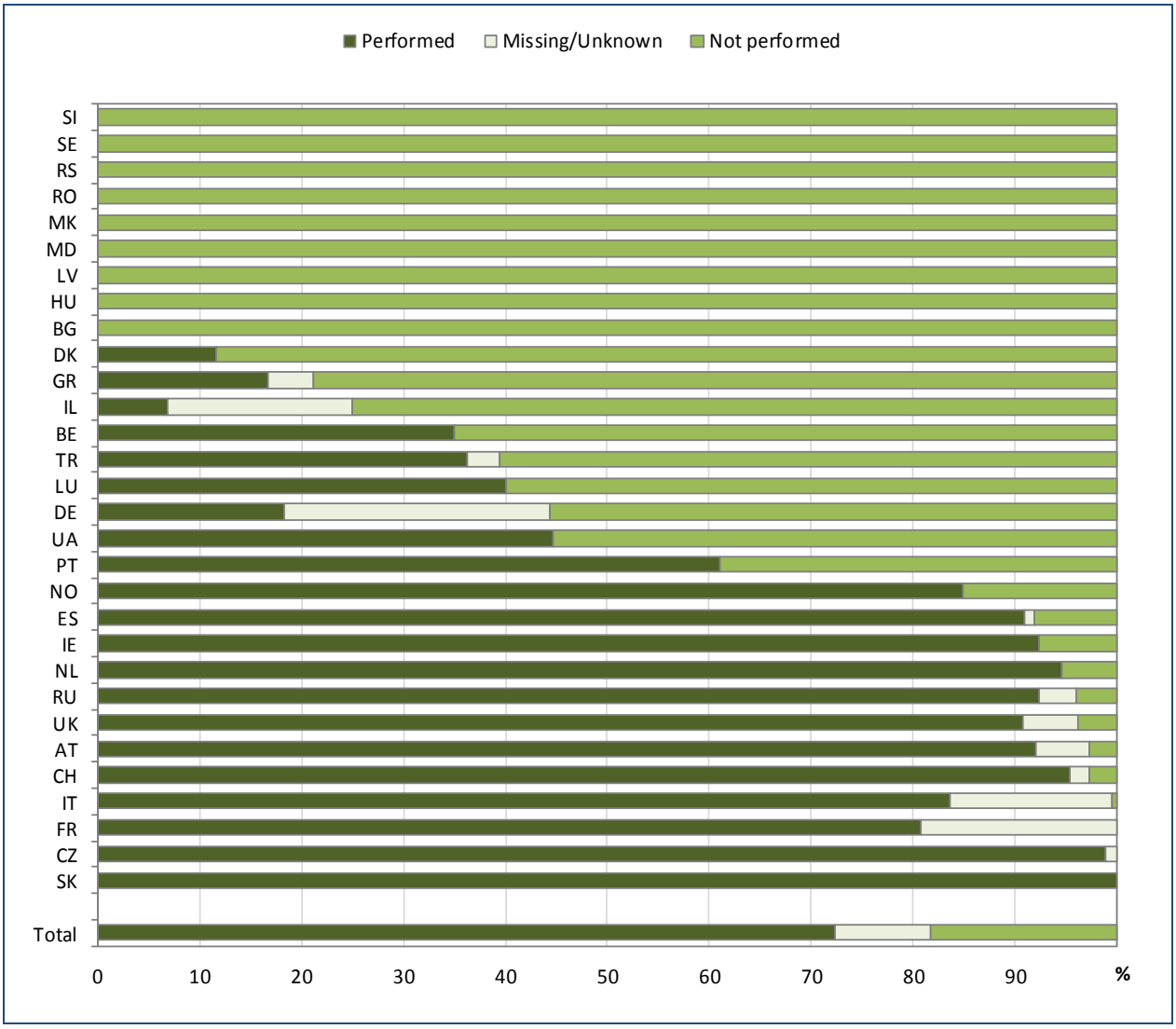


Note: For Hungary, Slovak Republic, Switzerland and Turkey the information on age at diagnosis is missing for more than 10% of the patients.
Lithuania has 100% coverage for adults and 0% coverage for children.

This graph shows age at diagnosis in subgroups. The vertical bars represent how many patients (as a percentage) were diagnosed within the first month of life (grey), within the first year of life (light green), and after 18 years of age (dark green).

Note that the diagnoses included in the sub-group for within 1 month are also part of the diagnoses in the sub-group for within the first year, and that diagnoses between 1 year and 18 years are not shown in the graph; therefore, the bars do not sum up to 100%.

Figure 2.3 Proportion of patients who underwent neonatal screening, by country and overall. Patients 5 years old or younger seen in 2016.

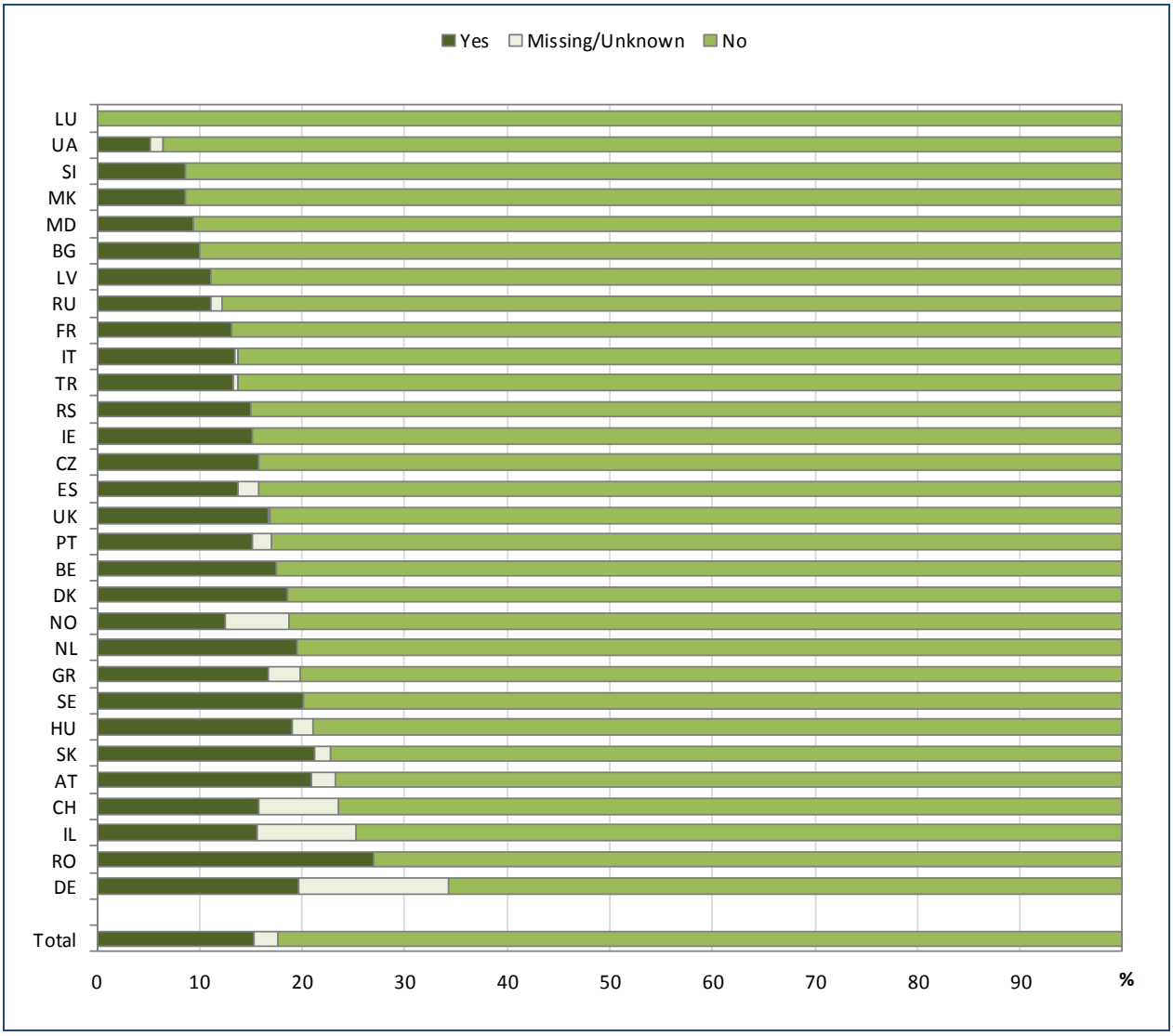


Note: For Germany, France, Israel and Italy the information on neonatal screening is missing for more than 10% of the patients.
Belgium: no national neonatal screening programme. Positive answers ("neonatal screening performed") are reported when neonatal screening is one of the factors that led to CF diagnosis.
Czech Republic: positive answers ("neonatal screening performed") are reported when neonatal screening is one of the factors that led to CF diagnosis.
France: neonatal screening is recorded only if it is part of the diagnosis.
United Kingdom: diagnosis suggested by neonatal screening.

This graph shows the percentage of patients at the age of 5 years or younger in 2016 who were screened at birth, (see country specific notes above). Dark green horizontal bars represent newborn screening "performed", light green ones "not performed".

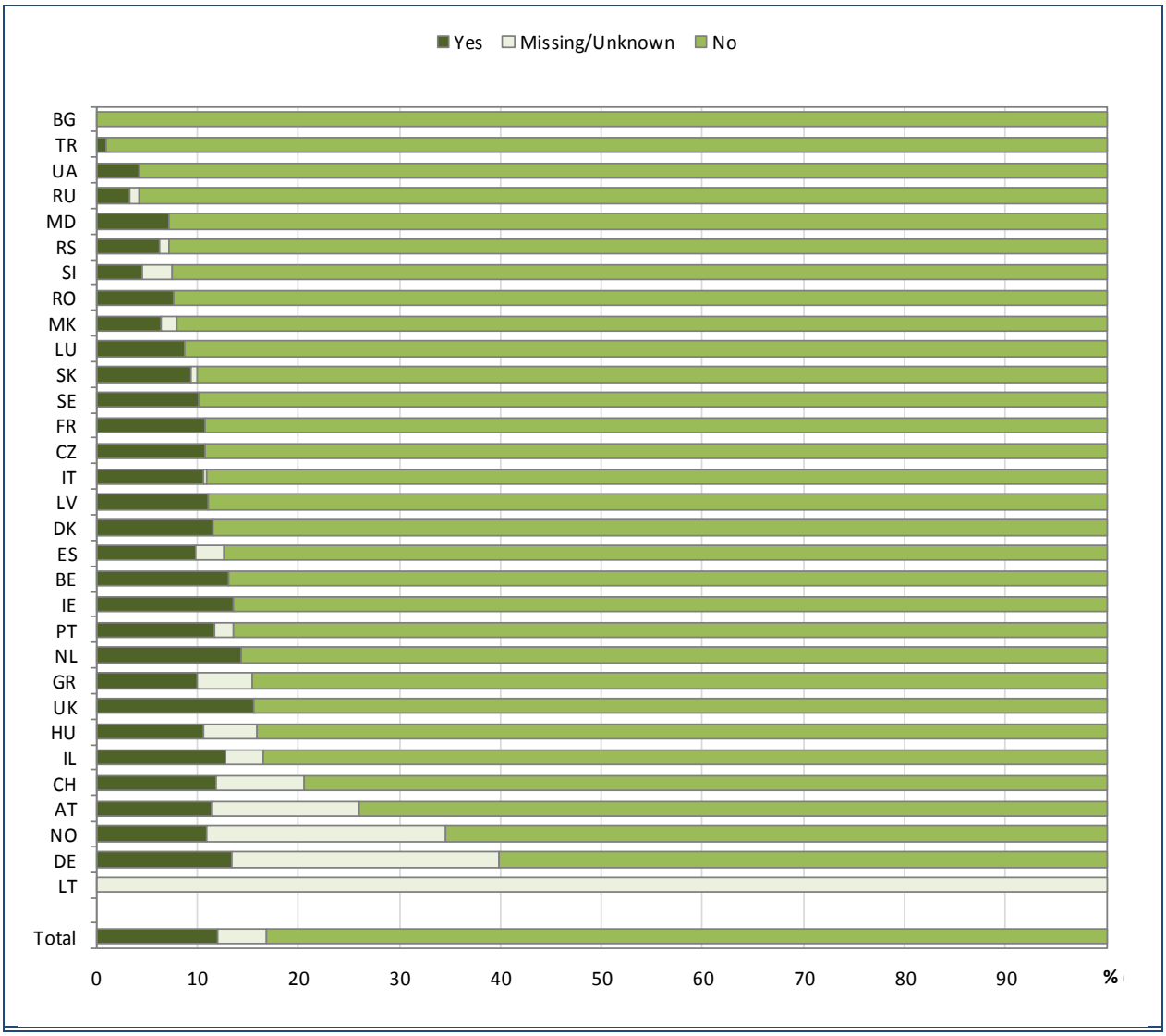
This graph shows that in some countries there is no newborn screening and that in others, in the five years previous to 2016, almost all the CF patients underwent newborn screening. In total, 72% of all children of 5 years old or younger registered in the ECFSPR in 2016 underwent newborn screening, however, this estimate reflects the fact that not all the countries perform newborn screening.

Figure 2.4 Patients with meconium ileus, by country and overall. Patients aged 10 years or younger.



Note: For Germany the information on meconium ileus is missing for more than 10% of the patients aged 10 years or younger.

Figure 2.5 Patients with meconium ileus, by country and overall. Patients aged 11 years or older.



Note: For Austria, Germany, Lithuania and Norway the information on meconium ileus is missing for more than 10% of the patients aged 11 years or older.

These two graphs show the prevalence of meconium ileus (with or without surgical repair) at birth in two age groups: 0 to 10 years (fig 2.4) and 11 years or older (fig 2.5). Overall, the proportion of younger patients (≤10 years) with meconium ileus is higher compared to the older age group (>10 years). This difference is not due to an increase in the prevalence of meconium ileus in the younger generations but could be due to the fact that some older patients with meconium ileus have died, and are therefore not present in the current data collection (which refers to patients seen in 2016). The graphs also show that the frequency of reported meconium ileus varies between countries.

3. Genetics

Cystic fibrosis is caused by mutations of the 'CFTR' gene; one on each allele. One mutation is inherited from the mother and one from the father. If both mutations are the same, the person is said to be homozygous for this mutation. If these are two different mutations, the person is considered to be heterozygous.

We supplied the countries with a list of the 1600 most common mutations based on the Cystic Fibrosis Mutation database (CFTR1). If the patient had a mutation that was not present in the database, the country had the possibility to enter the name of the mutation as free text. During the data cleaning process, the genotypes not on our list were checked for obvious misspellings or alternative names and, if identified as a known mutation, renamed. Although there are different naming conventions for mutations, we use the original mutation name (legacy name) in this report, since more than 90% of the mutations in the database use this nomenclature.

If DNA analysis to look for CFTR mutations was never carried out, we asked the countries to report "Not done" in the genotype field. If DNA analysis was done, but only one or no mutations were found, we asked the countries to write "Unknown" for the unidentified mutations. Please note that there are differences from country to country in how DNA testing is carried out; some countries use standard kits that test only a limited number of common mutations (e.g. 28), and other countries perform DNA analyses of the whole gene until the mutation is identified.

Table 3.1 Proportion of patients with DNA analysis and the result of this, by country and overall. All patients seen in 2016.

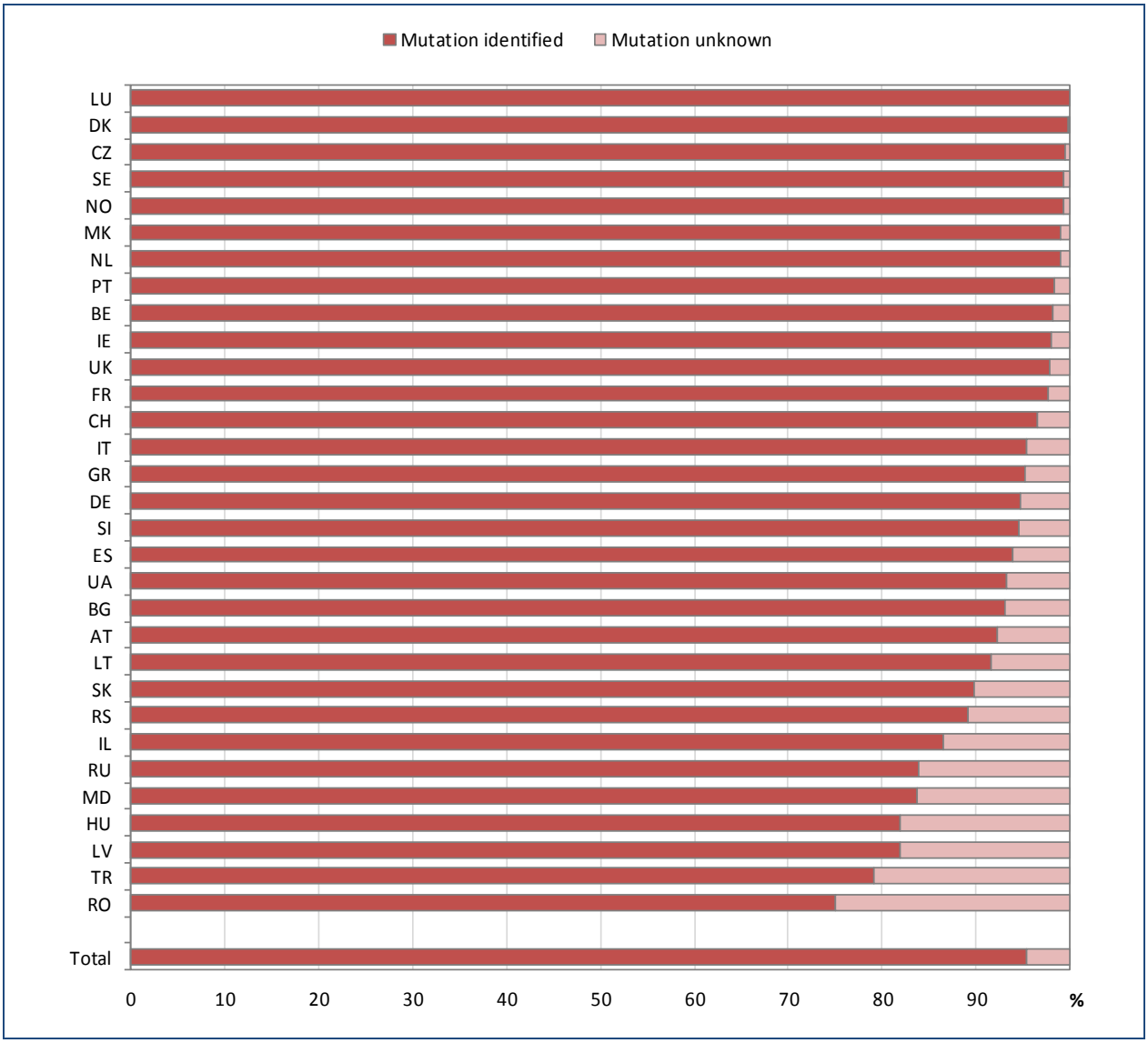
Country	N	Genotyping		Among genotyping done	
		not done	done	two mutations identified	at least one mutation unknown
		number (%)	number (%)	number (%)	number (%)
Austria	740	2 (0.27)	738 (99.73)	655 (88.75)	83 (11.25)
Belgium	1246	0 (0)	1246 (100)	1210 (97.11)	36 (2.89)
Bulgaria	140	1 (0.71)	139 (99.29)	122 (87.77)	17 (12.23)
Czech Republic	585	1 (0.17)	584 (99.83)	580 (99.32)	4 (0.68)
Denmark	482	0 (0)	482 (100)	481 (99.79)	1 (0.21)
France	6713	0 (0)	6713 (100)	6483 (96.57)	230 (3.43)
Germany	5738	9 (0.16)	5729 (99.84)	5252 (91.67)	477 (8.33)
Greece	594	0 (0)	594 (100)	551 (92.76)	43 (7.24)
Hungary	507	14 (2.76)	493 (97.24)	359 (72.82)	134 (27.18)
Ireland	1144	0 (0)	1144 (100)	1109 (96.94)	35 (3.06)
Israel	538	1 (0.19)	537 (99.81)	441 (82.12)	96 (17.88)
Italy	5361	28 (0.52)	5333 (99.48)	4896 (91.81)	437 (8.19)
Latvia	36	0 (0)	36 (100)	24 (66.67)	12 (33.33)
Lithuania	12	0 (0)	12 (100)	10 (83.33)	2 (16.67)
Luxembourg	32	0 (0)	32 (100)	32 (100)	0 (0)
Rep of Macedonia	109	1 (0.92)	108 (99.08)	106 (98.15)	2 (1.85)
Rep of Moldova	46	0 (0)	46 (100)	34 (73.91)	12 (26.09)
The Netherlands	1412	19 (1.35)	1393 (98.65)	1370 (98.35)	23 (1.65)
Norway	230	0 (0)	230 (100)	228 (99.13)	2 (0.87)
Portugal	319	0 (0)	319 (100)	311 (97.49)	8 (2.51)
Romania	50	0 (0)	50 (100)	33 (66.00)	17 (34.00)
Russian Federation	3022	284 (9.40)	2738 (90.60)	2012 (73.48)	726 (26.52)
Serbia	170	4 (2.35)	166 (97.65)	137 (82.53)	29 (17.47)
Slovak Republic	247	0 (0)	247 (100)	205 (83.00)	42 (17.00)
Slovenia	102	2 (1.96)	100 (98.04)	92 (92.00)	8 (8.00)
Spain	1898	2 (0.11)	1896 (99.89)	1692 (89.24)	204 (10.76)

[table 3.1 continued]

Country	N	Genotyping		Among genotyping done	
		not done number (%)	done number (%)	two mutations identified number (%)	at least one mutation unknown number (%)
Sweden	649	0 (0)	649 (100)	643 (99.08)	6 (0.92)
Switzerland	906	6 (0.66)	900 (99.34)	858 (95.33)	42 (4.67)
Turkey	313	6 (1.92)	307 (98.08)	226 (73.62)	81 (26.38)
Ukraine	150	0 (0)	150 (100)	132 (88.00)	18 (12.00)
United Kingdom	9695	60 (0.62)	9635 (99.38)	9269 (96.20)	366 (3.80)
Total	43186	440 (1.02)	42746 (98.98)	39553 (92.53)	3193 (7.47)

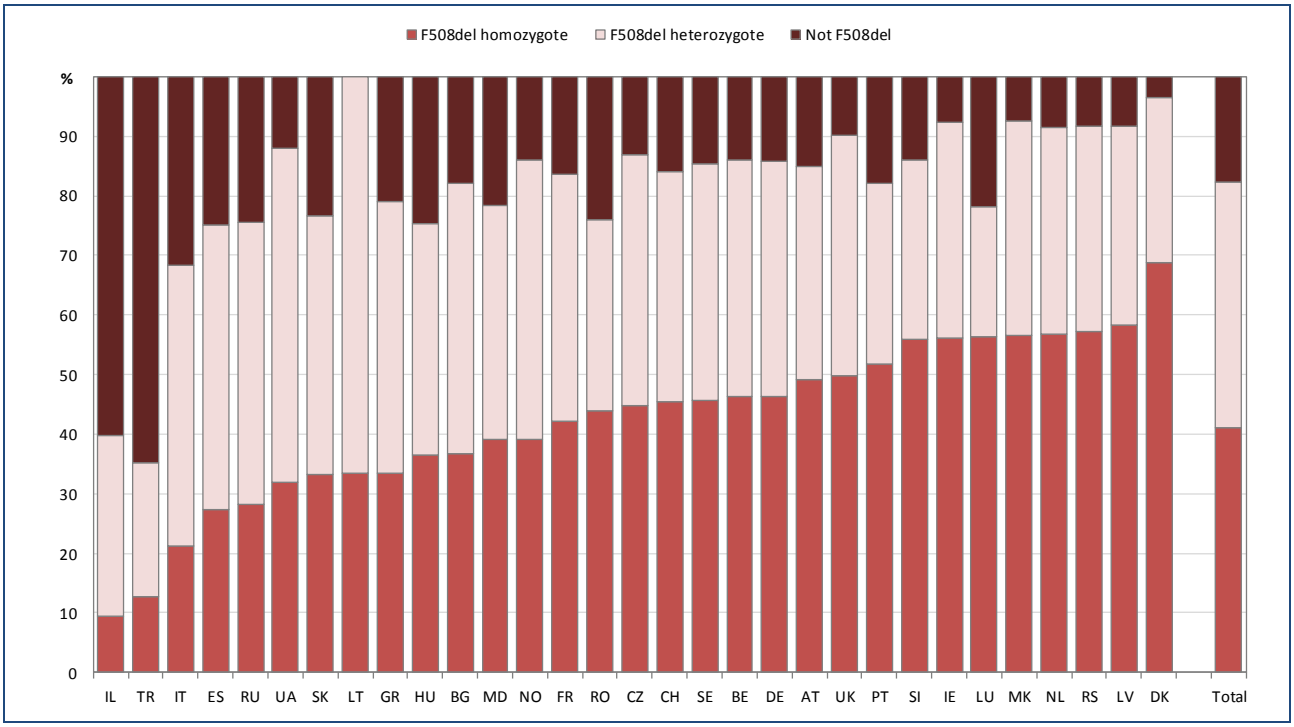
The table shows how many patients underwent DNA analysis to identify the CFTR mutations (column “genotyping done”) and, for those patients, how many patients had both mutations identified (column “two mutations identified”) and for how many one or both mutations remained unidentified (column “at least one mutation unknown”).

Figure 3.1 Proportion of identified mutations, by country and overall. Only patients with DNA analysis.



This graph shows the percentage of mutations that are not identified (unknown in light pink) after DNA analysis, by country and overall. One “allele” means one of the two CFTR genes. The number of non-identified alleles varies greatly from country to country; this is partly due to the different approaches to DNA testing. Overall, more than 4% of mutations remain unidentified after DNA analysis, leaving 7.47% of the patients with at least one mutation unidentified.

Figure 3.2 Prevalence of F508del homozygous and heterozygous patients, by country and overall. All patients seen in 2016.



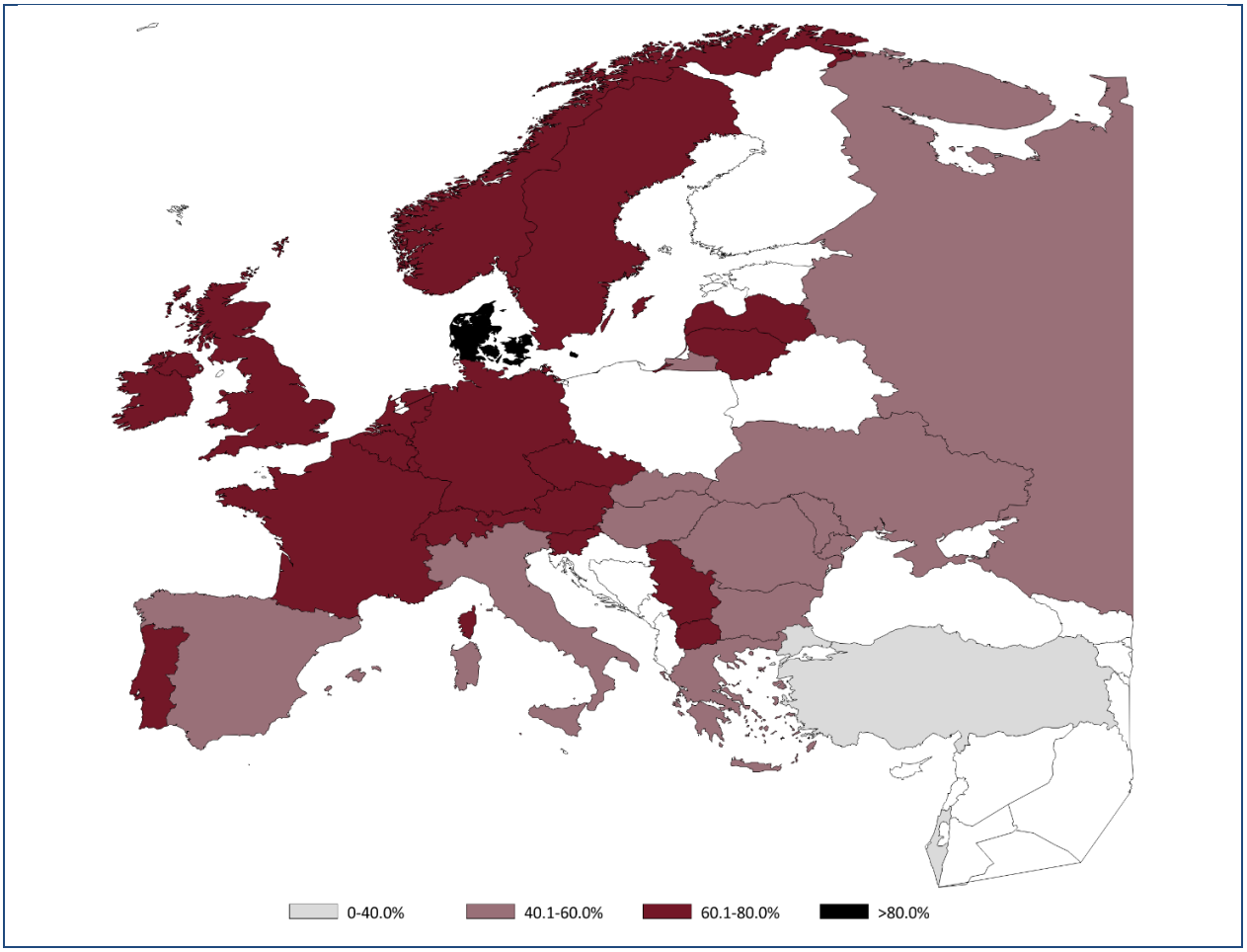
F508del is the name of the most commonly occurring CFTR mutation in the world. Patients who carry two F508del mutations are often described as having “classic CF”, but other combinations of mutations may cause the same degree of disease. We have grouped the patients in F508del homozygous (patients who have two F508del mutations), F508del heterozygous (patients who have one F508del mutation and another mutation, different from F508del), and patients without F508del mutations. Only patients for whom the genotype is known have been included in this graph. “Unknown” mutations have been classified as “other”, since F508del is included in all genotyping kits and would have been identified. Please note that the genotype grouping in this graph does not reflect the severity of the disease in the countries.

Table 3.2 Allelic frequencies of the 16 most common mutations in the ECFSPR database.

Mutation name	Number of alleles	Percentage among tested	Country with highest allele frequency
F508del	52776	61.73	Denmark (82.57%)
G542X	2278	2.66	Rep of Macedonia (6.02%)
N1303K	1828	2.14	Italy (5.62%)
G551D	1198	1.40	Ireland (8.78%)
W1282X	918	1.07	Israel (23.28%)
R117H	887	1.04	Ireland (2.80%)
2789+5G->A	828	0.97	Turkey (3.91%)
3849+10kbC->T	746	0.87	Lithuania (16.67%)
1717-1G->A	744	0.87	Switzerland (3.06%)
R553X	709	0.83	Luxembourg (3.13%)
CFTRdele2,3	699	0.82	Czech Republic (6.34%)
621+1G->T	558	0.65	Greece (6.14%)
2183AA->G	504	0.59	Turkey (4.23%)
R1162X	464	0.54	Slovenia (4.00%)
D1152H	462	0.54	Israel (5.12%)
R347P	425	0.50	Luxembourg (3.13%)

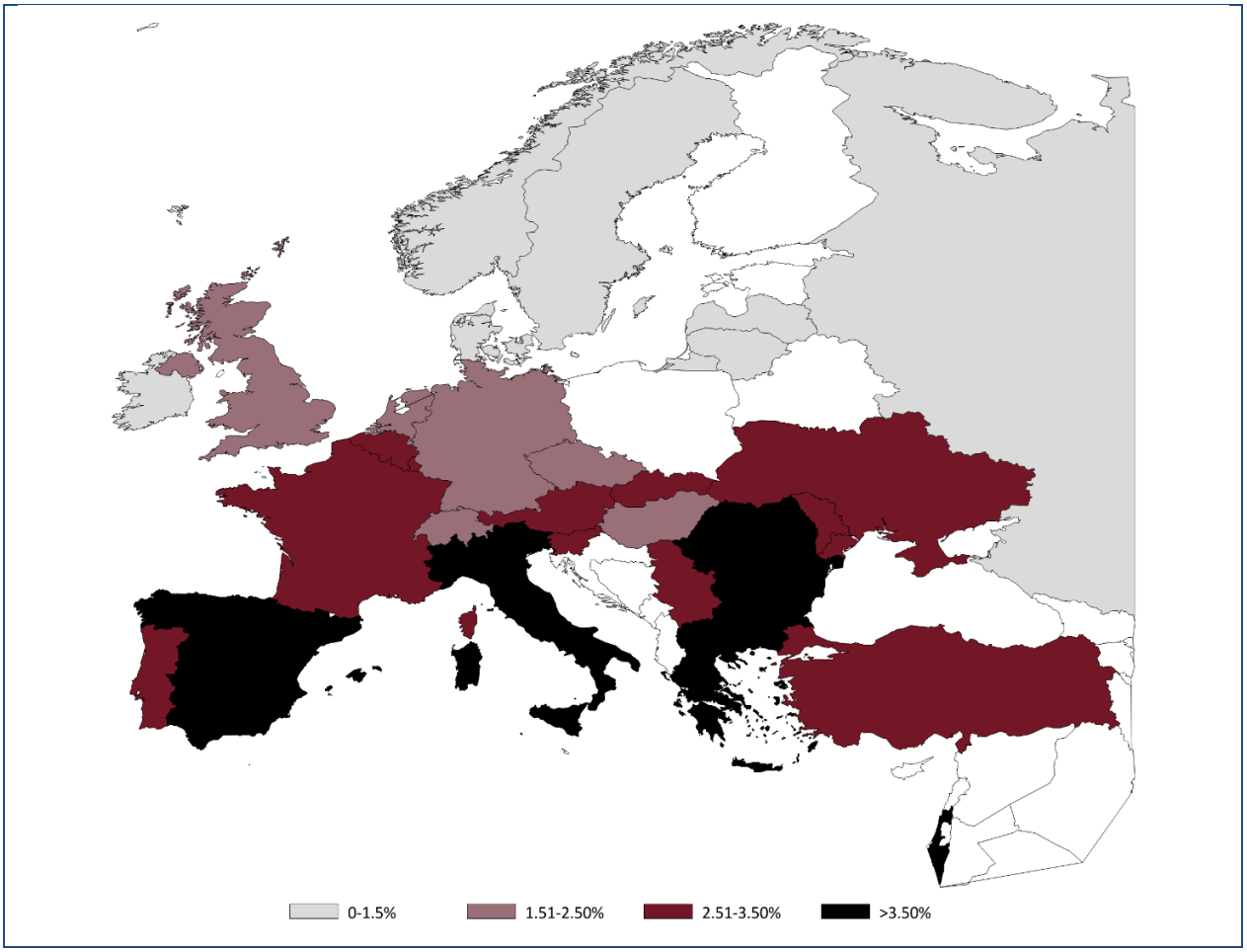
This table presents the allele frequency of the 16 most commonly occurring mutations found in the ECFSPR database. The last column reports in which country this particular mutation is most frequent. F508del is by far the most frequent mutation. Additionally, since F508del is included in all genetic screening tests, this is also the mutation with the highest detection rate.

Figure 3.3 Geographical distribution of mutation F508del.



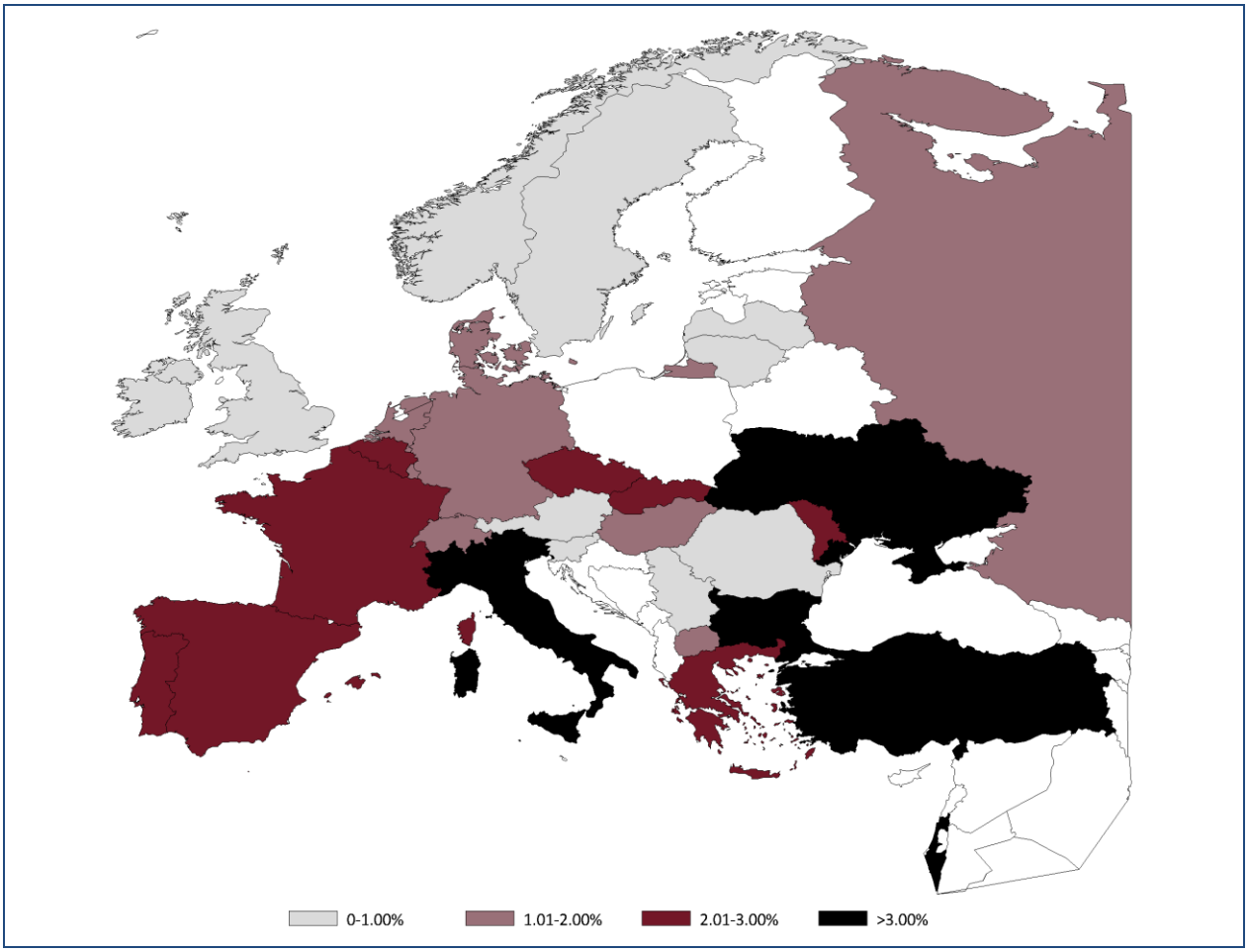
Although this mutation is the most common in all countries, it is most frequent in the north of Europe and its allele frequency varies from 23.94% in Turkey to 82.57% in Denmark.

Figure 3.4 Geographical distribution of mutation G542X.



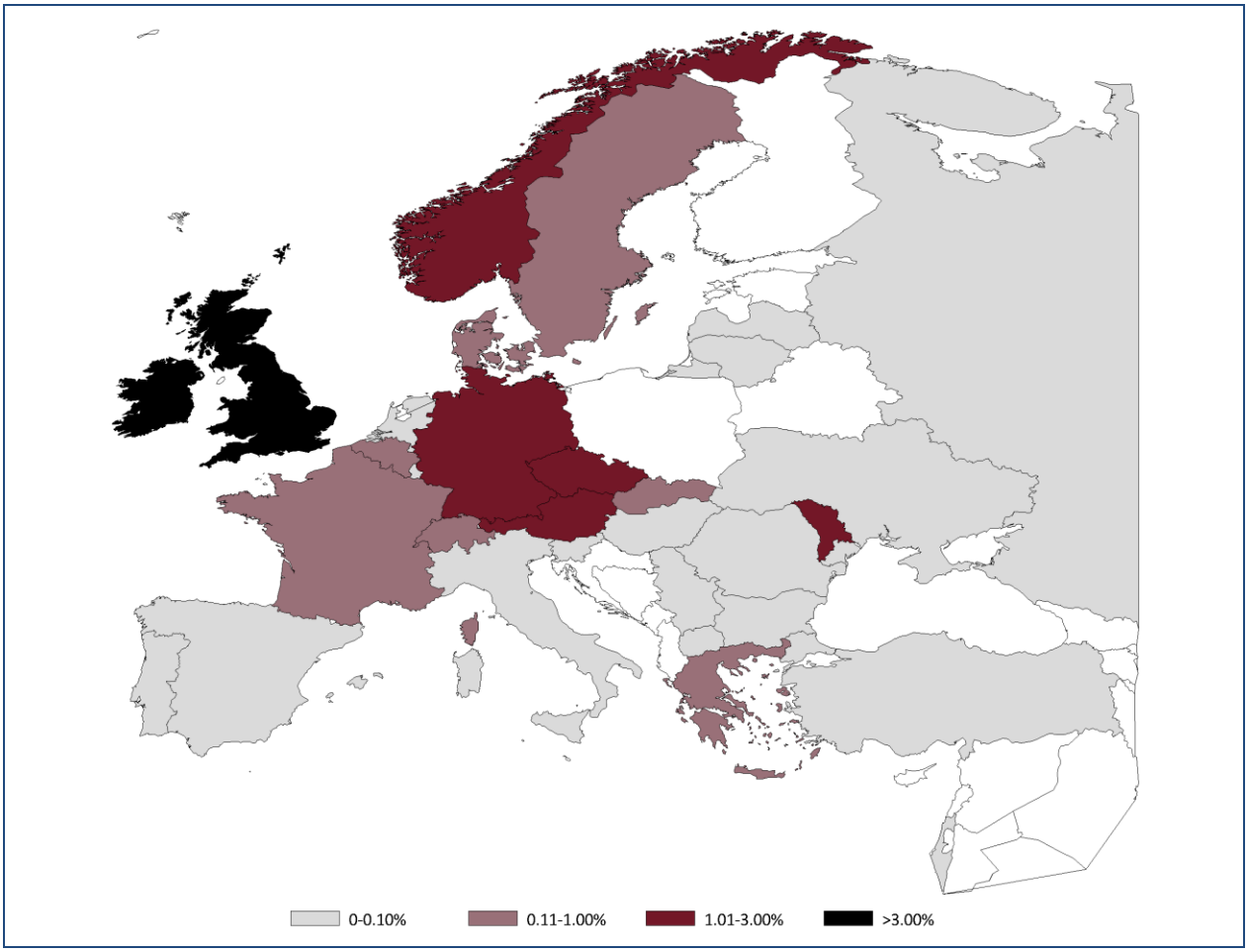
This mutation is most frequent in Southern Europe, with the highest allele frequency in the Republic of Macedonia (6.02%), whereas it is very rarely found in Ireland, in the Scandinavian countries, in the Baltic countries and in the Russian Federation.

Figure 3.5 Geographical distribution of mutation N1303K.



This mutation is most frequent in Italy (5.62%) and other countries in Southern Europe and in Eastern Europe, but rare in Northern Europe.

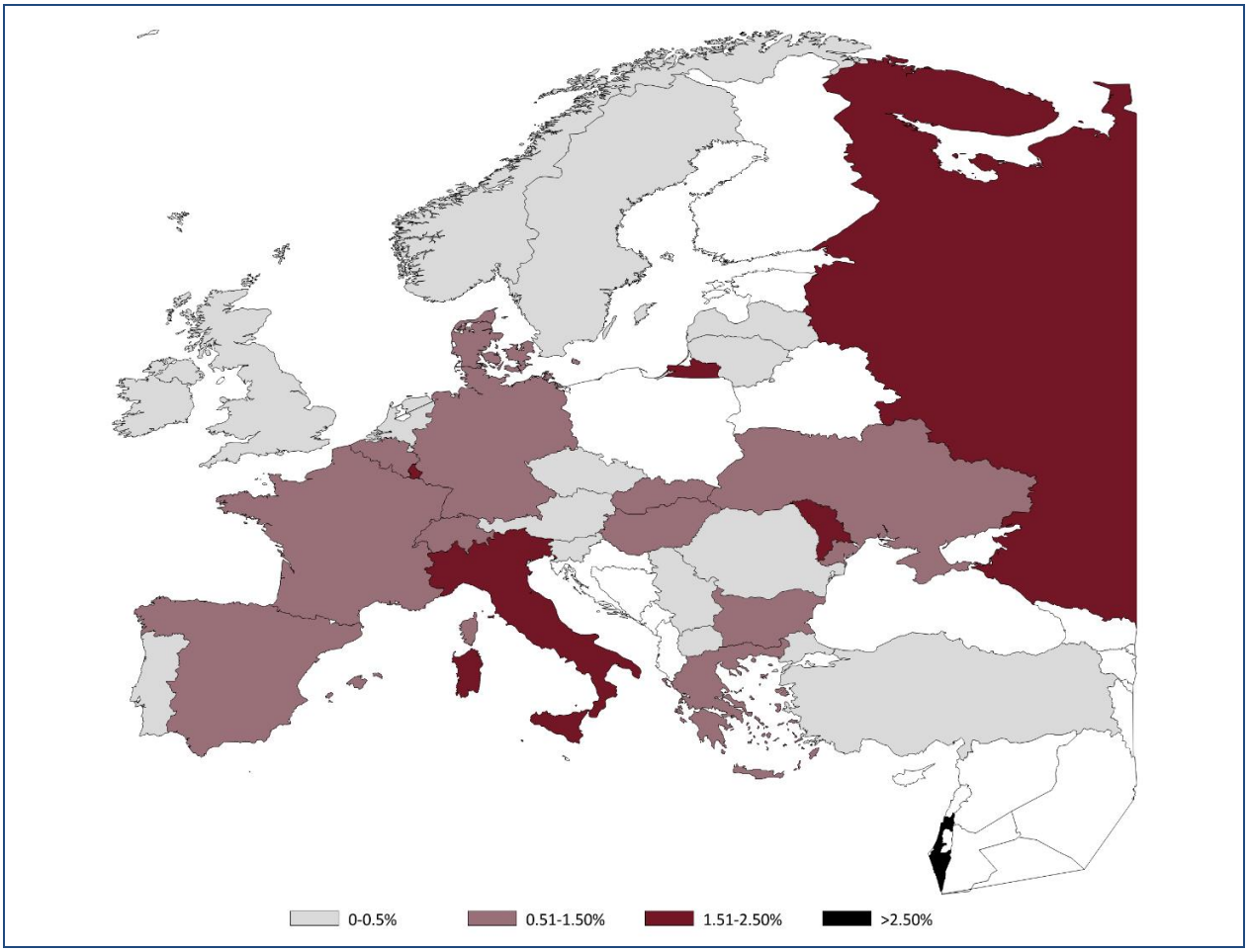
Figure 3.6 Geographical distribution of mutation G551D.



Note: Israel: G551D was not in the mutation panel for 2016, therefore the prevalence is unknown.

This mutation is most frequent in Ireland (8.78%) and United Kingdom (3.02%), whereas it is very rare in Southern Europe (less than 0.2%).

Figure 3.7 Geographical distribution of mutation W1282X.



This mutation, of Middle-Eastern origin, is by far most frequent in Israel (23.28%) with a very high allele frequency in Ashkenazi Jews.

4. Lung function

FEV_1 is measured in litres but it is normally expressed as a percentage of the expected value (FEV_1%). The expected value is computed from healthy individuals of the same sex, height and age and is termed the reference population.

We used the Global Lung Function Initiative equations described by Quanjer PH et al. for this report (for full reference we refer you to Appendix 1, page 134). This is the global reference for spirometry and it has been agreed, as part of the CF global harmonisation project, that this is the best way to present lung function.

A FEV_1% of 100 means that the lung function measurement is equal to the mean lung function measurement of people of the same age, sex and height of the healthy reference population.

Spirometry, the test that measures FEV_1, requires a certain amount of coordination, and usually cannot be performed reliably until a person with CF is about six years of age. We have therefore computed FEV_1% values only for patients aged 6 years or older.

We asked the countries to report the best FEV_1 recorded throughout the year (according to the FEV_1% computed at the CF centres) to the ECFSPR. Whereas in the past some national registries recorded a different value, we are pleased to announce that in this report all countries report the best FEV1.

We excluded patients from the analyses on FEV_1 who have had one or more lung transplants, since their lung function does not reflect the severity of their CF lung disease.

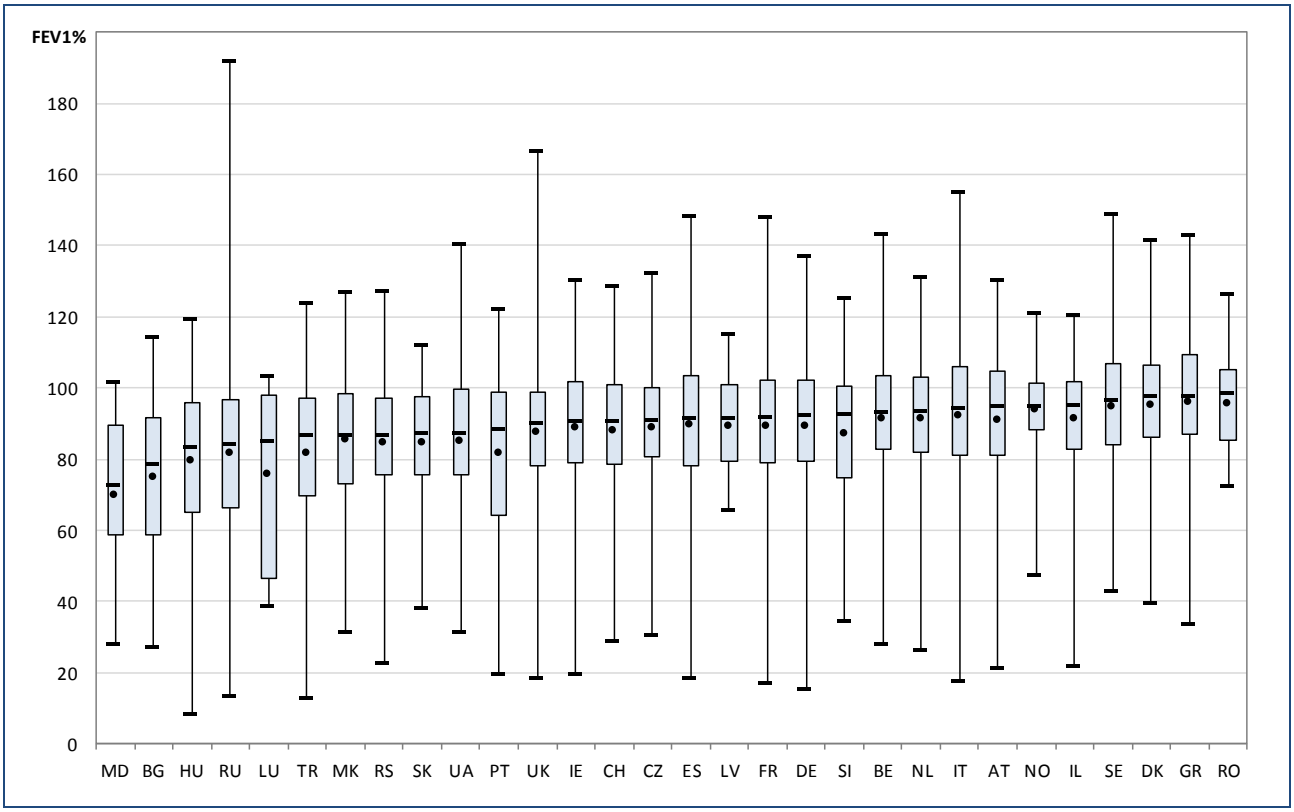
Table 4.1 FEV_1% of predicted: descriptive statistics, by country. Patients aged 6-17 years who have never had a lung transplant.

Country	N	N Miss	Mean (average FEV_1%)	Min	25th pctl (25% of patients have FEV_1% below this value)	Median (50% of patients have FEV_1% below this value)	75th pctl (75% of patients have FEV_1% below this value)	Max
Austria	259	4	91.2	21.3	81.2	94.7	104.6	130.3
Belgium	354	5	91.6	28.1	82.9	93.0	103.3	143.2
Bulgaria	47	4	75.0	27.2	58.6	78.9	91.7	114.4
Czech Republic	213	7	88.9	30.5	80.5	91.0	100.2	132.4
Denmark	140	0	95.2	39.4	86.1	97.9	106.3	141.7
France	2048	97	89.3	17.3	78.8	92.0	102.2	147.8
Germany	1823	24	89.2	15.6	79.3	92.4	102.1	137.2
Greece	217	4	96.2	33.7	87.1	97.9	109.2	143.1
Hungary	172	16	79.7	8.3	65.1	83.5	95.9	119.5
Ireland	365	<5	89.0	19.8	79.2	90.7	101.8	130.4
Israel	181	4	91.3	21.6	82.7	95.3	101.8	120.4
Italy	1387	199	92.4	17.5	81.3	94.5	106.2	155.2
Latvia	18	1	89.4	65.5	79.5	91.6	101.1	114.9
Luxembourg	<10	1	76.0	38.6	46.3	85.1	97.8	103.1
Rep of Macedonia	53	2	85.7	31.5	73.1	86.9	98.4	126.9
Rep of Moldova	26	4	69.8	28.3	58.8	73.0	89.4	101.5
The Netherlands	397	6	91.3	26.6	82.0	93.6	103.2	131.0
Norway	57	1	94.1	47.6	88.2	94.9	101.3	120.8
Portugal	124	6	81.9	19.8	64.1	88.4	98.9	122.2
Romania	28	0	95.6	72.4	85.3	98.7	105.2	126.6
Russian Federation	858	396	81.9	13.2	66.3	84.2	96.8	192.0
Serbia	80	0	84.5	22.7	75.7	86.9	97.0	127.4
Slovak Republic	67	2	84.8	38.1	75.6	87.4	97.5	112.3
Slovenia	40	0	87.2	34.6	74.8	92.6	100.4	125.3
Spain	654	23	89.6	18.3	78.0	91.4	103.4	148.4
Sweden	184	6	94.7	42.9	84.0	96.3	106.7	149.0
Switzerland	262	9	88.2	28.8	78.4	90.8	100.9	128.6
Turkey	116	33	81.6	13.1	69.5	86.7	97.1	124.0
Ukraine	76	5	85.0	31.4	75.8	87.4	99.6	140.6
United Kingdom[1]	2556	301	87.8	18.4	78.3	90.0	99.0	166.4

Note: Lithuania has 0% coverage for children.

This table shows some descriptive statistics for FEV_1 in children, expressed as % of predicted. Note that patients who have had a lung transplant and children below 6 years of age have been excluded from the analyses.

Figure 4.1 FEV_1% of predicted: box-plot, by country and overall. Patients aged 6-17 years who have never had a lung transplant.



This box-plot is a graphic representation of the FEV_1 in children, expressed as % of predicted, detailed in table 4.1. For each country the dash (black line crossing the blue box) is the median, the black dot is the mean and the whiskers (vertical lines with a T-shaped end) are the minimum and the maximum.

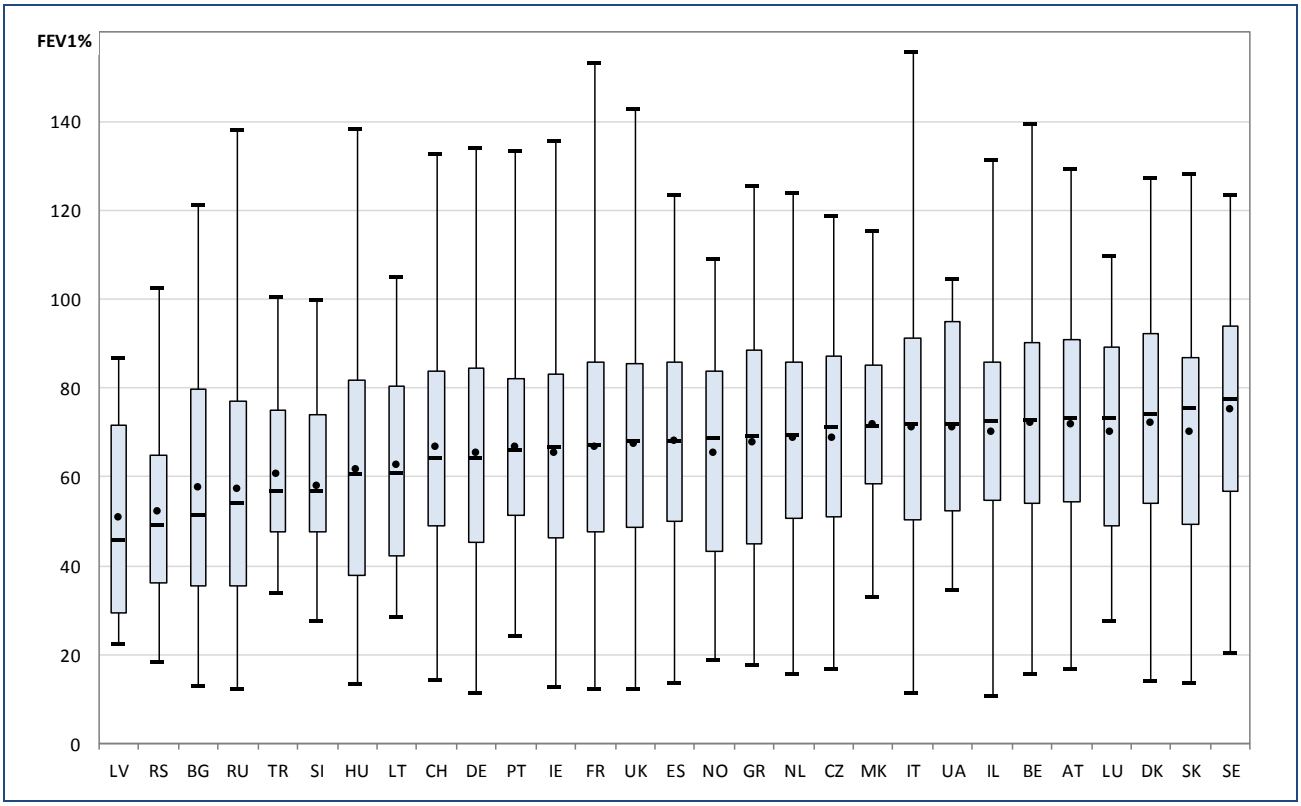
Table 4.2 FEV_1% of predicted: descriptive statistics, by country. Patients aged 18 years or older who have never had a lung transplant.

Country	N	N Miss	Mean (average FEV_1%)	Min	25th pctl (25% of patients have FEV_1% below this value)	Median (50% of patients have FEV_1% below this value)	75th pctl (75% of patients have FEV_1% below this value)	Max
Austria	278	3	71.9	16.8	54.5	73.2	90.8	129.1
Belgium	570	5	72.0	15.7	54.2	72.8	90.2	139.4
Bulgaria	58	2	57.7	13.0	35.5	51.5	79.7	121.0
Czech Republic	187	32	68.9	16.9	51.0	71.0	87.3	118.8
Denmark	234	0	72.2	14.1	54.1	74.2	92.1	127.2
France	2754	46	66.7	12.3	47.5	67.2	85.8	153.3
Germany	2806	78	65.3	11.2	45.3	64.4	84.4	133.9
Greece	255	11	67.7	17.9	44.9	69.0	88.4	125.4
Hungary	157	7	61.8	13.4	37.9	60.5	81.7	138.2
Ireland	512	11	65.4	12.6	46.3	66.9	83.0	135.7
Israel	289	2	70.2	10.7	54.8	72.6	85.8	131.2
Italy	2472	222	71.0	11.3	50.3	71.9	91.2	155.4
Latvia	10	0	50.7	22.6	29.3	45.8	71.8	86.8
Lithuania	10	0	62.6	28.7	42.4	60.9	80.4	104.8
Luxembourg	19	0	70.0	27.5	48.9	73.2	89.2	109.5
Rep of Macedonia	28	0	71.9	33.0	58.5	71.4	85.2	115.5
The Netherlands	726	11	68.8	15.6	50.8	69.5	85.9	123.7
Norway	128	2	65.5	18.8	43.3	68.8	83.9	109.0
Portugal	102	5	66.9	24.3	51.5	66.2	82.1	133.1
Russian Federation	462	146	57.3	12.4	35.4	54.3	76.9	138.1
Serbia	44	0	52.3	18.5	36.2	49.3	65.0	102.6
Slovak Republic	129	0	70.2	13.6	49.4	75.5	86.9	128.1
Slovenia	29	0	58.1	27.5	47.5	57.1	73.9	100.0
Spain	645	26	68.1	13.6	49.9	68.2	85.7	123.6
Sweden	312	10	75.1	20.5	56.8	77.5	94.0	123.4
Switzerland	415	2	66.8	14.5	48.9	64.3	83.7	132.5
Turkey	22	4	60.8	34.0	47.7	57.0	74.9	100.4
Ukraine	16	2	71.1	34.7	52.3	71.9	95.0	104.7
United Kingdom[1]	4506	476	67.3	12.2	48.8	68.0	85.4	142.7

Note: Romania and Rep of Moldova have <5 patients aged 18 years or more at FEV_1 measurement and are excluded from this table.

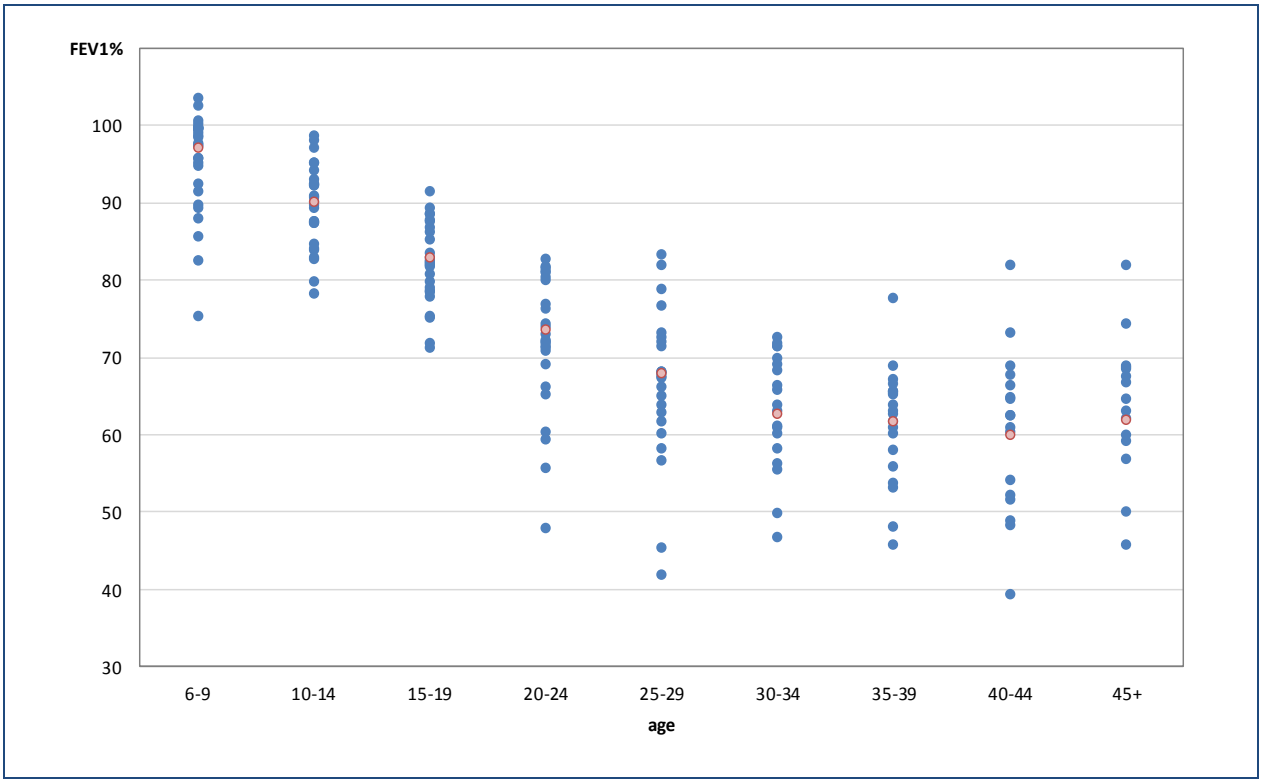
This table shows some descriptive statistics for FEV_1 in adults, expressed as % of predicted. Note that patients who have had a lung transplant have been excluded from the analyses.

Figure 4.2 FEV_1% of predicted: box-plot, by country and overall. Patients aged 18 years or older who have never had a lung transplant.



This box-plot is a graphic representation of the FEV_1 in adults, expressed as % of predicted detailed in table 4.2. For each country the dash (black line crossing the blue box) is the median, the black dot is the mean and the whiskers (vertical lines with a T-shaped end) are the minimum and the maximum.

Figure 4.3 Median FEV_1% of predicted by age group and by country. Patients aged 6 years or older who have never had a lung transplant.



Note: We excluded from the analyses those age groups with the number of patients <10.

This graph shows the median FEV_1% (the value that separates the highest and lowest half of the patients) by age group. Each country is represented by a dot (in blue) and the overall estimate is in red. The general pattern shows that the FEV_1% slowly decreases until the age of 30-34, and then levels out. The patients in the oldest age groups are patients that survived, and may therefore represent the patients with less disease severity. There is considerable variability between countries.

Table 4.3 FEV_1% of predicted: descriptive statistics by age group (patients aged 6 years or older) who have never had a lung transplant.

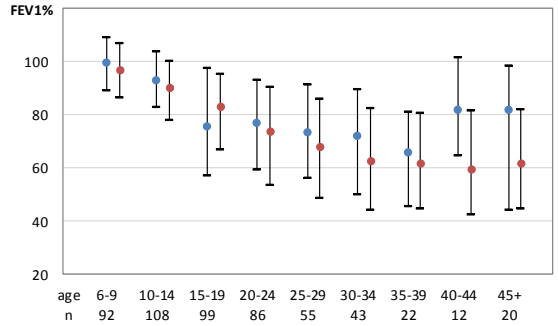
Age at FEV_1 measurement	N	N Miss	Mean	Min	25th pctl	Median	75th pctl	Max
6-9	4332	541	95.6	24.7	86.6	97.1	106.6	192.0
10-14	5228	399	87.8	13.1	77.7	90.2	99.9	146.3
15-19	5093	354	79.7	8.3	66.3	83.0	95.2	142.6
20-24	4406	298	71.8	12.4	53.5	73.7	90.2	138.1
25-29	3799	239	67.2	13.4	48.3	68.0	85.8	131.2
30-34	2744	155	63.6	11.2	44.1	62.7	82.2	142.7
35-39	1943	90	62.9	10.7	44.7	61.8	80.5	155.4
40-44	1331	65	62.5	11.3	42.2	60.0	81.4	138.6
45+	2110	123	63.8	13.0	44.3	62.0	81.8	153.3

This table shows FEV_1% by age group for the total data set. The median values reported in this table are shown as red dots in fig 4.3.

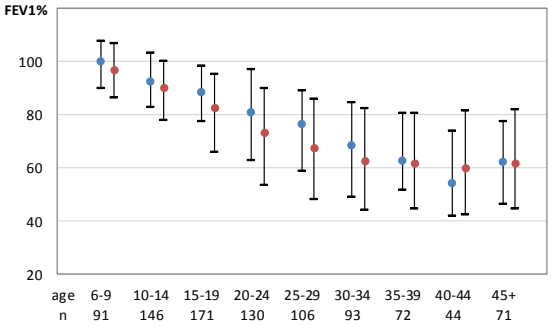
Figure 4.4 Quartiles of FEV_1% of predicted by age group and by country. Patients aged 6 years or older and who have never had a lung transplant.

The figures below show the FEV_1% in different age groups, separately for each country. The dot shows the median, and the whiskers show the 25th and 75th percentiles (the median, the 25th percentile and the 75th percentile are collectively named "quartiles"). In blue are the quartiles for the country, in red are the pooled quartiles computed on all other countries (i.e. excluding that country). We did not compute quartiles where the number of patients is <10 in an age group, so there are no blue dots for those age groups (the number of patients in each age group is shown below the horizontal axis). We therefore excluded Latvia, Lithuania, Luxembourg from the graphs because none of the age groups had more than 10 patients.

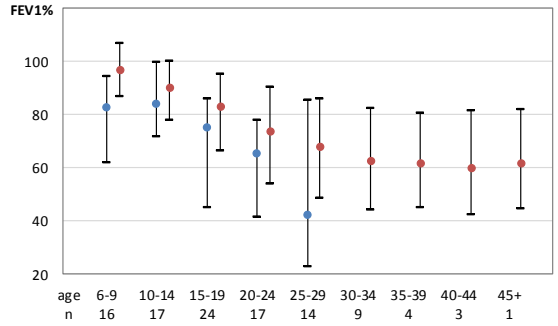
Quartiles of FEV_1%: Austria



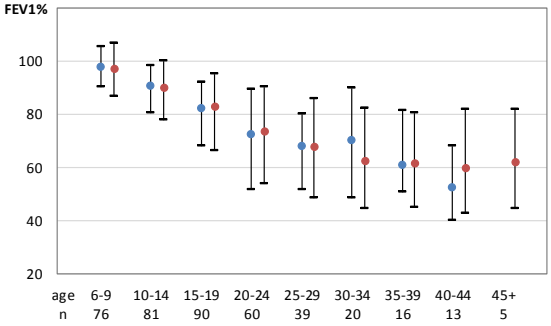
Quartiles of FEV_1%: Belgium



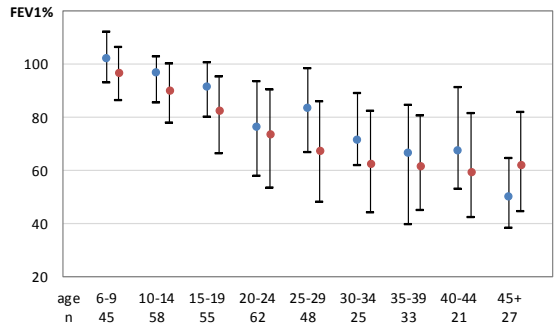
Quartiles of FEV_1%: Bulgaria



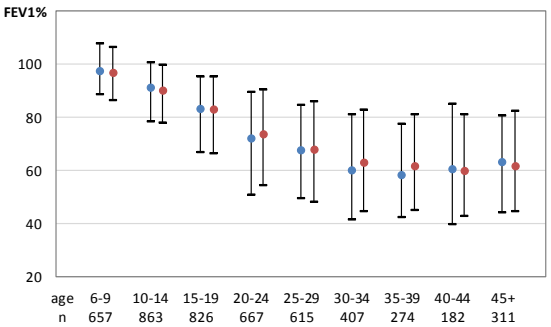
Quartiles of FEV_1%: Czech Republic



Quartiles of FEV_1%: Denmark

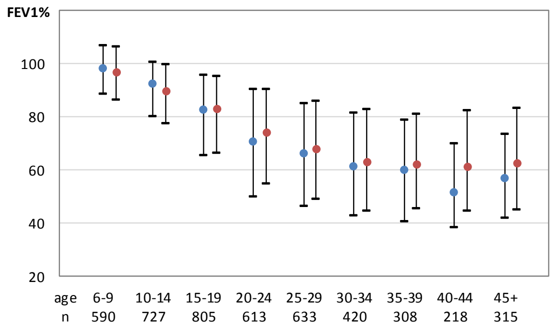


Quartiles of FEV_1%: France

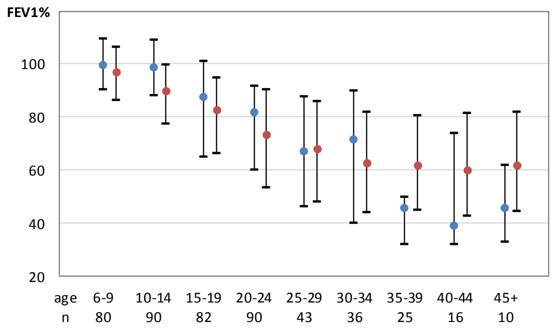


[figure 4.4 continued]

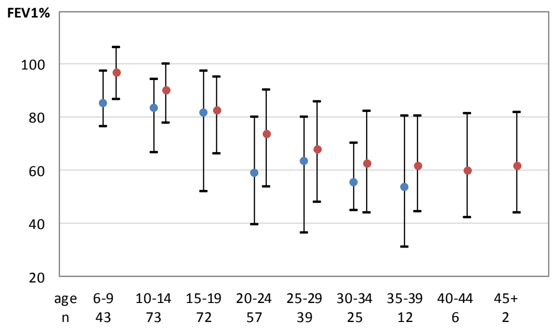
Quartiles of FEV_1%: Germany



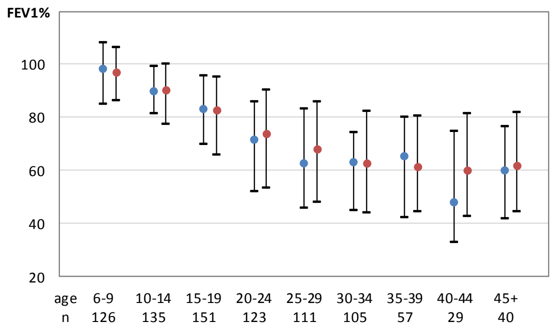
Quartiles of FEV_1%: Greece



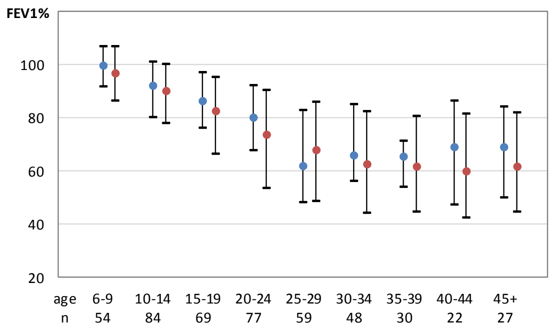
Quartiles of FEV_1%: Hungary



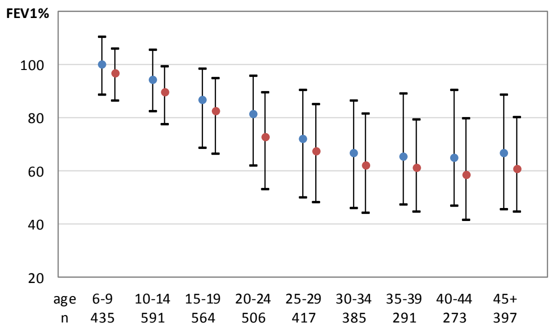
Quartiles of FEV1%: Ireland



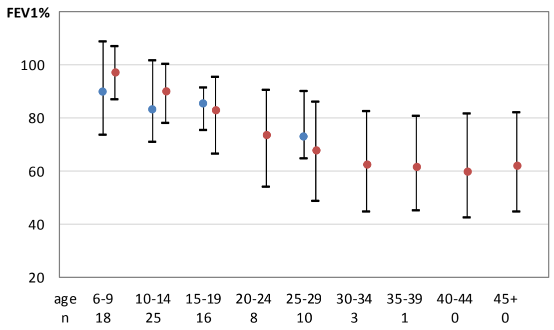
Quartiles of FEV1%: Israel



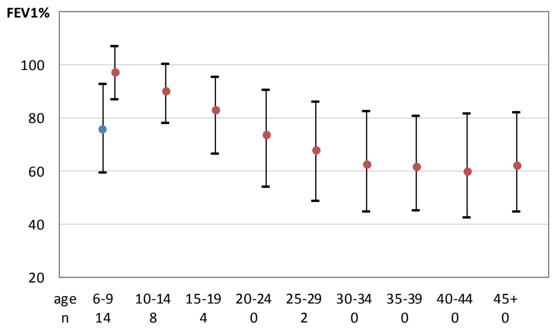
Quartiles of FEV1%: Italy



Quartiles of FEV1%: Rep of Macedonia

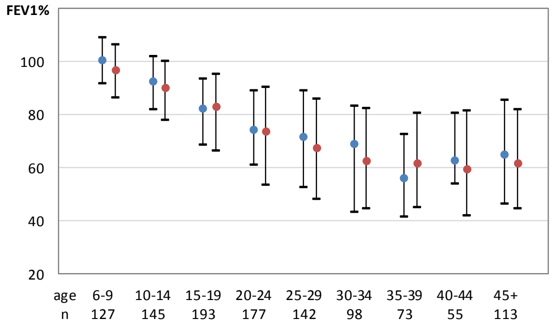


Quartiles of FEV1%: Rep of Moldova

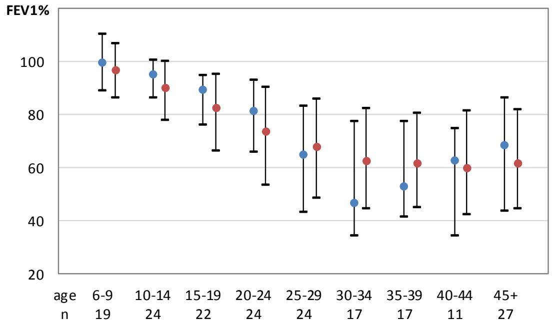


[figure 4.4 continued]

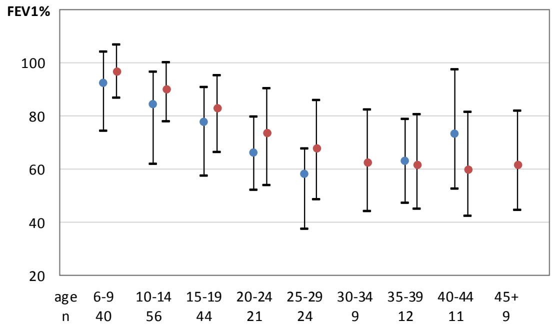
Quartiles of FEV1%: The Netherlands



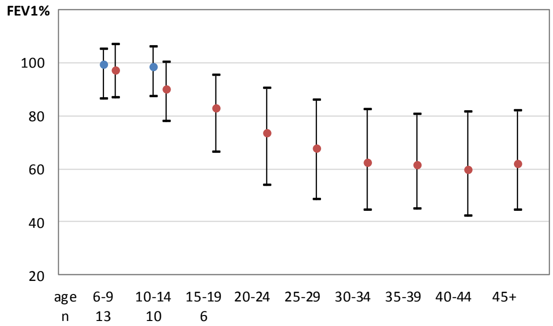
Quartiles of FEV1%: Norway



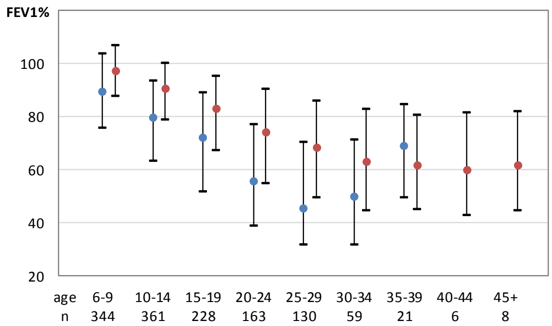
Quartiles of FEV1%: Portugal



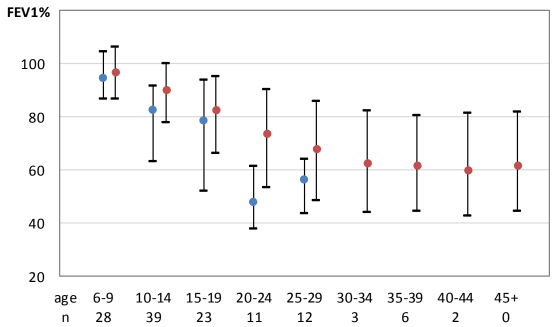
Quartiles of FEV1%: Romania



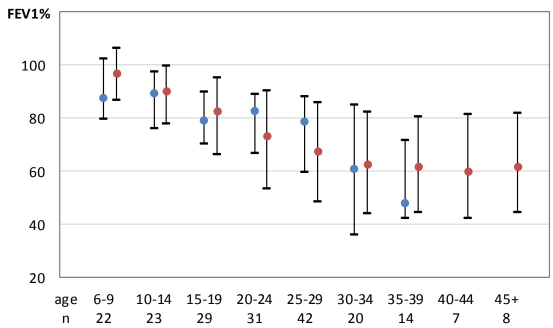
Quartiles of FEV1%: Russian Federation



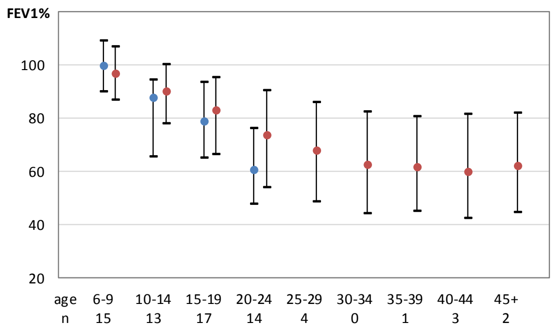
Quartiles of FEV1%: Serbia



Quartiles of FEV1%: Slovak Republic

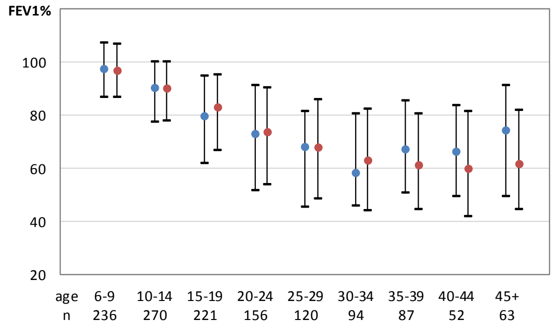


Quartiles of FEV_1%: Slovenia

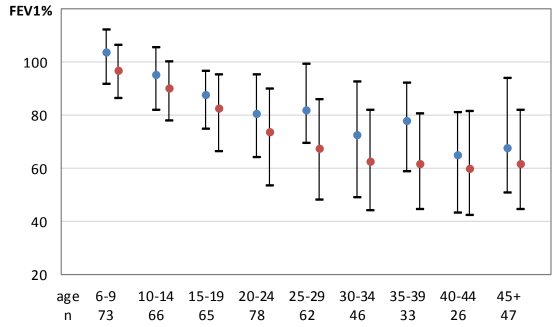


[figure 4.4 continued]

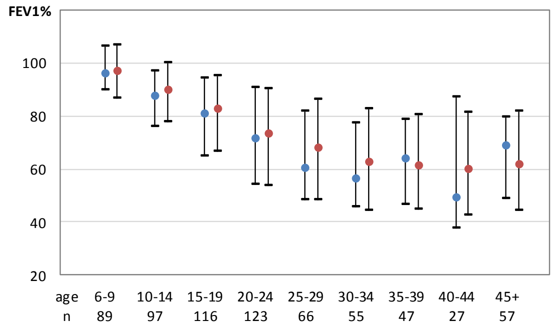
Quartiles of FEV_1%: Spain



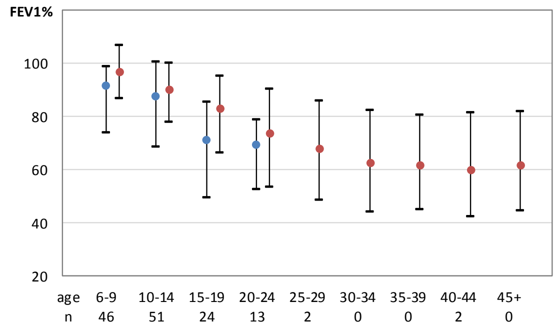
Quartiles of FEV_1%: Sweden



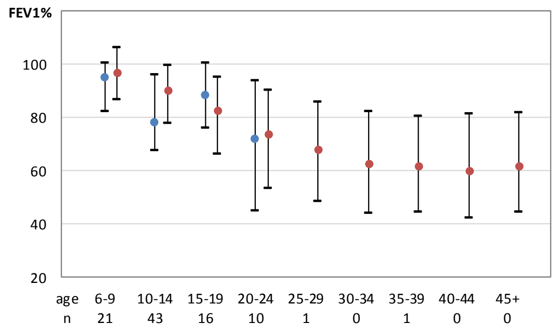
Quartiles of FEV_1%: Switzerland



Quartiles of FEV_1%: Turkey



Quartiles of FEV_1%: Ukraine



Quartiles of FEV_1%: United Kingdom[1]

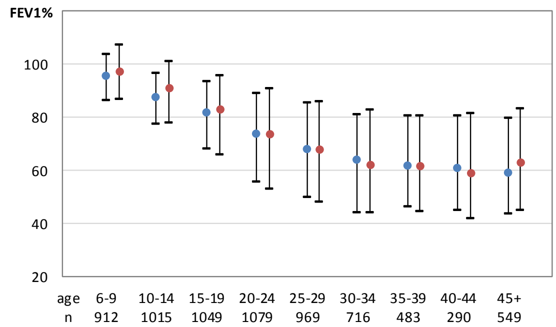
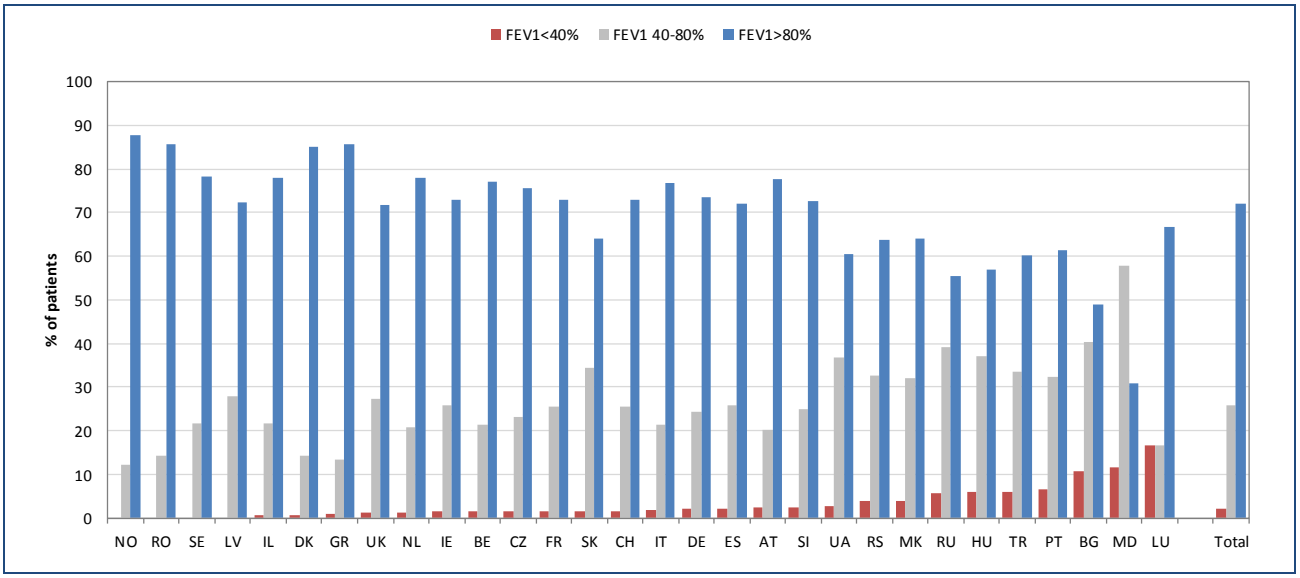


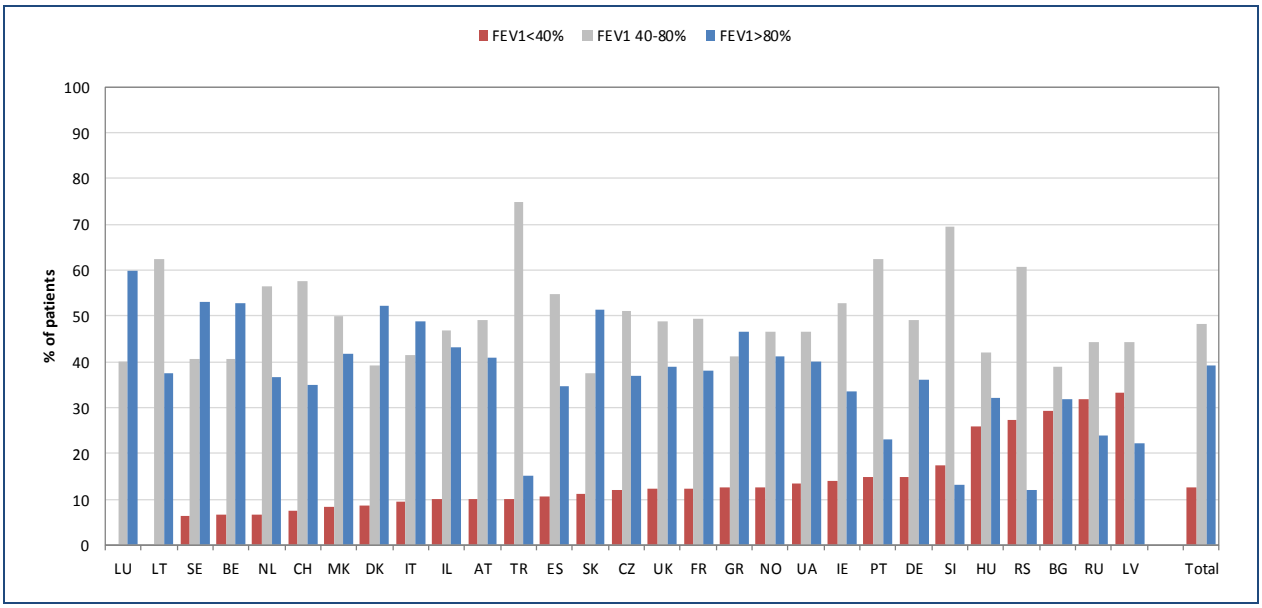
Figure 4.5 FEV_1% of predicted according to severity group and age group, by country and overall. Patients aged 6-17 years who have never had a lung transplant.



Note: Lithuania has 0% coverage for children.

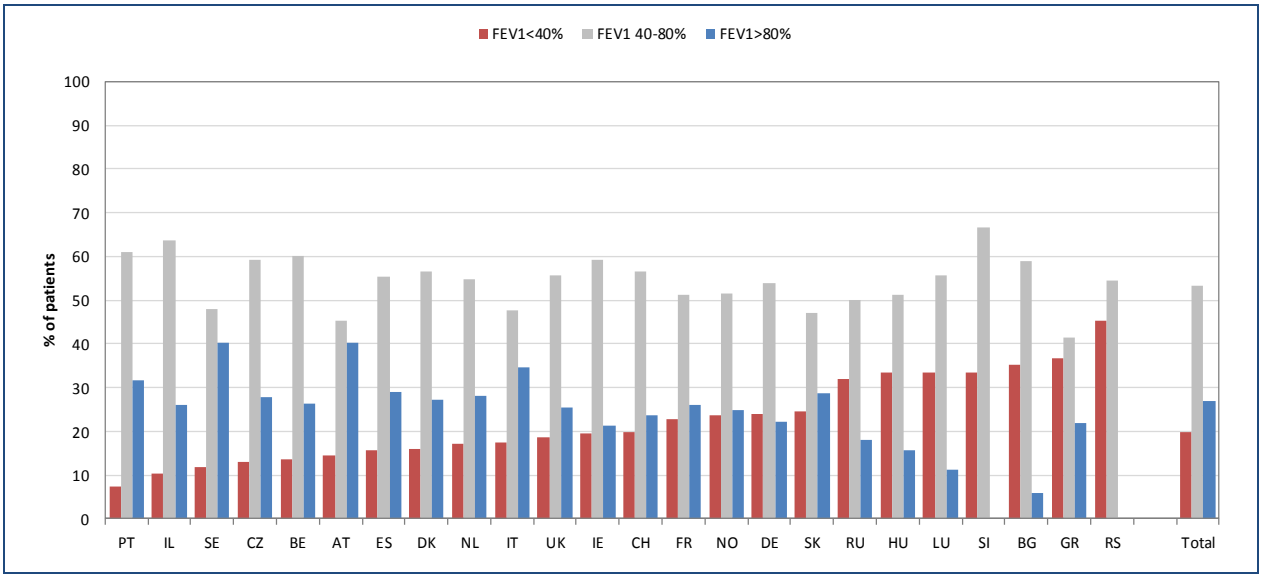
Figures 4.5, 4.6 and 4.7 show the FEV_1% by severity group, by country and overall. Patients with an FEV_1% higher than 80% are generally considered to have mild lung disease, patients with FEV_1% between 80% and 40% moderate lung disease, and patients with FEV_1 <40% severe lung disease. However, since a 10 year old child with a lung function of 50% has considerably worse lung disease than a 50 year old patient with the same FEV_1%, and the age distribution is not the same in all countries, we have chosen to present children (fig 4.5) and adults (fig 4.6 and 4.7) separately.

Figure 4.6 FEV_1% of predicted according to severity group and age group, by country and overall. Patients aged 18-29 years who have never had a lung transplant.



Note: Romania and Rep of Moldova have <5 patients aged 18-29 years at FEV_1 measurement and are excluded from this graph.

Figure 4.7 FEV_1% of predicted according to severity group and age group, by country and overall. Patients aged 30 years or older who have never had a lung transplant.



Note: Republic of Moldova and Romania have no patients aged 30 years or older.
Latvia, Lithuania, Rep of Macedonia, Turkey and Ukraine have <5 patients aged 30 years or older and are excluded from this graph.

5. Microbiology

We collect data on three chronic infections – *Pseudomonas aeruginosa*, *Burkholderia cepacia complex species* and *Staphylococcus aureus* – as well as the occurrence of non-tuberculous mycobacteria (NTM) and *Stenotrophomonas maltophilia*.

In the microbiology category discrepancies exist between the ECFSPR definitions and those of the national registries. The ECFSPR definition of chronic infection (see Appendix 2, page 135) is:

Patient should be defined as chronically infected if he/she fulfils the criteria now or has done in recent years and the physician has no reason to think the status has changed:

a. modified Leeds criteria, chronic infection: >50% of the sputum samples positive, collected during the last 12 months. At least 4 sputum samples during that period;
b. and/or significantly raised bacteria-specific antibodies according to local laboratories.

When minor differences exist the alternative definition is in a footnote; when differences are major, or if the variable is not collected at all, the variable has been set to missing for that country.

Table 5.1 Prevalence of chronic bacterial infection in all patients seen in 2016, by country.

Country	Chronic *Pseudomonas aeruginosa* number (%)			Chronic *Burkholderia cepacia complex species* number (%)			Chronic *Staphylococcus aureus* number (%)		
	Missing/ unknown	No	Yes	Missing/ unknown	No	Yes	Missing/ unknown	No	Yes
Austria	8 (1.08)	541 (73.11)	191 (25.81)	4 (0.54)	712 (96.22)	24 (3.24)	6 (0.81)	334 (45.14)	400 (54.05)
Belgium[1]	224 (17.98)	747 (59.95)	275 (22.07)	222 (17.82)	997 (80.01)	27 (2.17)	1246 (100)	-	-
Bulgaria	1 (0.71)	48 (34.29)	91 (65.00)	1 (0.71)	137 (97.86)	2 (1.43)	1 (0.71)	105 (75.00)	34 (24.29)
Czech Republic	12 (2.05)	448 (76.58)	125 (21.37)	10 (1.71)	524 (89.57)	51 (8.72)	10 (1.71)	305 (52.14)	270 (46.15)
Denmark	0 (0)	326 (67.63)	156 (32.37)	0 (0)	453 (93.98)	29 (6.02)	482 (100)	-	-
France	0 (0)	5286 (78.74)	1427 (21.26)	0 (0)	6647 (99.02)	66 (0.98)	6713 (100)	-	-
Germany	170 (2.96)	3605 (62.83)	1963 (34.21)	165 (2.88)	5453 (95.03)	120 (2.09)	171 (2.98)	3245 (56.55)	2322 (40.47)
Greece	63 (10.61)	250 (42.08)	281 (47.31)	49 (8.25)	544 (91.58)	1 (0.17)	50 (8.42)	383 (64.48)	161 (27.10)
Hungary	15 (2.96)	319 (62.92)	173 (34.12)	36 (7.10)	460 (90.73)	11 (2.17)	18 (3.55)	251 (49.51)	238 (46.94)
Ireland[2]	<5 (0.17)	847 (74.04)	295 (25.79)	<5 (0.17)	1122 (98.08)	20 (1.75)	<5 (0.17)	733 (64.08)	409 (35.75)
Israel	33 (6.13)	271 (50.38)	234 (43.49)	30 (5.58)	500 (92.93)	8 (1.49)	34 (6.32)	297 (55.20)	207 (38.48)
Italy[3]	75 (1.40)	3350 (62.49)	1936 (36.11)	70 (1.31)	5152 (96.10)	139 (2.59)	71 (1.32)	2446 (45.63)	2844 (53.05)
Latvia	2 (5.56)	21 (58.33)	13 (36.11)	2 (5.56)	33 (91.66)	1 (2.78)	2 (5.56)	19 (52.77)	15 (41.67)
Lithuania	2 (16.67)	8 (66.66)	2 (16.67)	2 (16.67)	9 (75.00)	1 (8.33)	2 (16.67)	3 (25.00)	7 (58.33)
Luxembourg	0 (0)	23 (71.87)	9 (28.13)	0 (0)	30 (93.75)	2 (6.25)	0 (0)	12 (37.50)	20 (62.50)
Rep of Macedonia	1 (0.92)	65 (59.63)	43 (39.45)	1 (0.92)	107 (98.16)	1 (0.92)	1 (0.92)	85 (77.98)	23 (21.10)
Rep of Moldova	2 (4.34)	22 (47.83)	22 (47.83)	46 (100)	-	-	2 (4.35)	13 (28.26)	31 (67.39)
The Netherlands	73 (5.17)	883 (62.54)	456 (32.29)	73 (5.17)	1316 (93.20)	23 (1.63)	73 (5.17)	745 (52.76)	594 (42.07)
Norway[4]	24 (10.43)	152 (66.09)	54 (23.48)	30 (13.04)	195 (84.79)	5 (2.17)	132 (57.39)	0 (0)	98 (42.61)
Portugal	11 (3.45)	219 (68.65)	89 (27.90)	10 (3.13)	286 (89.66)	23 (7.21)	13 (4.08)	163 (51.10)	143 (44.82)
Romania	0 (0)	40 (80.00)	10 (20.00)	0 (0)	50 (100)	0 (0)	0 (0)	42 (84.00)	8 (16.00)
Russian Federation	112 (3.71)	1991 (65.88)	919 (30.41)	104 (3.44)	2744 (90.80)	174 (5.76)	124 (4.10)	1218 (40.30)	1680 (55.60)

[1] Belgium: *Chronic Pseudomonas aeruginosa* and *Chronic Burkholderia cepacia complex species* are not collected for transplanted patients and most of the missing data refers to this sub-population.

[2] Ireland: chronicity for *Pseudomonas aeruginosa*, *Burkholderia* and *Staphylococcus aureus* is defined as: at least 3 or more positive isolates during the last 12 months window preceding the last reported culture in 2016.

[3] Italy: chronicity for *Pseudomonas aeruginosa*, *Burkholderia* and *Staphylococcus aureus* is defined as: at least 3 or more positive cultures during 2016.

[4] Norway: the high percentage of missing and the zero percentage of no in *Staphylococcus aureus* is because a tick-box was used by Norway to collect this information, which did not allow to distinguish “no” from “unknown”.

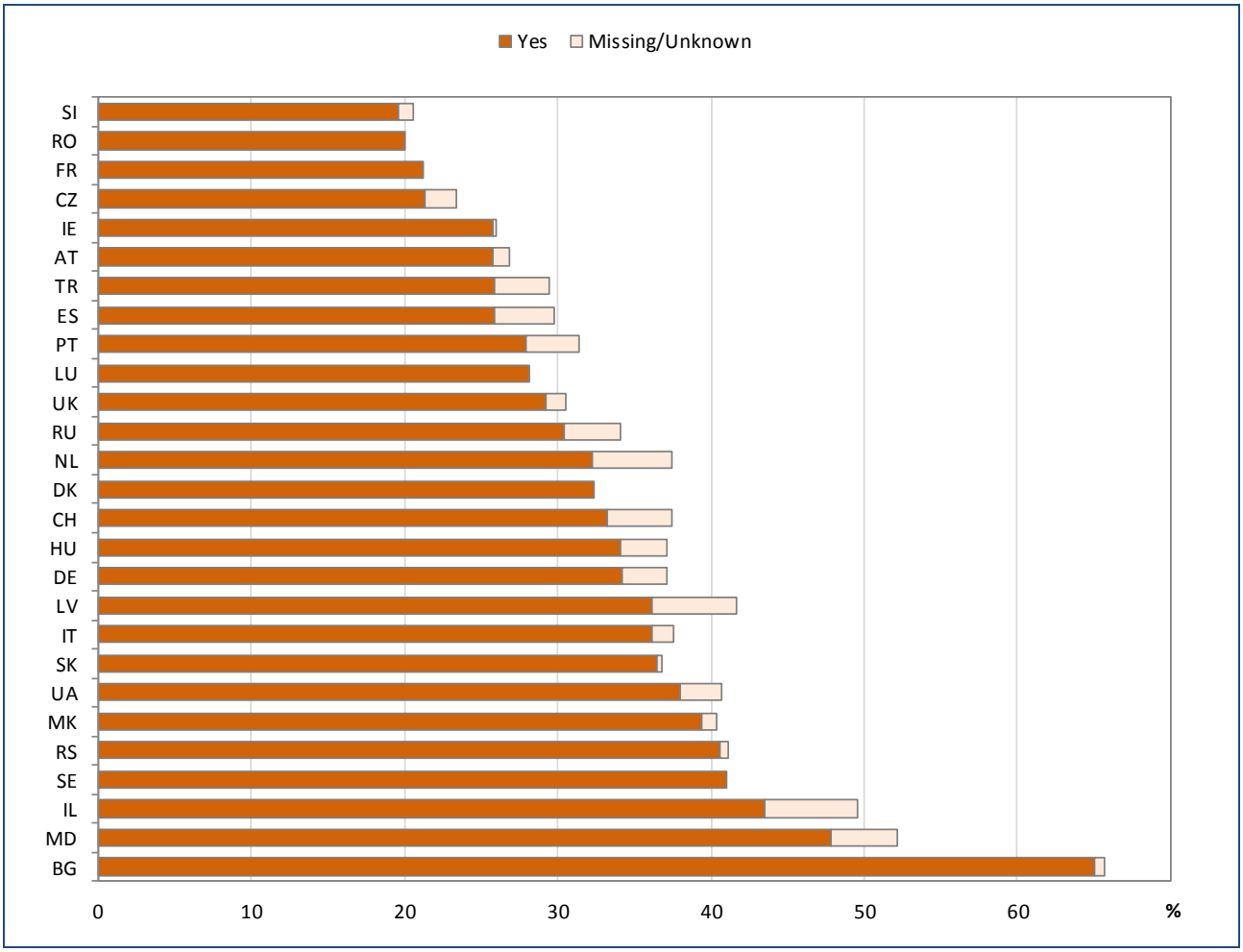
[table 5.1 continued]

Country	Chronic *Pseudomonas aeruginosa* number (%)			Chronic *Burkholderia cepacia complex species* number (%)			Chronic *Staphylococcus aureus* number (%)		
	Missing/ unknown	No	Yes	Missing/ unknown	No	Yes	Missing/ unknown	No	Yes
Serbia	1 (0.59)	100 (58.82)	69 (40.59)	1 (0.59)	150 (88.23)	19 (11.18)	1 (0.59)	48 (28.24)	121 (71.17)
Slovak Republic	1 (0.40)	156 (63.16)	90 (36.44)	0 (0)	232 (93.93)	15 (6.07)	0 (0)	150 (60.73)	97 (39.27)
Slovenia	1 (0.98)	81 (79.41)	20 (19.61)	1 (0.98)	99 (97.06)	2 (1.96)	1 (0.98)	33 (32.35)	68 (66.67)
Spain	74 (3.90)	1332 (70.18)	492 (25.92)	79 (4.16)	1734 (91.36)	85 (4.48)	75 (3.95)	1037 (54.64)	786 (41.41)
Sweden	0 (0)	383 (59.01)	266 (40.99)	0 (0)	633 (97.53)	16 (2.47)	90 (13.87)	401 (61.78)	158 (24.35)
Switzerland	38 (4.19)	567 (62.59)	301 (33.22)	36 (3.97)	846 (93.38)	24 (2.65)	39 (4.30)	386 (42.60)	481 (53.10)
Turkey	11 (3.51)	221 (70.61)	81 (25.88)	16 (5.11)	296 (94.57)	1 (0.32)	12 (3.83)	213 (68.05)	88 (28.12)
Ukraine	4 (2.67)	89 (59.33)	57 (38.00)	1 (0.67)	144 (96.00)	5 (3.33)	2 (1.33)	60 (40.00)	88 (58.67)
United Kingdom[5]	128 (1.32)	6738 (69.50)	2829 (29.18)	0 (0)	9344 (96.38)	351 (3.62)	119 (1.23)	8121 (83.76)	1455 (15.01)

[5] United Kingdom: chronicity for *Pseudomonas aeruginosa* and *Staphylococcus aureus* is defined as: 3 or more positive isolates during the last 12 months. Information on *Burkholderia* is collected as follows: *Burkholderia* grown since last annual review, not necessarily chronic.

Table 5.1 shows, separately by country, the frequency of chronic *Pseudomonas aeruginosa*, chronic *Burkholderia cepacia complex species* and chronic *Staphylococcus aureus*. The number of missing values is also included. The identification rate of *Burkholderia cepacia complex species* in particular may also be influenced by differences in culture techniques employed.

Figure 5.1 Prevalence of chronic Pseudomonas aeruginosa infection in all patients seen in 2016, by country.

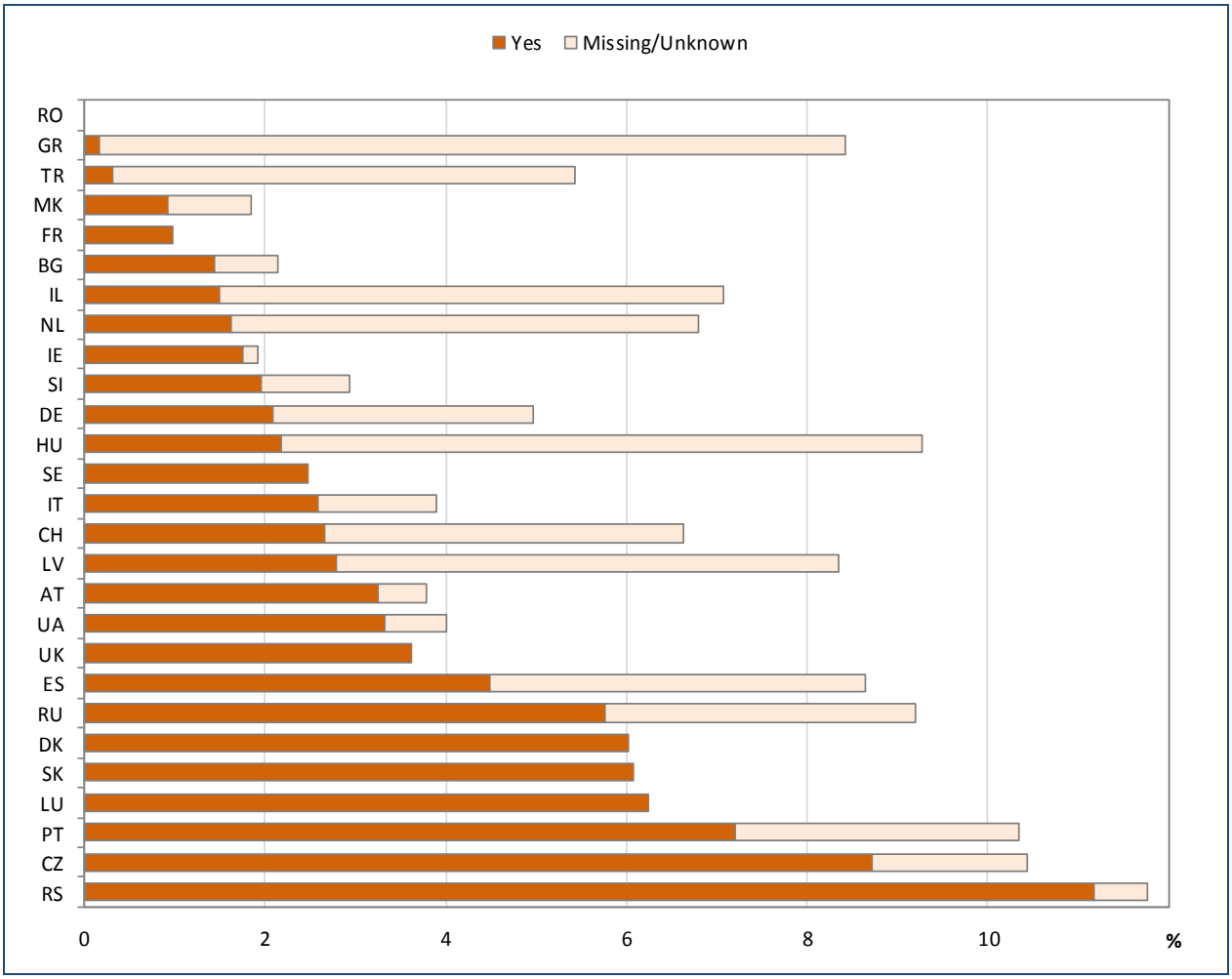


Note: We excluded from the graph the countries for which the information on *Pseudomonas aeruginosa* was missing for more than 10% of the patients.

Note: Belgium: *Chronic Pseudomonas aeruginosa* is not collected for transplanted patients and most of the missing data refers to this sub-population.
Ireland: chronicity for *Pseudomonas aeruginosa* is defined as: at least 3 or more positive isolates during the last 12 months window preceding the last reported culture in 2016.
Italy: chronicity for *Pseudomonas aeruginosa* is defined as: at least 3 or more positive cultures during 2016.
United Kingdom: for chronic *Pseudomonas aeruginosa* the definition is: 3 or more positive isolates during the last 12 months.

The horizontal bars represent the percentage of patients with chronic *Pseudomonas aeruginosa* infection (in dark orange) and the percentage of patients where information on *Pseudomonas aeruginosa* infection was missing (in light orange). This is a frequent infection, but prevalence varies considerably between countries.

Figure 5.2 Prevalence of chronic Burkholderia cepacia complex species infection in all patients seen in 2016, by country.

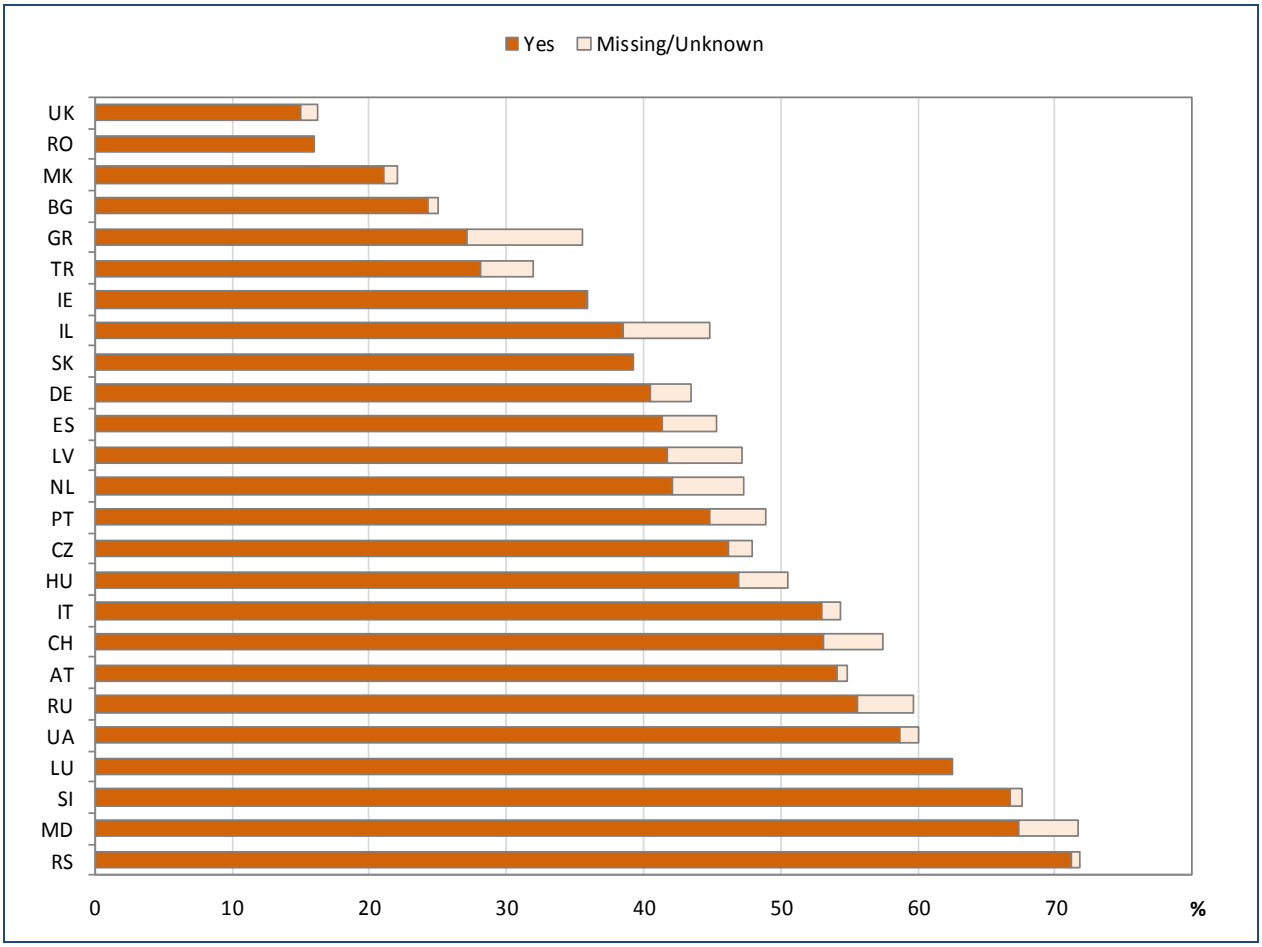


Note: We excluded from the graph the countries for which the information on *Burkholderia cepacia complex species* was missing for more than 10% of the patients.

Note: Belgium: *Chronic Burkholderia cepacia complex species* is not collected for transplanted patients and most of the missing data refers to this sub-population.
Ireland: chronicity for *Burkholderia* is defined as: at least 3 or more positive isolates during the last 12 months window preceding the last reported culture in 2016.
Italy: chronicity for *Burkholderia* is defined as: at least 3 or more positive cultures during 2016.
United Kingdom: information on *Burkholderia* is collected as: *Burkholderia* grown since last annual review, not necessarily chronic, and is excluded from the graph.

The horizontal bars represent the percentage of patients with chronic *Burkholderia* infection (in dark orange) and the percentage of patients where information on *Burkholderia* infection was missing (in light orange). This infection is much less frequent than *Pseudomonas aeruginosa* (note the different scale on the horizontal axis), and there is also some variation.

Figure 5.3 Prevalence of chronic Staphylococcus aureus infection in all patients seen in 2016, by country.



Note: We excluded from the graph the countries for which the information on *Staphylococcus aureus* was missing for more than 10% of the patients.

Note: Ireland: chronicity for *Staphylococcus aureus* is defined as: at least 3 or more positive isolates during the last 12 months window preceding the last reported culture in 2016.
Italy: chronicity for *Staphylococcus aureus* is defined as: at least 3 or more positive cultures during 2016.
United Kingdom: for chronic *Staphylococcus aureus* the definition is: 3 or more positive isolates during the last 12 months.

The horizontal bars represent the percentage of patients with chronic *Staphylococcus aureus* infection (in dark orange) and the percentage of patients where information on *Staphylococcus aureus* was missing (in light orange). This infection is as frequent as chronic *Pseudomonas aeruginosa* infection and a similar degree of variation between the countries can be observed.

Table 5.2 Prevalence of chronic bacterial infection in children seen in 2016, by country.

Country	Chronic *Pseudomonas aeruginosa* number (%)			Chronic *Burkholderia cepacia complex species* number (%)			Chronic *Staphylococcus aureus* number (%)		
	Missing/ unknown	No	Yes	Missing/ unknown	No	Yes	Missing/ unknown	No	Yes
Austria	6 (1.60)	338 (89.89)	32 (8.51)	2 (0.53)	369 (98.14)	5 (1.33)	4 (1.06)	165 (43.88)	207 (55.06)
Belgium[1]	12 (2.47)	428 (88.06)	46 (9.47)	11 (2.26)	468 (96.30)	7 (1.44)	486 (100)	-	-
Bulgaria	0 (0)	42 (54.55)	35 (45.45)	0 (0)	77 (100)	0 (0)	0 (0)	58 (75.32)	19 (24.68)
Czech Republic	2 (0.63)	290 (91.19)	26 (8.18)	1 (0.31)	310 (97.49)	7 (2.20)	1 (0.31)	169 (53.14)	148 (46.55)
Denmark	0 (0)	176 (93.12)	13 (6.88)	0 (0)	188 (99.47)	1 (0.53)	189 (100)	-	-
France	0 (0)	2829 (93.49)	197 (6.51)	0 (0)	3011 (99.50)	15 (0.50)	3026 (100)	-	-
Germany	24 (0.97)	2167 (87.73)	279 (11.30)	21 (0.85)	2427 (98.26)	22 (0.89)	21 (0.85)	1518 (61.46)	931 (37.69)
Greece	16 (5.57)	189 (65.86)	82 (28.57)	2 (0.70)	285 (99.30)	0 (0)	4 (1.39)	227 (79.10)	56 (19.51)
Hungary	6 (2.19)	214 (78.10)	54 (19.71)	21 (7.66)	251 (91.61)	2 (0.73)	8 (2.92)	158 (57.66)	108 (39.42)
Ireland[2]	0 (0)	465 (91.54)	43 (8.46)	0 (0)	504 (99.21)	<5 (0.79)	0 (0)	293 (57.68)	215 (42.32)
Israel	16 (6.99)	164 (71.61)	49 (21.40)	15 (6.55)	212 (92.58)	2 (0.87)	18 (7.86)	110 (48.04)	101 (44.10)
Italy[3]	31 (1.33)	1937 (83.39)	355 (15.28)	31 (1.33)	2284 (98.33)	8 (0.34)	32 (1.38)	1064 (45.80)	1227 (52.82)
Latvia	2 (8.00)	19 (76.00)	4 (16.00)	2 (8.00)	22 (88.00)	1 (4.00)	2 (8.00)	13 (52.00)	10 (40.00)
Luxembourg	0 (0)	10 (83.33)	2 (16.67)	0 (0)	12 (100)	0 (0)	0 (0)	8 (66.67)	4 (33.33)
Rep of Macedonia	1 (1.25)	56 (70.00)	23 (28.75)	1 (1.25)	78 (97.50)	1 (1.25)	1 (1.25)	63 (78.75)	16 (20.00)
Rep of Moldova	2 (4.65)	20 (46.51)	21 (48.84)	43 (100)	-	-	2 (4.65)	12 (27.91)	29 (67.44)
The Netherlands	3 (0.53)	508 (89.28)	58 (10.19)	3 (0.53)	561 (98.59)	5 (0.88)	3 (0.53)	333 (58.52)	233 (40.95)
Norway[4]	0 (0)	74 (92.50)	6 (7.50)	1 (1.25)	78 (97.50)	1 (1.25)	44 (55.00)	0 (0)	36 (45.00)
Portugal	5 (2.66)	141 (75.00)	42 (22.34)	5 (2.66)	170 (90.43)	13 (6.91)	7 (3.72)	105 (55.85)	76 (40.43)
Romania	0 (0)	39 (82.98)	8 (17.02)	0 (0)	47 (100)	0 (0)	0 (0)	39 (82.98)	8 (17.02)
Russian Federation	66 (2.88)	1667 (72.83)	556 (24.29)	61 (2.66)	2137 (93.36)	91 (3.98)	74 (3.23)	888 (38.80)	1327 (57.97)

[1] Belgium: *Chronic Pseudomonas aeruginosa* and *Chronic Burkholderia cepacia complex species* are not collected for transplanted patients and most of the missing data refers to this sub-population.

[2] Ireland: chronicity for *Pseudomonas aeruginosa*, *Burkholderia* and *Staphylococcus aureus* is defined as: at least 3 or more positive isolates during the last 12 months window preceding the last reported culture in 2016.

[3] Italy: chronicity for *Pseudomonas aeruginosa*, *Burkholderia* and *Staphylococcus aureus* is defined as: at least 3 or more positive cultures during 2016.

[4] Norway: the high percentage of missing and the zero percentage of no in *Staphylococcus aureus* is because a tick-box was used by Norway to collect this information, which did not allow to distinguish “no” from “unknown”.

Note: Lithuania has 0% coverage for children.

[table 5.2 continued]

Country	Chronic *Pseudomonas aeruginosa* number (%)			Chronic *Burkholderia cepacia complex species* number (%)			Chronic *Staphylococcus aureus* number (%)		
	Missing/ unknown	No	Yes	Missing/ unknown	No	Yes	Missing/ unknown	No	Yes
Serbia	1 (0.83)	87 (71.90)	33 (27.27)	1 (0.83)	110 (90.91)	10 (8.26)	1 (0.83)	27 (22.31)	93 (76.86)
Slovak Republic	0 (0)	79 (73.83)	28 (26.17)	0 (0)	105 (98.13)	2 (1.87)	0 (0)	59 (55.14)	48 (44.86)
Slovenia	0 (0)	55 (91.67)	5 (8.33)	0 (0)	60 (100)	0 (0)	0 (0)	15 (25.00)	45 (75.00)
Spain	13 (1.24)	894 (85.39)	140 (13.37)	12 (1.15)	1006 (96.08)	29 (2.77)	14 (1.34)	588 (56.16)	445 (42.50)
Sweden	0 (0)	211 (83.07)	43 (16.93)	0 (0)	251 (98.82)	3 (1.18)	18 (7.09)	183 (72.04)	53 (20.87)
Switzerland	2 (0.48)	378 (89.78)	41 (9.74)	2 (0.48)	415 (98.57)	4 (0.95)	3 (0.71)	194 (46.08)	224 (53.21)
Turkey	11 (3.86)	213 (74.74)	61 (21.40)	16 (5.61)	268 (94.04)	1 (0.35)	12 (4.21)	195 (68.42)	78 (27.37)
Ukraine	3 (2.34)	85 (66.41)	40 (31.25)	1 (0.78)	123 (96.09)	4 (3.13)	2 (1.56)	54 (42.19)	72 (56.25)
United Kingdom[5]	15 (0.36)	3862 (91.97)	322 (7.67)	0 (0)	4144 (98.69)	55 (1.31)	6 (0.14)	3850 (91.69)	343 (8.17)

[5] United Kingdom: chronicity for *Pseudomonas aeruginosa* and *Staphylococcus aureus* is defined as: 3 or more positive isolates during the last 12 months. Information on *Burkholderia* is collected as follows: *Burkholderia* grown since last annual review, not necessarily chronic.

Table 5.2 shows, separately by country, the frequency of chronic *Pseudomonas aeruginosa*, chronic *Burkholderia cepacia complex species* and chronic *Staphylococcus aureus* in children. The number of missing values is also included. The identification rate of *Burkholderia cepacia complex species* in particular may also be influenced by differences in culture techniques employed.

Table 5.3 Prevalence of chronic bacterial infection in adults seen in 2016, by country.

Country	Chronic *Pseudomonas aeruginosa* number (%)			Chronic *Burkholderia cepacia complex species* number (%)			Chronic *Staphylococcus aureus* number (%)		
	Missing/ unknown	No	Yes	Missing/ unknown	No	Yes	Missing/ unknown	No	Yes
Austria	2 (0.55)	203 (55.77)	159 (43.68)	2 (0.55)	343 (94.23)	19 (5.22)	2 (0.55)	169 (46.43)	193 (53.02)
Belgium[1]	212 (27.89)	319 (41.98)	229 (30.13)	211 (27.76)	529 (69.61)	20 (2.63)	760 (100)	-	-
Bulgaria	1 (1.59)	6 (9.52)	56 (88.89)	1 (1.59)	60 (95.24)	2 (3.17)	1 (1.59)	47 (74.60)	15 (23.81)
Czech Republic	10 (3.75)	158 (59.17)	99 (37.08)	9 (3.37)	214 (80.15)	44 (16.48)	9 (3.37)	136 (50.94)	122 (45.69)
Denmark	0 (0)	150 (51.19)	143 (48.81)	0 (0)	265 (90.44)	28 (9.56)	293 (100)	-	-
France	0 (0)	2457 (66.64)	1230 (33.36)	0 (0)	3636 (98.62)	51 (1.38)	3687 (100)	-	-
Germany	146 (4.47)	1438 (44.00)	1684 (51.53)	144 (4.41)	3026 (92.59)	98 (3.00)	150 (4.59)	1727 (52.85)	1391 (42.56)
Greece	47 (15.31)	61 (19.87)	199 (64.82)	47 (15.31)	259 (84.36)	1 (0.33)	46 (14.98)	156 (50.82)	105 (34.20)
Hungary	9 (3.88)	105 (45.26)	118 (50.86)	15 (6.47)	208 (89.65)	9 (3.88)	10 (4.31)	92 (39.66)	130 (56.03)
Ireland[2]	<5 (0.31)	382 (60.07)	252 (39.62)	<5 (0.31)	618 (97.17)	16 (2.52)	<5 (0.31)	440 (69.19)	194 (30.50)
Israel	17 (5.50)	107 (34.63)	185 (59.87)	15 (4.85)	288 (93.21)	6 (1.94)	16 (5.18)	187 (60.52)	106 (34.30)
Italy[3]	44 (1.45)	1413 (46.51)	1581 (52.04)	39 (1.28)	2868 (94.41)	131 (4.31)	39 (1.28)	1382 (45.49)	1617 (53.23)
Latvia	0 (0)	2 (18.18)	9 (81.82)	0 (0)	11 (100)	0 (0)	0 (0)	6 (54.55)	5 (45.45)
Lithuania	2 (16.67)	8 (66.66)	2 (16.67)	2 (16.67)	9 (75.00)	1 (8.33)	2 (16.67)	3 (25.00)	7 (58.33)
Luxembourg	0 (0)	13 (65.00)	7 (35.00)	0 (0)	18 (90.00)	2 (10.00)	0 (0)	4 (20.00)	16 (80.00)
Rep of Macedonia	0 (0)	9 (31.03)	20 (68.97)	0 (0)	29 (100)	0 (0)	0 (0)	22 (75.86)	7 (24.14)
The Netherlands	70 (8.30)	375 (44.48)	398 (47.22)	70 (8.30)	755 (89.56)	18 (2.14)	70 (8.30)	412 (48.88)	361 (42.82)
Norway[4]	24 (16.00)	78 (52.00)	48 (32.00)	29 (19.33)	117 (78.00)	4 (2.67)	88 (58.67)	0 (0)	62 (41.33)
Portugal	6 (4.58)	78 (59.54)	47 (35.88)	5 (3.82)	116 (88.55)	10 (7.63)	6 (4.58)	58 (44.27)	67 (51.15)
Russian Federation	46 (6.28)	324 (44.20)	363 (49.52)	43 (5.87)	607 (82.81)	83 (11.32)	50 (6.82)	330 (45.02)	353 (48.16)

[1] Belgium: *Chronic Pseudomonas aeruginosa* and *Chronic Burkholderia cepacia complex species* are not collected for transplanted patients and most of the missing data refers to this sub-population.

[2] Ireland: chronicity for *Pseudomonas aeruginosa*, *Burkholderia* and *Staphylococcus aureus* is defined as: at least 3 or more positive isolates during the last 12 months window preceding the last reported culture in 2016.

[3] Italy: chronicity for *Pseudomonas aeruginosa*, *Burkholderia* and *Staphylococcus aureus* is defined as: at least 3 or more positive cultures during 2016.

[4] Norway: the high percentage of missing and the zero percentage of no in *Staphylococcus aureus* is because a tick-box was used by Norway to collect this information, which did not allow only to distinguish “no” from “unknown”.

Note: Romania and Rep of Moldova have <5 patients aged 18 years or more at 31/12/2016 and are excluded from this table.

[table 5.3 continued]

Country	Chronic *Pseudomonas aeruginosa* number (%)			Chronic *Burkholderia cepacia complex species* number (%)			Chronic *Staphylococcus aureus* number (%)		
	Missing/ unknown	No	Yes	Missing/ unknown	No	Yes	Missing/ unknown	No	Yes
Serbia	0 (0)	13 (26.53)	36 (73.47)	0 (0)	40 (81.63)	9 (18.37)	0 (0)	21 (42.86)	28 (57.14)
Slovak Republic	1 (0.71)	77 (55.00)	62 (44.29)	0 (0)	127 (90.71)	13 (9.29)	0 (0)	91 (65.00)	49 (35.00)
Slovenia	1 (2.38)	26 (61.91)	15 (35.71)	1 (2.38)	39 (92.86)	2 (4.76)	1 (2.38)	18 (42.86)	23 (54.76)
Spain	61 (7.17)	438 (51.47)	352 (41.36)	67 (7.87)	728 (85.55)	56 (6.58)	61 (7.17)	449 (52.76)	341 (40.07)
Sweden	0 (0)	172 (43.54)	223 (56.46)	0 (0)	382 (96.71)	13 (3.29)	72 (18.23)	218 (55.19)	105 (26.58)
Switzerland	36 (7.42)	189 (38.97)	260 (53.61)	34 (7.01)	431 (88.87)	20 (4.12)	36 (7.42)	192 (39.59)	257 (52.99)
Turkey	0 (0)	8 (28.57)	20 (71.43)	0 (0)	28 (100)	0 (0)	0 (0)	18 (64.29)	10 (35.71)
Ukraine	1 (4.55)	4 (18.18)	17 (77.27)	0 (0)	21 (95.45)	1 (4.55)	0 (0)	6 (27.27)	16 (72.73)
United Kingdom[5]	113 (2.06)	2876 (52.33)	2507 (45.61)	0 (0)	5200 (94.61)	296 (5.39)	113 (2.06)	4271 (77.71)	1112 (20.23)

[5] United Kingdom: chronicity for *Pseudomonas aeruginosa* and *Staphylococcus aureus* is defined as: 3 or more positive isolates during the last 12 months. Information on *Burkholderia* is collected as follows: *Burkholderia* grown since last annual review, not necessarily chronic.

This table shows, separately by country, the frequency of chronic *Pseudomonas aeruginosa*, chronic *Burkholderia cepacia complex species* and chronic *Staphylococcus aureus* in adults. The number of missing values is also included. The identification rate of *Burkholderia cepacia complex species* in particular may also be influenced by differences in culture techniques employed.

Table 5.4 Prevalence of non-tuberculous mycobacteria and Stenotrophomonas maltophilia infection in all patients seen in 2016, by country.

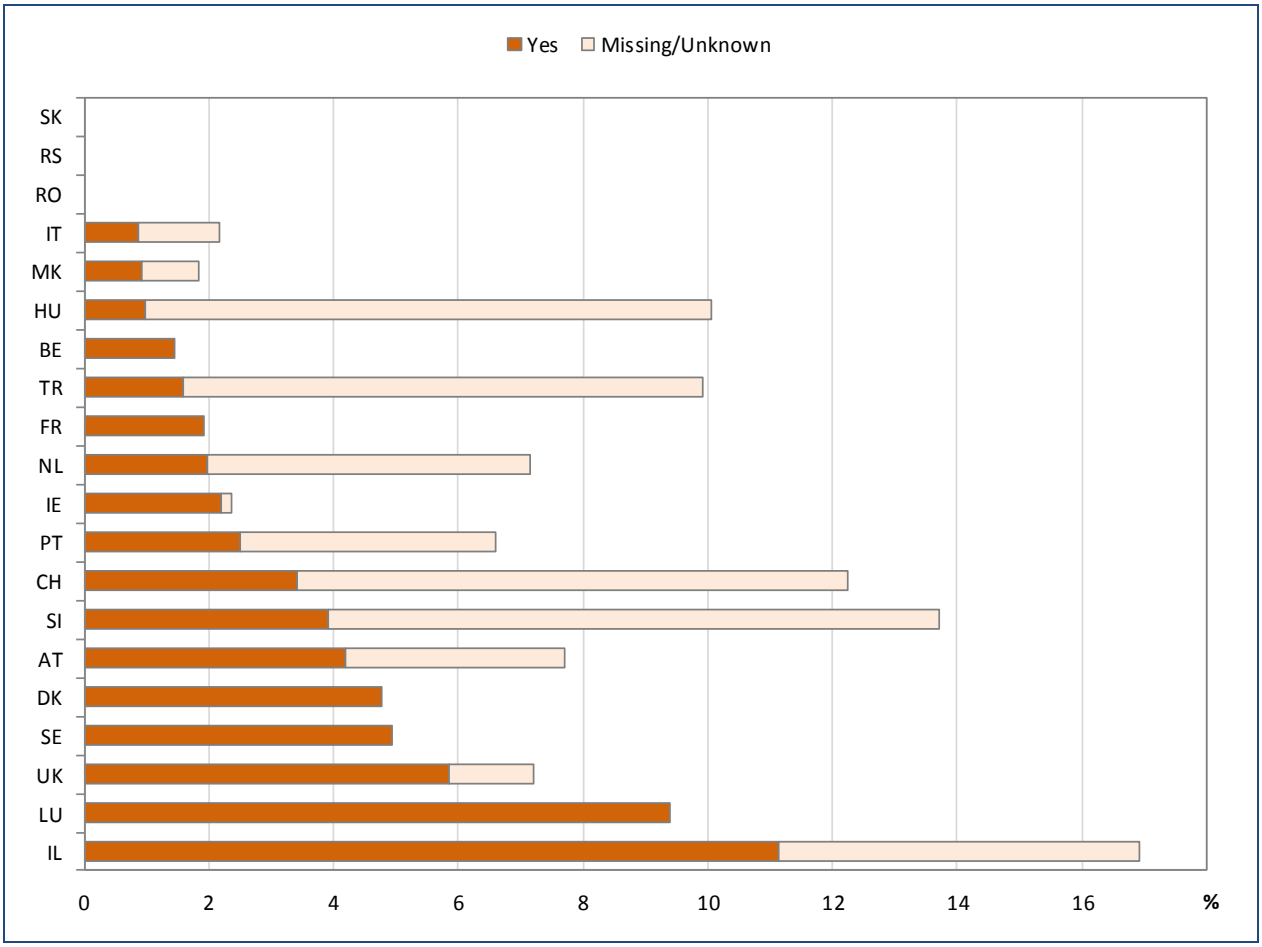
Country	Non-tuberculous mycobacteria (NTM) infection this year number (%)			*Stenotrophomonas maltophilia* infection this year number (%)		
	Missing/ unknown	No	Yes	Missing/ unknown	No	Yes
Austria	26 (3.51)	683 (92.30)	31 (4.19)	7 (0.95)	636 (85.94)	97 (13.11)
Belgium	0 (0)	1228 (98.56)	18 (1.44)	0 (0)	1103 (88.52)	143 (11.48)
Bulgaria	137 (97.86)	3 (2.14)	0 (0)	1 (0.71)	135 (96.43)	4 (2.86)
Czech Republic	332 (56.76)	239 (40.85)	14 (2.39)	6 (1.03)	518 (88.54)	61 (10.43)
Denmark	0 (0)	459 (95.23)	23 (4.77)	0 (0)	437 (90.66)	45 (9.34)
France	0 (0)	6584 (98.08)	129 (1.92)	0 (0)	6007 (89.48)	706 (10.52)
Germany	3933 (68.54)	1669 (29.09)	136 (2.37)	204 (3.56)	4944 (86.16)	590 (10.28)
Greece	383 (64.48)	206 (34.68)	5 (0.84)	49 (8.25)	506 (85.18)	39 (6.57)
Hungary	46 (9.07)	456 (89.94)	5 (0.99)	15 (2.96)	468 (92.31)	24 (4.73)
Ireland	<5 (0.17)	1117 (97.64)	25 (2.19)	<5 (0.17)	1024 (89.52)	118 (10.31)
Israel	31 (5.76)	447 (83.09)	60 (11.15)	30 (5.58)	473 (87.91)	35 (6.51)
Italy	71 (1.32)	5244 (97.82)	46 (0.86)	70 (1.31)	4993 (93.13)	298 (5.56)
Latvia	36 (100)	-	-	2 (5.56)	32 (88.88)	2 (5.56)
Lithuania	2 (16.67)	10 (83.33)	0 (0)	2 (16.67)	9 (75.00)	1 (8.33)
Luxembourg	0 (0)	29 (90.62)	3 (9.38)	0 (0)	25 (78.12)	7 (21.88)
Rep of Macedonia	1 (0.92)	107 (98.16)	1 (0.92)	1 (0.92)	108 (99.08)	0 (0)
Rep of Moldova	46 (100)	-	-	46 (100)	-	-
The Netherlands	73 (5.17)	1311 (92.85)	28 (1.98)	73 (5.17)	1166 (82.58)	173 (12.25)
Norway	34 (14.78)	180 (78.26)	16 (6.96)	27 (11.74)	159 (69.13)	44 (19.13)
Portugal	13 (4.08)	298 (93.41)	8 (2.51)	10 (3.13)	280 (87.78)	29 (9.09)
Romania	0 (0)	50 (100)	0 (0)	0 (0)	50 (100)	0 (0)
Russian Federation	453 (14.99)	2551 (84.41)	18 (0.60)	139 (4.60)	2781 (92.02)	102 (3.38)
Serbia	0 (0)	170 (100)	0 (0)	0 (0)	160 (94.12)	10 (5.88)
Slovak Republic	0 (0)	247 (100)	0 (0)	0 (0)	234 (94.74)	13 (5.26)
Slovenia	10 (9.80)	88 (86.28)	4 (3.92)	13 (12.75)	83 (81.37)	6 (5.88)
Spain	380 (20.02)	1453 (76.56)	65 (3.42)	76 (4.00)	1674 (88.20)	148 (7.80)

[table 5.4 continued]

Country	Non-tuberculous mycobacteria (NTM) infection this year number (%)			*Stenotrophomonas maltophilia* infection this year number (%)		
	Missing/ unknown	No	Yes	Missing/ unknown	No	Yes
Sweden	0 (0)	617 (95.07)	32 (4.93)	0 (0)	609 (93.84)	40 (6.16)
Switzerland	80 (8.83)	795 (87.75)	31 (3.42)	37 (4.08)	755 (83.34)	114 (12.58)
Turkey	26 (8.30)	282 (90.10)	5 (1.60)	15 (4.79)	287 (91.70)	11 (3.51)
Ukraine	146 (97.33)	3 (2.00)	1 (0.67)	2 (1.33)	142 (94.67)	6 (4.00)
United Kingdom	133 (1.37)	8995 (92.78)	567 (5.85)	119 (1.23)	8943 (92.24)	633 (6.53)

Table 5.4 shows the frequency of two other infections, non-tuberculous mycobacteria (NTM) and *Stenotrophomonas maltophilia.* Both these infections seem to be relatively rare, in line with the frequencies of *Burkholderia* infection. The identification rate of these bacteria may also be influenced by differences in culture techniques employed.

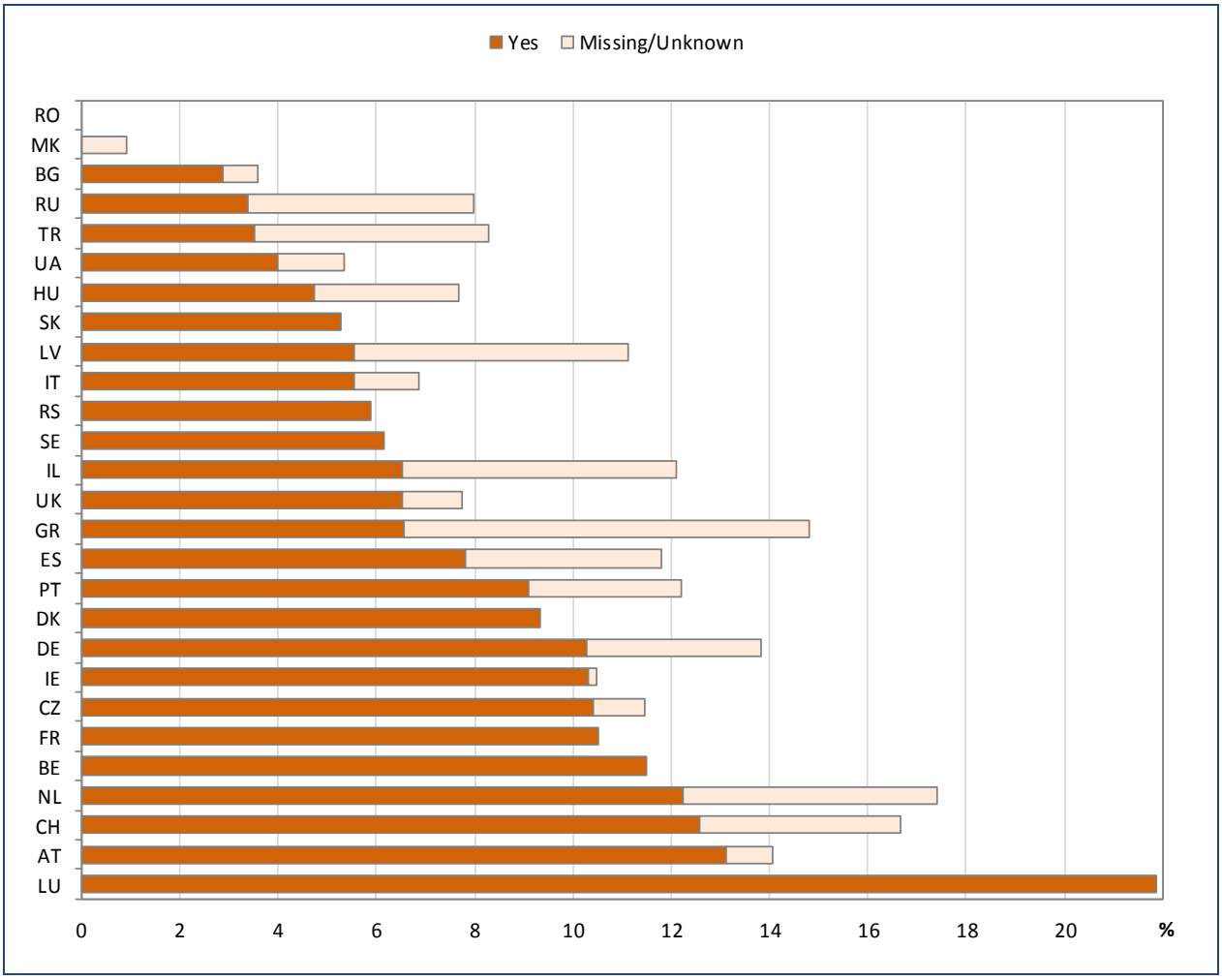
Figure 5.4 Prevalence of non-tuberculous mycobacteria in all patients seen in 2016, by country.



Note: We excluded from the graph the countries for which the information on non-tuberculous mycobacteria was missing for more than 10% of the patients.

The horizontal bars represent the percentage of patients with non-tuberculous mycobacteria infection (in dark orange) and the percentage of patients where information on non-tuberculous mycobacteria infection was missing (in light orange). Generally, infections from these bacteria are not very frequent in any country.

Figure 5.5 Prevalence of Stenotrophomonas maltophilia infection in all patients seen in 2016, by country.



Note: We excluded from the graph the countries for which the information on *Stenotrophomonas maltophilia* was missing for more than 10% of the patients.

The horizontal bars represent the percentage of patients with *Stenotrophomonas maltophilia* infection (in dark orange) and the percentage of patients where information on *Stenotrophomonas maltophilia* was missing (light orange). The frequency varies considerably between countries.

Table 5.5 Prevalence of non-tuberculous mycobacteria and Stenotrophomonas maltophilia infection in children seen in 2016, by country.

Country	Non-tuberculous mycobacteria (NTM) infection this year number (%)			*Stenotrophomonas maltophilia* infection this year number (%)		
	Missing/ unknown	No	Yes	Missing/ unknown	No	Yes
Austria	18 (4.79)	354 (94.15)	4 (1.06)	2 (0.53)	326 (86.7)	48 (12.77)
Belgium	0 (0)	479 (98.56)	7 (1.44)	0 (0)	416 (85.60)	70 (14.40)
Bulgaria	75 (97.40)	2 (2.60)	0 (0)	0 (0)	74 (96.10)	3 (3.90)
Czech Republic	258 (81.13)	58 (18.24)	2 (0.63)	0 (0)	286 (89.94)	32 (10.06)
Denmark	0 (0)	187 (98.94)	2 (1.06)	0 (0)	169 (89.42)	20 (10.58)
France	0 (0)	2989 (98.78)	37 (1.22)	0 (0)	2678 (88.50)	348 (11.50)
Germany	1972 (79.84)	470 (19.03)	28 (1.13)	30 (1.21)	2178 (88.18)	262 (10.61)
Greece	187 (65.16)	99 (34.49)	1 (0.35)	2 (0.70)	270 (94.07)	15 (5.23)
Hungary	30 (10.95)	244 (89.05)	0 (0)	6 (2.19)	263 (95.99)	5 (1.82)
Ireland	0 (0)	502 (98.82)	6 (1.18)	0 (0)	459 (90.35)	49 (9.65)
Israel	15 (6.55)	196 (85.59)	18 (7.86)	15 (6.55)	200 (87.34)	14 (6.11)
Italy	32 (1.38)	2282 (98.23)	9 (0.39)	31 (1.33)	2178 (93.76)	114 (4.91)
Latvia	25 (100)	-	-	2 (8.00)	21 (84.00)	2 (8.00)
Luxembourg	0 (0)	12 (100)	0 (0)	0 (0)	8 (66.67)	4 (33.33)
Rep of Macedonia	1 (1.25)	79 (98.75)	0 (0)	1 (1.25)	79 (98.75)	0 (0)
Rep of Moldova	43 (100)	-	-	43 (100)	-	-
The Netherlands	3 (0.53)	555 (97.54)	11 (1.93)	3 (0.53)	488 (85.76)	78 (13.71)
Norway	6 (7.50)	69 (86.25)	5 (6.25)	3 (3.75)	66 (82.50)	11 (13.75)
Portugal	7 (3.72)	178 (94.68)	3 (1.60)	5 (2.66)	164 (87.23)	19 (10.11)
Romania	0 (0)	47 (100)	0 (0)	0 (0)	47 (100)	0 (0)
Russian Federation	216 (9.44)	2061 (90.04)	12 (0.52)	83 (3.63)	2128 (92.96)	78 (3.41)
Serbia	0 (0)	121 (100)	0 (0)	0 (0)	111 (91.74)	10 (8.26)
Slovak Republic	0 (0)	107 (100)	0 (0)	0 (0)	101 (94.39)	6 (5.61)
Slovenia	0 (0)	57 (95.00)	3 (5.00)	0 (0)	56 (93.33)	4 (6.67)
Spain	240 (22.92)	781 (74.60)	26 (2.48)	13 (1.24)	949 (90.64)	85 (8.12)

Note: Lithuania has 0% coverage for children.

[table 5.5 continued]

Country	Non-tuberculous mycobacteria (NTM) infection this year number (%)			*Stenotrophomonas maltophilia* infection this year number (%)		
	Missing/ unknown	No	Yes	Missing/ unknown	No	Yes
Sweden	0 (0)	245 (96.46)	9 (3.54)	0 (0)	242 (95.28)	12 (4.72)
Switzerland	26 (6.18)	391 (92.87)	4 (0.95)	3 (0.71)	360 (85.51)	58 (13.78)
Turkey	24 (8.42)	258 (90.53)	3 (1.05)	15 (5.26)	261 (91.58)	9 (3.16)
Ukraine	126 (98.44)	2 (1.56)	0 (0)	2 (1.56)	120 (93.75)	6 (4.69)
United Kingdom	10 (0.24)	4027 (95.90)	162 (3.86)	6 (0.14)	3920 (93.36)	273 (6.50)

Table 5.6 Prevalence of non-tuberculous mycobacteria and Stenotrophomonas maltophilia infection in adults seen in 2016, by country.

Country	Non-tuberculous mycobacteria (NTM) infection this year number (%)			*Stenotrophomonas maltophilia* infection this year number (%)		
	Missing/ unknown	No	Yes	Missing/ unknown	No	Yes
Austria	8 (2.20)	329 (90.38)	27 (7.42)	5 (1.37)	310 (85.17)	49 (13.46)
Belgium	0 (0)	749 (98.55)	11 (1.45)	0 (0)	687 (90.39)	73 (9.61)
Bulgaria	62 (98.41)	1 (1.59)	0 (0)	1 (1.59)	61 (96.82)	1 (1.59)
Czech Republic	74 (27.72)	181 (67.79)	12 (4.49)	6 (2.25)	232 (86.89)	29 (10.86)
Denmark	0 (0)	272 (92.83)	21 (7.17)	0 (0)	268 (91.47)	25 (8.53)
France	0 (0)	3595 (97.50)	92 (2.50)	0 (0)	3329 (90.29)	358 (9.71)
Germany	1961 (60.01)	1199 (36.69)	108 (3.30)	174 (5.32)	2766 (84.64)	328 (10.04)
Greece	196 (63.85)	107 (34.85)	4 (1.3)	47 (15.31)	236 (76.87)	24 (7.82)
Hungary	16 (6.90)	211 (90.94)	5 (2.16)	9 (3.88)	205 (88.36)	18 (7.76)
Ireland	<5 (0.31)	615 (96.70)	19 (2.99)	<5 (0.31)	565 (88.84)	69 (10.85)
Israel	16 (5.18)	251 (81.23)	42 (13.59)	15 (4.85)	273 (88.35)	21 (6.80)
Italy	39 (1.28)	2962 (97.50)	37 (1.22)	39 (1.28)	2815 (92.66)	184 (6.06)
Latvia	11 (100)	-	-	0 (0)	11 (100)	0 (0)
Lithuania	2 (16.67)	10 (83.33)	0 (0)	2 (16.67)	9 (75.00)	1 (8.33)
Luxembourg	0 (0)	17 (85.00)	3 (15.00)	0 (0)	17 (85.00)	3 (15.00)
Rep of Macedonia	0 (0)	28 (96.55)	1 (3.45)	0 (0)	29 (100)	0 (0)
The Netherlands	70 (8.30)	756 (89.68)	17 (2.02)	70 (8.30)	678 (80.43)	95 (11.27)
Norway	28 (18.67)	111 (74.00)	11 (7.33)	24 (16.00)	93 (62.00)	33 (22.00)
Portugal	6 (4.58)	120 (91.60)	5 (3.82)	5 (3.82)	116 (88.55)	10 (7.63)
Russian Federation	237 (32.33)	490 (66.85)	6 (0.82)	56 (7.64)	653 (89.09)	24 (3.27)
Serbia	0 (0)	49 (100)	0 (0)	0 (0)	49 (100)	0 (0)
Slovak Republic	0 (0)	140 (100)	0 (0)	0 (0)	133 (95.00)	7 (5.00)
Slovenia	10 (23.81)	31 (73.81)	1 (2.38)	13 (30.95)	27 (64.29)	2 (4.76)
Spain	140 (16.45)	672 (78.97)	39 (4.58)	63 (7.40)	725 (85.20)	63 (7.40)

[table 5.6 continued]

Country	Non-tuberculous mycobacteria (NTM) infection this year number (%)			*Stenotrophomonas maltophilia* infection this year number (%)		
	Missing/ unknown	No	Yes	Missing/ unknown	No	Yes
Sweden	0 (0)	372 (94.18)	23 (5.82)	0 (0)	367 (92.91)	28 (7.09)
Switzerland	54 (11.13)	404 (83.30)	27 (5.57)	34 (7.01)	395 (81.44)	56 (11.55)
Turkey	2 (7.14)	24 (85.72)	2 (7.14)	0 (0)	26 (92.86)	2 (7.14)
Ukraine	20 (90.90)	1 (4.55)	1 (4.55)	0 (0)	22 (100)	0 (0)
United Kingdom	123 (2.24)	4968 (90.39)	405 (7.37)	113 (2.06)	5023 (91.39)	360 (6.55)

Note: Romania and Rep of Moldova have <5 patients aged 18 years or more at 31/12/2016 and are excluded from this table.

6. Nutrition

Pancreatic insufficiency is usually defined as absence of pancreatic enzymes in two stool samples (or elevated levels of fat in stools). Since information on both was rarely collected by the national registries, we therefore applied the information on the use of pancreatic enzymes as an indicator of pancreatic insufficiency.

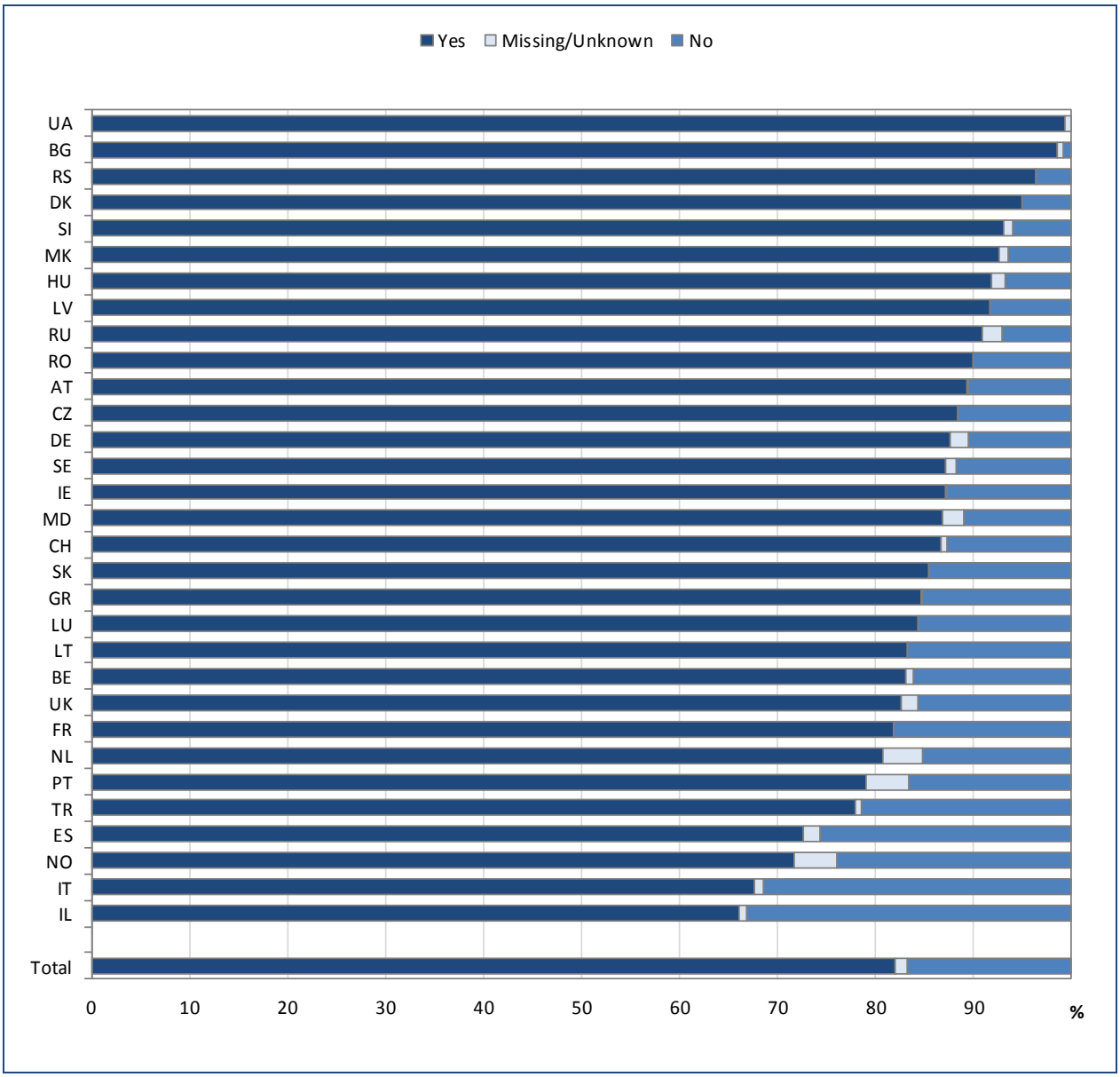
We collected weight and height measured on the date the best FEV_1 value was recorded and, for patients that did not perform spirometry, the last measurements of the year were considered. From these raw values we calculated body mass index (BMI). A patient with a low weight is not necessarily underweight if the height is also low, and BMI may better illustrate the nutritional status; BMI describes the weight/height relationship and is considered a good measure of nutritional status. The ECFS Standards of Care guidelines recommend: for adults, a BMI of above 20 kg/m^2; for older children and adolescents, the 50th percentile for BMI; for infants and children up to 2 years of age, weight and height percentiles similar to those for the non-CF population.[2]

Weight, height and BMI were then expressed in terms of so-called z-scores by using a reference population of healthy individuals (in this case the US population with reference values issued by the Centre for Disease Control, USA, see Appendix 1, page 134, for details).

A z-score of 0 means that the height/weight/BMI is equal to the mean height/weight/BMI of people of the same age and sex of the reference population. A z-score of -2 means that the height/weight/BMI value is 2 standard deviations below the mean height/weight/BMI of people of the same age and sex of the reference population; a z-score of +2 means that the value is 2 standard deviations above that mean. In the reference population, 95% of all individuals have a z-score for weight between -2 and +2 (the same for height) and it is expected that the same happens for approximately 95% of individuals of a population without conditions that affect weight (or height). The average z-score for a largely healthy population should be very close to zero.

[2] A.R. Smyth et al, JCF 2014;13, S23–S42

Figure 6.1 Use of pancreatic enzymes in 2016 for all patients, by country and overall.



This graph shows the use of pancreatic enzymes by country. This can be seen as an informed estimate of pancreatic insufficiency.

Table 6.1 Number of patients for whom height and weight measurements were available. All patients seen in 2016.

Country	Number of patients	Height		Weight	
		N	N miss	N	N miss
Austria	**740**	725	15	728	12
Belgium	**1246**	1242	4	1242	4
Bulgaria	**140**	138	2	139	1
Czech Republic	**585**	580	5	579	6
Denmark	**482**	468	14	467	15
France	**6713**	6573	140	6561	152
Germany	**5738**	5642	96	5625	113
Greece	**594**	587	7	584	10
Hungary	**507**	488	19	487	20
Ireland	**1144**	1083	61	1001	143
Israel	**538**	524	14	526	12
Italy	**5361**	5183	178	5186	175
Latvia	**36**	36	0	36	0
Lithuania	**12**	10	2	10	2
Luxembourg	**32**	30	2	32	0
Rep of Macedonia	**109**	108	1	108	1
Rep of Moldova	**46**	44	2	45	1
The Netherlands	**1412**	1401	11	1400	12
Norway	**230**	224	6	223	7
Portugal	**319**	312	7	312	7
Romania	**50**	50	0	50	0
Russian Federation	**3022**	2850	172	2865	157
Serbia	**170**	163	7	165	5
Slovak Republic	**247**	245	2	245	2
Slovenia	**102**	101	1	101	1
Spain	**1898**	1768	130	1782	116
Sweden	**649**	640	9	633	16
Switzerland	**906**	885	21	886	20
Turkey	**313**	284	29	309	4
Ukraine	**150**	149	1	149	1
United Kingdom	**9695**	9542	153	9558	137

Table 6.2 Z-scores for height: descriptive statistics by country. Patients aged 17 years or younger.

Country	N	Mean	Min	25th pctl (25% of the patients are below this z-score for height)	Median (50% of the patients are below this z-score for height)	75th pctl (75% of the patients are below this z-score for height)	Max
Austria	374	0.0	-4.5	-0.7	0.0	0.7	3.7
Belgium	511	-0.3	-3.5	-1.0	-0.3	0.4	2.9
Bulgaria	77	-0.5	-3.6	-1.3	-0.4	0.3	3.6
Czech Republic	328	0.2	-3.8	-0.6	0.1	1.0	5.8
Denmark	197	0.0	-2.2	-0.6	0.0	0.5	2.5
France	3036	-0.4	-5.6	-1.1	-0.5	0.3	6.5
Germany	2567	-0.2	-7.5	-0.9	-0.2	0.5	6.8
Greece	293	-0.2	-4.0	-1.0	-0.3	0.4	3.3
Hungary	279	0.0	-4.3	-0.8	-0.1	0.8	5.7
Ireland	486	-0.2	-3.6	-0.9	-0.3	0.5	2.4
Israel	226	-0.5	-3.8	-1.3	-0.6	0.2	2.4
Italy	2327	-0.1	-7.8	-0.8	-0.1	0.7	5.7
Latvia	26	0.2	-2.3	-0.4	0.3	0.9	1.9
Luxembourg	10	0.2	-1.8	-0.6	0.0	1.1	2.1
Rep of Macedonia	79	-0.4	-4.4	-1.3	-0.6	0.6	2.4
Rep of Moldova	42	-0.8	-4.3	-1.6	-0.7	0.2	1.4
The Netherlands	584	0.2	-4.0	-0.4	0.3	0.9	3.5
Norway[1]	81	0.0	-2.2	-0.6	0.1	0.7	2.2
Portugal	193	-0.5	-3.1	-1.3	-0.6	0.3	3.3
Romania	49	-0.3	-2.9	-1.0	-0.3	0.4	1.4
Russian Federation	2232	-0.5	-9.8	-1.3	-0.4	0.4	8.3
Serbia	117	-0.3	-3.0	-1.0	-0.4	0.4	2.6
Slovak Republic	111	0.4	-3.1	-0.4	0.2	1.3	4.3
Slovenia	60	0.1	-1.7	-0.6	-0.1	0.7	3.0
Spain	1006	-0.2	-4.6	-0.9	-0.2	0.5	4.9
Sweden	257	-0.1	-4.9	-0.7	-0.1	0.6	2.9
Switzerland	422	-0.3	-6.2	-0.9	-0.2	0.4	5.1
Turkey	258	-0.2	-4.9	-1.3	-0.3	0.6	5.5
Ukraine	131	-0.5	-4.1	-1.2	-0.4	0.2	2.7
United Kingdom	4292	-0.3	-4.5	-1.0	-0.3	0.4	5.4

[1] Norway: sometimes any value (instead of last of the year) for height is used when no lung function test was available.

Note: Lithuania has 0% coverage for children.

This table reports the median z-score for height (the value that separates the highest and lowest half of the patients), the mean z-score for height (the average) and other descriptive statistics for children (17 years or younger).

Table 6.3 Z-scores for height: descriptive statistics by country. Patients aged 18 years or older.

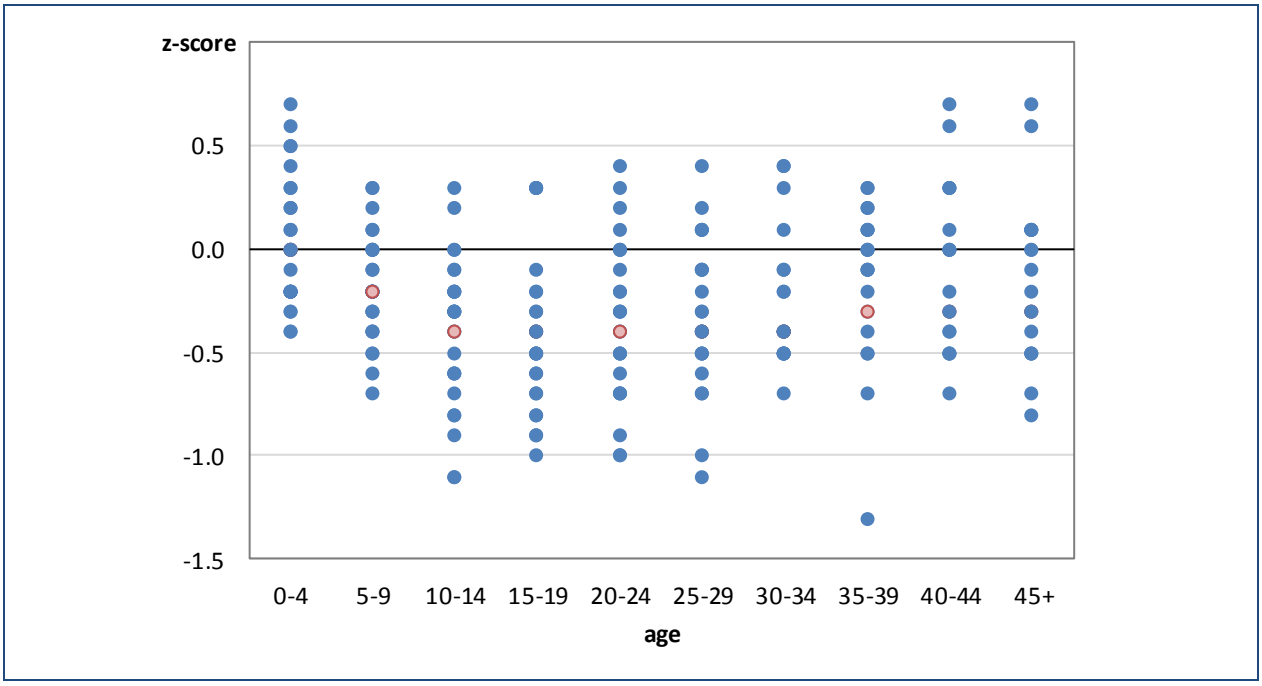
Country	N	Mean	Min	25th pctl (25% of the patients are below this z-score for height)	Median (50% of the patients are below this z-score for height)	75th pctl (75% of the patients are below this z-score for height)	Max
Austria	351	-0.2	-3.4	-0.8	-0.3	0.3	2.7
Belgium	731	-0.3	-3.9	-1.0	-0.4	0.4	3.2
Bulgaria	61	-0.4	-2.6	-1.0	-0.5	0.3	1.9
Czech Republic	252	-0.1	-3.4	-0.7	-0.1	0.4	3.1
Denmark	271	0.1	-2.5	-0.5	0.1	0.9	3.2
France	3537	-0.5	-5.7	-1.2	-0.5	0.1	3.2
Germany	3075	-0.1	-4.0	-0.8	-0.1	0.6	5.1
Greece	294	-0.5	-3.6	-1.2	-0.5	0.3	2.0
Hungary	209	-0.1	-2.9	-0.8	-0.1	0.6	3.6
Ireland	597	-0.4	-5.1	-1.0	-0.4	0.3	2.1
Israel	298	-0.7	-4.3	-1.4	-0.7	0.1	2.4
Italy	2856	-0.6	-4.4	-1.2	-0.5	0.1	2.9
Latvia	10	0.5	-1.1	-0.1	0.9	1.1	1.5
Lithuania	10	1.4	-0.1	0.7	1.4	2.1	2.4
Luxembourg	20	-0.1	-2.6	-1.0	0.1	0.5	2.4
Rep of Macedonia	29	-0.4	-2.6	-1.0	-0.5	0.1	2.4
The Netherlands	817	0.3	-3.0	-0.4	0.4	1.0	4.0
Norway[1]	143	0.3	-2.5	-0.3	0.3	0.9	2.8
Portugal	119	-0.8	-3.0	-1.4	-0.8	-0.2	1.3
Russian Federation	618	-0.3	-9.5	-1.0	-0.3	0.4	3.4
Serbia	46	0.1	-1.5	-0.5	0.0	0.7	2.3
Slovak Republic	134	0.0	-3.7	-0.5	0.1	0.7	2.4
Slovenia	41	-0.1	-1.6	-1.0	0.1	0.6	2.4
Spain	762	-0.7	-3.8	-1.4	-0.7	-0.1	2.8
Sweden	383	0.1	-2.8	-0.6	0.2	0.7	3.3
Switzerland	463	-0.3	-3.7	-0.8	-0.3	0.3	2.7
Turkey	26	-0.9	-2.5	-1.6	-0.8	-0.3	0.5
Ukraine	18	-0.5	-1.7	-1.0	-0.6	0.0	0.6
United Kingdom	5250	-0.4	-6.0	-1.0	-0.4	0.3	3.5

[1] Norway: sometimes any value (instead of last of the year) for height is used when no lung function test was available.

Note: Romania has only 1 patient aged 18 years or more at height measurement and is excluded from this table. Rep of Moldova has only 2 patients aged 18 years or more at height measurement and is excluded from this table.

This table reports the median z-score for height (the value that separates the highest and lowest half of the patients), the mean z-score for height (the average) and other descriptive statistics for adults (18 years or older).

Figure 6.2 Median z-scores for height by age group and by country. All patients seen in 2016.



Note: We excluded from the analyses those age groups where the number of patients was <10.

This graph shows the median z-scores for height by age group. Each country is represented by a dot (in blue) and the overall median estimate is in red. The overall median z-scores for height tend to slowly decrease up to the teenage years and then rise again before levelling out. The graph also shows that there is large variability between countries.

Table 6.4 Z-scores for height: descriptive statistics by age group. All patients seen in 2016.

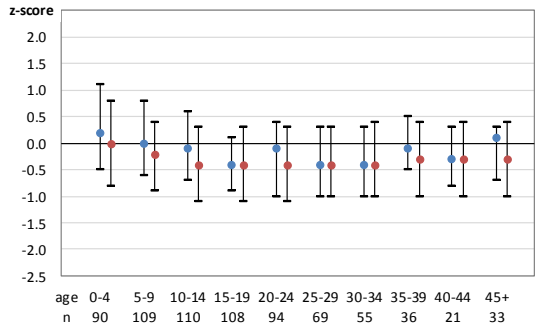
Age at height measurement	N	Mean	Min	25th pctl	Median	75th pctl	Max
0-4	5345	0.0	-9.8	-0.8	0.0	0.8	8.3
5-9	6145	-0.2	-7.5	-0.9	-0.2	0.4	7.0
10-14	5644	-0.4	-7.7	-1.1	-0.4	0.3	5.0
15-19	5533	-0.4	-7.0	-1.1	-0.4	0.3	4.2
20-24	4915	-0.4	-4.7	-1.1	-0.4	0.3	4.0
25-29	4431	-0.4	-4.3	-1.0	-0.4	0.3	3.6
30-34	3347	-0.3	-9.5	-1.0	-0.4	0.4	3.6
35-39	2445	-0.3	-5.7	-1.0	-0.3	0.4	3.3
40-44	1672	-0.2	-3.7	-1.0	-0.3	0.4	5.1
45+	2598	-0.3	-5.1	-1.0	-0.3	0.4	3.3

This table reports the median z-score for height and other descriptive statistics by age group for all the patients seen in 2016. The median values reported in this table are shown as red dots in fig 6.2.

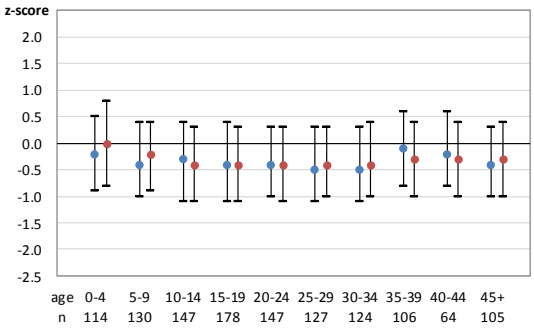
Figure 6.3 Quartiles of z-scores for height by age group and by country. All patients seen in 2016.

The figures below show the z-scores for height by country. The dot is the median and the whiskers show the 25th and 75th percentiles. In blue are the quartiles for the country, in red are the pooled quartiles computed on all other countries (i.e. excluding that country). We did not compute quartiles where the number of patients in the age group is <10, therefore there are no blue dots for those age groups (the number of patients in each age group is shown underneath the horizontal axis). We therefore excluded Lithuania and Luxembourg from the graphs because none of the age groups in these countries had more than 10 patients.

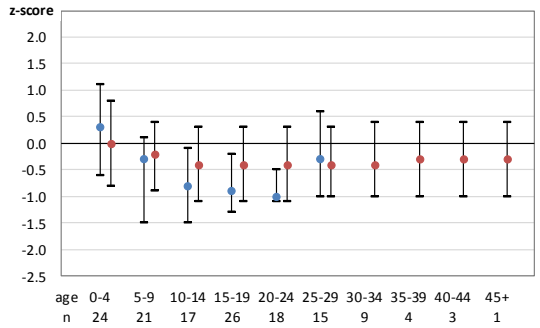
Quartiles of z-scores for height: Austria



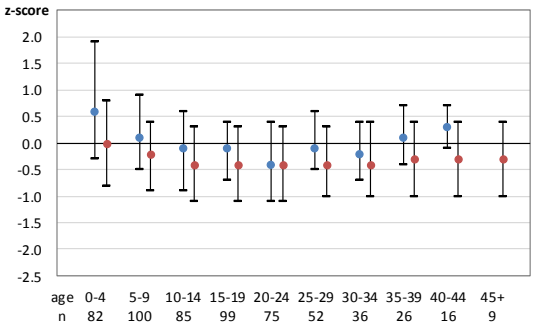
Quartiles of z-scores for height: Belgium



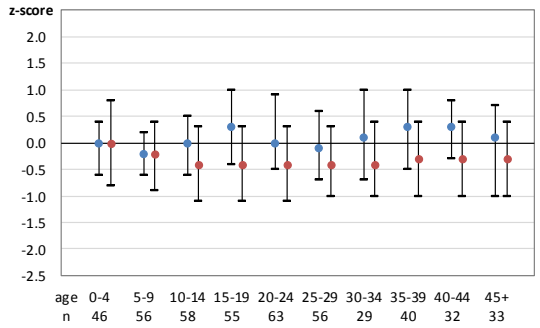
Quartiles of z-scores for height: Bulgaria



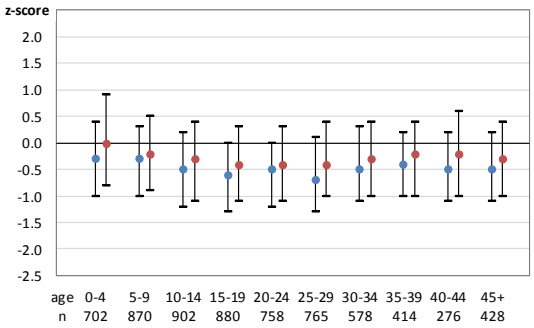
Quartiles of z-scores for height: Czech Republic



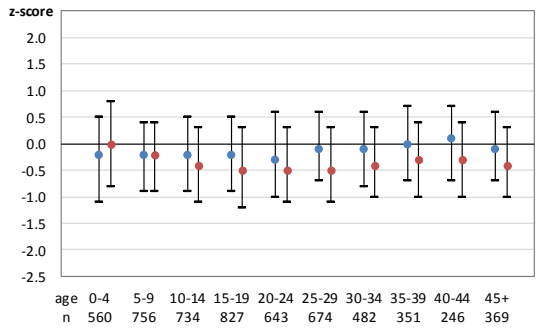
Quartiles of z-scores for height: Denmark



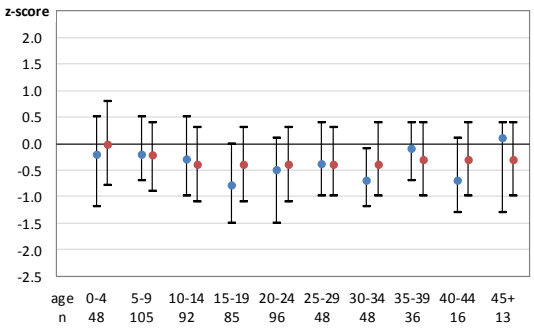
Quartiles of z-scores for height: France



Quartiles of z-scores for height: Germany

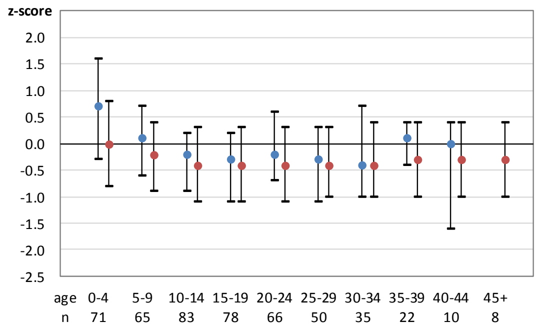


Quartiles of z-scores for height: Greece

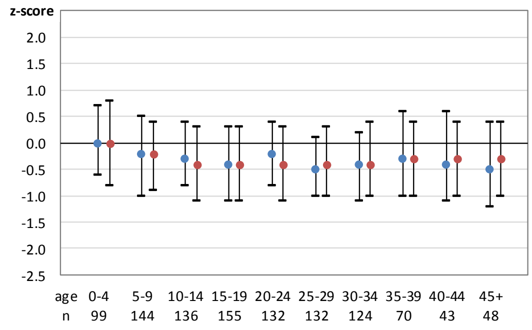


[figure 6.3 continued]

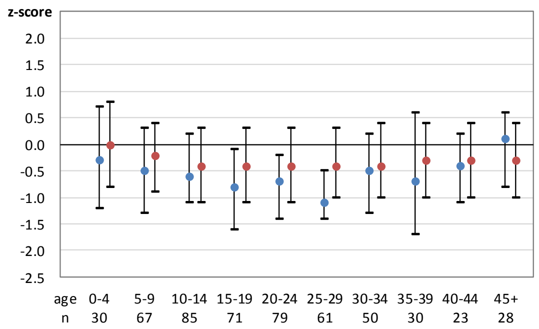
Quartiles of z-scores for height: Hungary



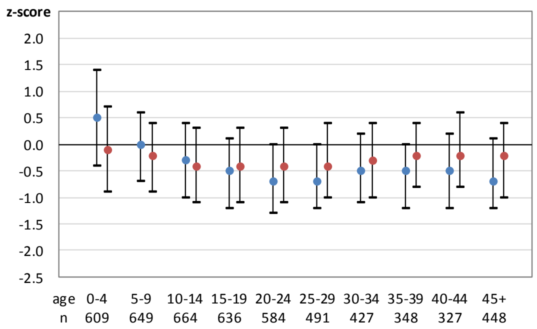
Quartiles of z-scores for height: Ireland



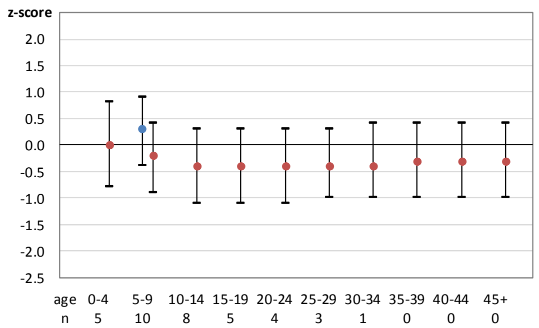
Quartiles of z-scores for height: Israel



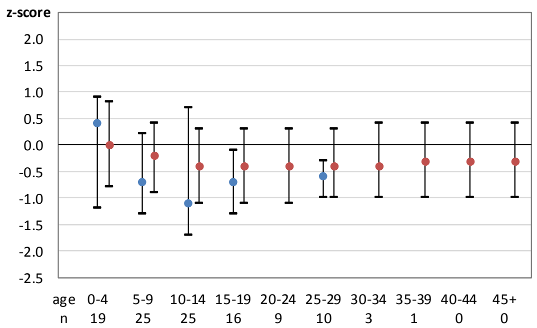
Quartiles of z-scores for height: Italy



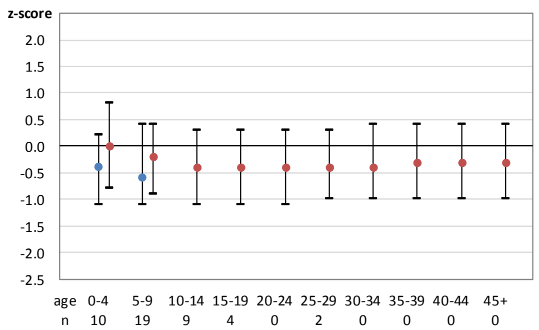
Quartiles of z-scores for height: Latvia



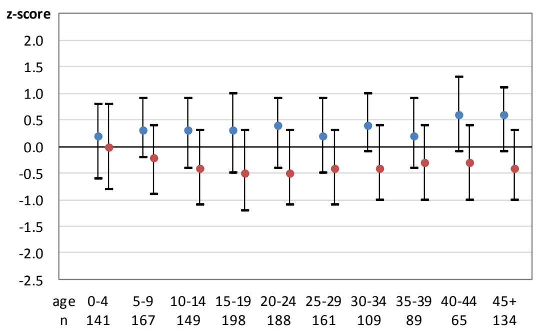
Quartiles of z-scores for height: Rep of Macedonia



Quartiles of z-scores for height: Rep of Moldova

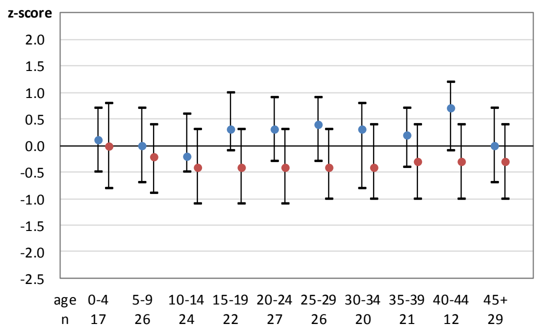


Quartiles of z-scores for height: The Netherlands

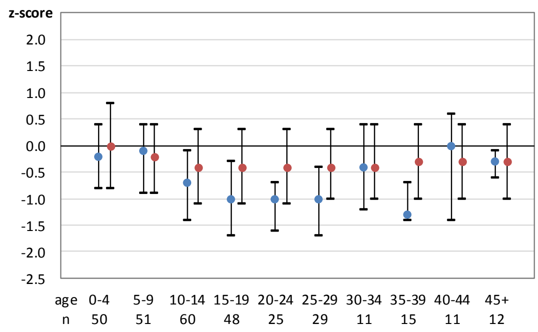


[figure 6.3 continued]

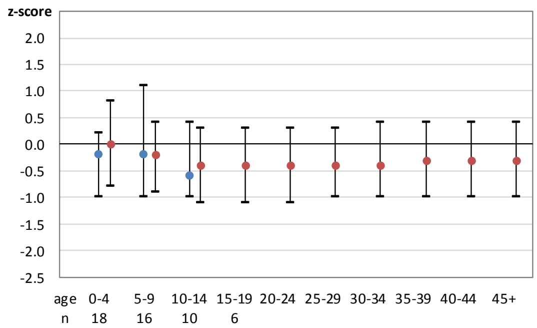
Quartiles of z-scores for height: Norway



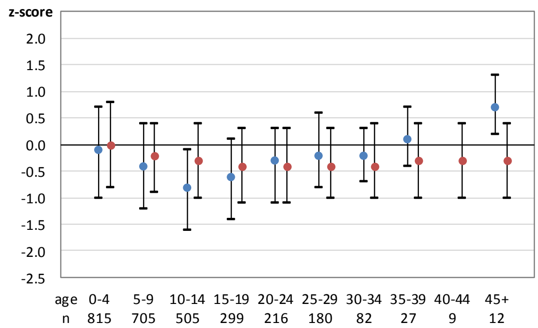
Quartiles of z-scores for height: Portugal



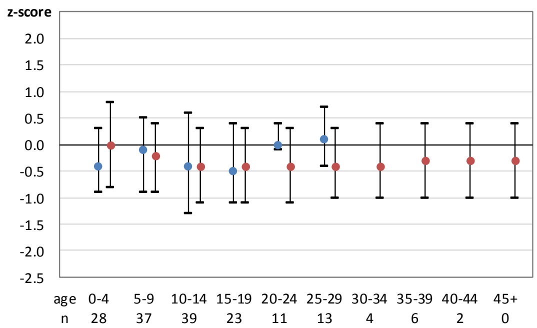
Quartiles of z-scores for height: Romania



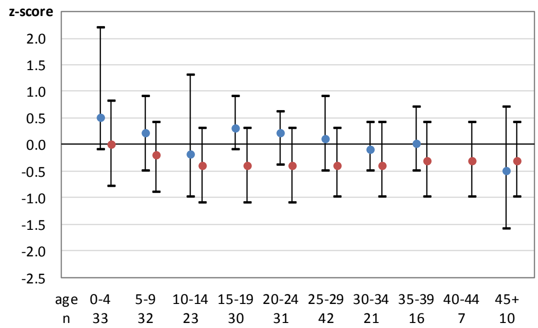
Quartiles of z-scores for height: Russian Federation



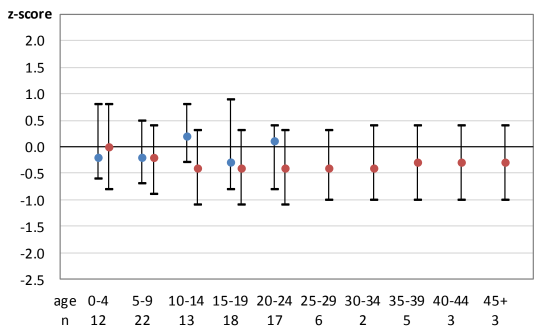
Quartiles of z-scores for height: Serbia



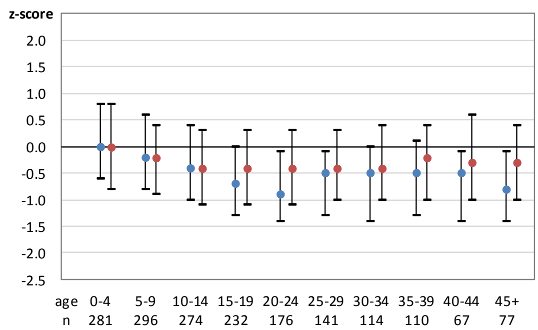
Quartiles of z-scores for height: Slovak Republic



Quartiles of z-scores for height: Slovenia

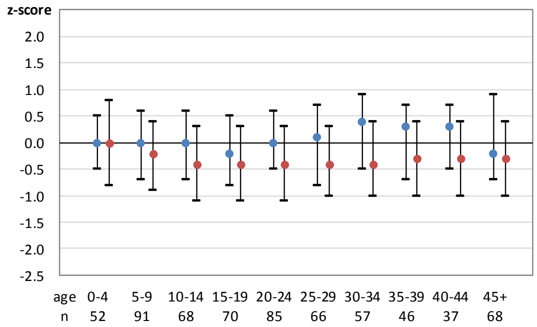


Quartiles of z-scores for height: Spain

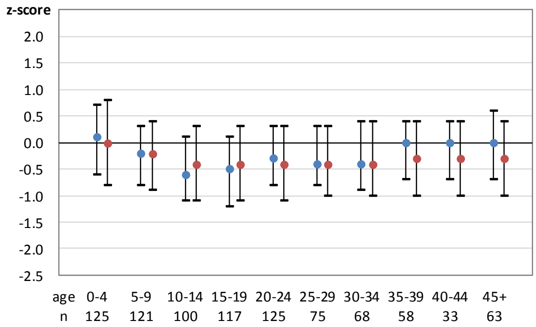


[figure 6.3 continued]

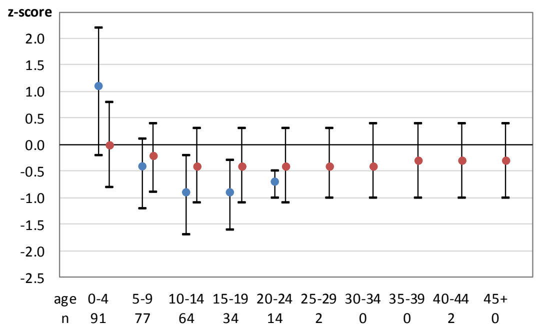
Quartiles of z-scores for height: Sweden



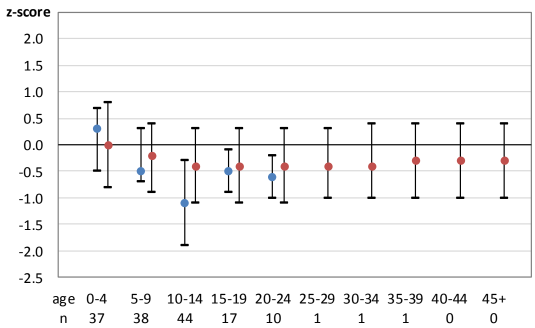
Quartiles of z-scores for height: Switzerland



Quartiles of z-scores for height: Turkey



Quartiles of z-scores for height: Ukraine



Quartiles of z-scores for height: United Kingdom

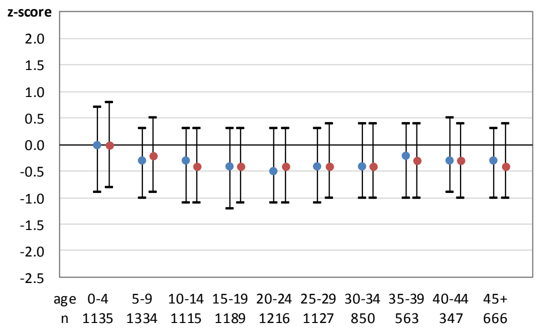


Table 6.5 Z-scores for weight: descriptive statistics by country. Patients aged 17 years or younger.

Country	N	Mean	Min	25th pctl (25% of the patients are below this z-score for weight)	Median (50% of the patients are below this z-score for weight)	75th pctl (75% of the patients are below this z-score for weight)	Max
Austria	377	-0.3	-3.5	-1.0	-0.2	0.4	2.4
Belgium	511	-0.5	-3.7	-1.1	-0.4	0.2	2.4
Bulgaria	78	-1.1	-5.3	-1.9	-0.8	-0.1	1.3
Czech Republic	328	-0.1	-4.4	-0.8	0.0	0.6	3.5
Denmark	197	-0.3	-3.5	-1.0	-0.2	0.4	2.1
France	3039	-0.6	-6.2	-1.3	-0.5	0.1	2.6
Germany	2568	-0.5	-6.1	-1.1	-0.4	0.3	3.1
Greece	293	-0.1	-3.5	-0.7	0.1	0.8	2.8
Hungary	278	-0.5	-6.6	-1.3	-0.4	0.3	3.8
Ireland	490	-0.1	-5.8	-0.7	0.0	0.6	3.1
Israel	228	-0.5	-4.0	-1.3	-0.4	0.3	2.7
Italy	2331	-0.1	-6.8	-0.9	-0.1	0.6	8.3
Latvia	26	-0.4	-2.0	-0.8	-0.3	0.2	0.9
Luxembourg	12	-0.4	-3.3	-1.1	-0.3	0.5	1.1
Rep of Macedonia	79	-0.4	-5.4	-1.4	-0.5	0.7	2.7
Rep of Moldova	43	-1.2	-6.1	-2.4	-1.0	0.0	1.1
The Netherlands	583	-0.1	-4.5	-0.6	0.0	0.5	2.4
Norway[1]	81	-0.3	-2.4	-0.8	-0.2	0.2	2.3
Portugal	193	-0.5	-5.3	-1.3	-0.5	0.2	5.8
Romania	49	-0.6	-3.6	-1.5	-0.6	0.2	1.7
Russian Federation	2246	-0.9	-7.8	-1.7	-0.8	0.0	8.2
Serbia	119	-0.7	-7.5	-1.4	-0.7	0.1	3.1
Slovak Republic	111	-0.1	-3.1	-0.9	-0.2	0.6	2.8
Slovenia	60	-0.3	-2.7	-0.9	-0.2	0.3	1.8
Spain	1011	-0.3	-5.4	-0.9	-0.3	0.5	4.6
Sweden	257	-0.2	-4.4	-0.8	-0.1	0.4	2.0
Switzerland	423	-0.4	-6.0	-1.0	-0.3	0.2	3.3
Turkey	283	-0.5	-5.9	-1.4	-0.3	0.4	5.6
Ukraine	131	-1.1	-4.9	-1.9	-1.0	-0.4	4.6
United Kingdom	4310	-0.2	-6.5	-0.8	-0.1	0.6	4.4

[1] Norway: sometimes any value (instead of last of the year) for weight is used when no lung function test was available.

Note: Lithuania has 0% coverage for children.

This table reports the median z-score for weight (the value that separates the highest and lowest half of the patients), the mean z-score for weight (the average) and other descriptive statistics for children (17 years or younger).

Table 6.6 Z-scores for weight: descriptive statistics by country. Patients aged 18 years or older.

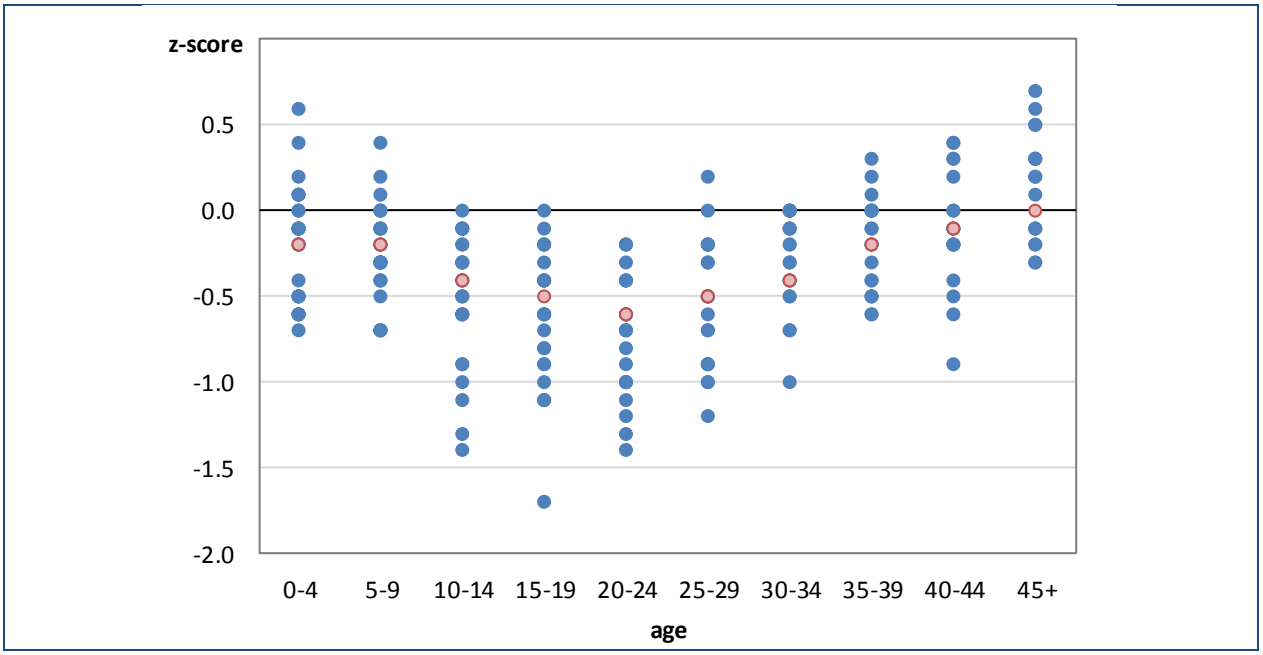
Country	N	Mean	Min	25th pctl (25% of the patients are below this z-score for weight)	Median (50% of the patients are below this z-score for weight)	75th pctl (75% of the patients are below this z-score for weight)	Max
Austria	351	-0.6	-4.7	-1.3	-0.5	0.2	2.3
Belgium	731	-0.5	-6.2	-1.2	-0.4	0.3	2.2
Bulgaria	61	-1.3	-6.8	-1.9	-1.2	-0.4	2.3
Czech Republic	251	-0.6	-4.6	-1.3	-0.5	0.2	2.1
Denmark	270	-0.2	-5.4	-1.0	0.0	0.6	2.3
France	3522	-0.8	-7.4	-1.5	-0.7	0.0	2.9
Germany	3057	-0.5	-5.8	-1.1	-0.4	0.3	2.9
Greece	291	-0.6	-5.4	-1.2	-0.4	0.3	2.0
Hungary	209	-0.8	-5.0	-1.6	-0.6	0.0	2.0
Ireland	511	-0.3	-5.8	-0.9	-0.2	0.4	2.5
Israel	298	-0.5	-4.7	-1.3	-0.4	0.4	2.4
Italy	2855	-0.5	-7.4	-1.2	-0.4	0.2	2.9
Latvia	10	-0.5	-1.9	-1.2	-0.4	0.0	0.7
Lithuania	10	-0.1	-1.2	-0.5	0.0	0.4	1.3
Luxembourg	20	-0.2	-4.5	-0.9	0.0	0.7	2.3
Rep of Macedonia	29	-0.7	-3.1	-1.2	-0.6	0.2	1.6
The Netherlands	817	0.0	-4.3	-0.6	0.0	0.6	2.6
Norway[1]	142	0.0	-3.6	-0.7	0.0	0.6	2.7
Portugal	119	-0.6	-6.0	-1.2	-0.4	0.3	2.4
Russian Federation	619	-1.3	-7.3	-2.1	-1.2	-0.4	2.4
Serbia	46	-0.9	-3.6	-1.5	-1.0	-0.2	1.2
Slovak Republic	134	-0.4	-4.4	-1.3	-0.2	0.4	2.4
Slovenia	41	-1.0	-4.6	-1.6	-1.0	-0.1	1.3
Spain	771	-0.6	-4.9	-1.2	-0.5	0.2	2.4
Sweden	376	-0.1	-4.6	-0.7	0.0	0.6	2.9
Switzerland	463	-0.6	-4.2	-1.2	-0.5	0.1	2.1
Turkey	26	-1.1	-2.7	-1.7	-1.1	-0.6	0.6
Ukraine	18	-1.3	-3.5	-2.3	-1.0	-0.6	0.2
United Kingdom	5248	-0.2	-9.2	-0.9	-0.1	0.6	3.8

[1] Norway: sometimes any value (instead of last of the year) for weight is used when no lung function test was available.

Note: Romania and Rep of Moldova have <5 patients aged 18 years or more at height measurement and are excluded from this table.

This table reports the median z-score for weight (the value that separates the highest and lowest half of the patients), the mean z-score for weight (the average) and other descriptive statistics for adults (18 years or older).

Figure 6.4 Median z-scores for weight by age group and by country. All patients seen in 2016.



Note: We excluded from the analyses those age groups where the number of patients was <10.

This graph shows the median z-scores for weight by age group. Each country is represented by a dot (in blue) and the overall estimate is in red. Overall, the median z-scores for weight decrease from the third youngest age group to the 20-24 years age group before they increase in the older age groups. Again, the patients in the oldest age groups are patients that survived, and may therefore represent the patients with less disease severity. There is considerable variability between countries.

Table 6.7 Z-scores for weight: descriptive statistics by age group. All patients seen in 2016.

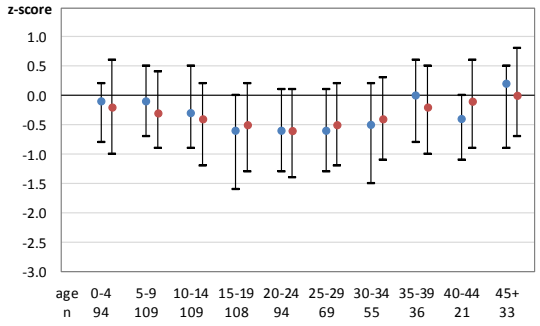
Age at weight measurement	N	Mean	Min	25th pctl	Median	75th pctl	Max
0-4	5431	-0.3	-7.7	-1.0	-0.2	0.6	8.3
5-9	6153	-0.3	-7.8	-0.9	-0.2	0.4	3.1
10-14	5644	-0.5	-7.3	-1.2	-0.4	0.3	4.3
15-19	5516	-0.7	-7.8	-1.3	-0.5	0.2	2.8
20-24	4889	-0.7	-7.4	-1.4	-0.6	0.1	3.0
25-29	4393	-0.6	-6.8	-1.2	-0.5	0.2	3.5
30-34	3326	-0.4	-9.2	-1.1	-0.4	0.3	2.8
35-39	2431	-0.3	-7.4	-1.0	-0.2	0.5	3.8
40-44	1662	-0.2	-5.4	-0.9	-0.1	0.6	3.2
45+	2589	0.0	-6.8	-0.7	0.0	0.8	2.9

This table reports the median z-score for weight and other descriptive statistics by age group for all the patients seen in 2016. The median values reported in this table are shown as red dots in fig 6.4.

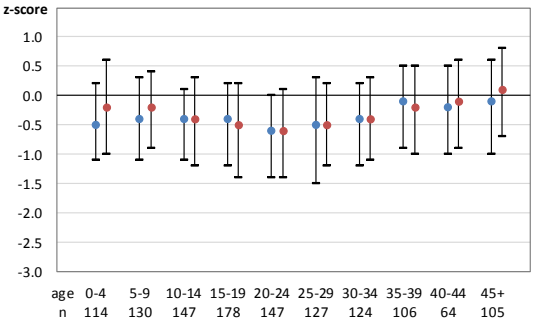
Figure 6.5 Quartiles of z-scores for weight by age group and by country. All patients seen in 2016.

The figures below show the z-scores for weight by country. The dot is the median, and the whiskers show the 25th and 75th percentiles. In blue are the quartiles for the country, in red are the pooled quartiles computed on all other countries (i.e. excluding that country). We did not compute quartiles where the number of patients in the age group is <10. Therefore, there are no blue dots for those age groups (the number of patients in each age group is shown underneath the horizontal axis). We therefore excluded Lithuania and Luxembourg from the graphs because none of the age groups in these countries had more than 10 patients.

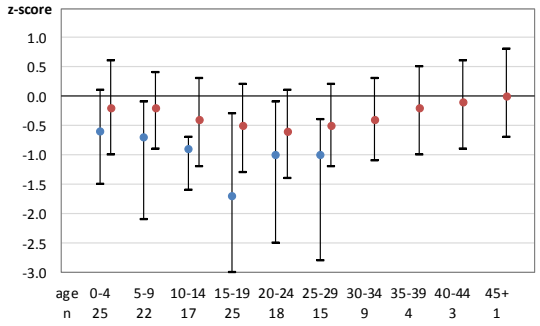
Quartiles of z-scores for weight: Austria



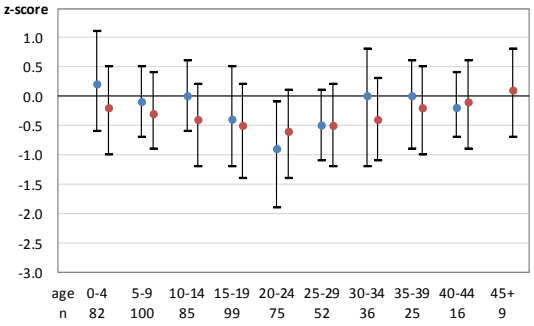
Quartiles of z-scores for weight: Belgium



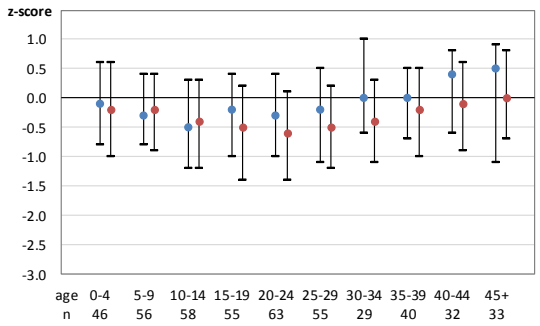
Quartiles of z-scores for weight: Bulgaria



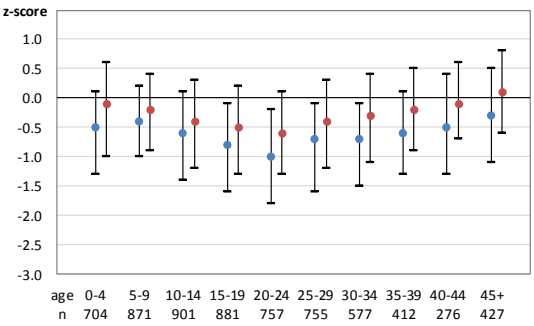
Quartiles of z-scores for weight: Czech Republic



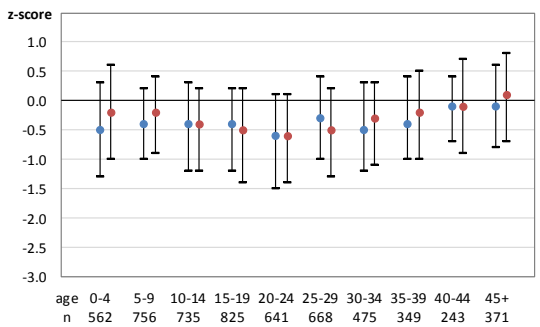
Quartiles of z-scores for weight: Denmark



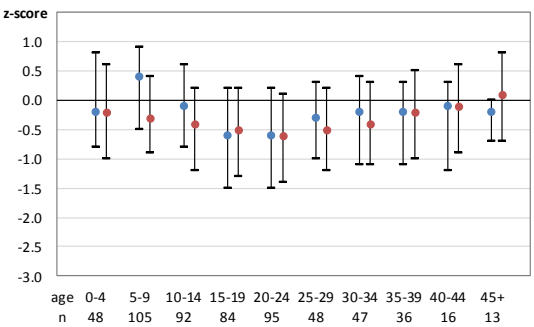
Quartiles of z-scores for weight: France



Quartiles of z-scores for weight: Germany

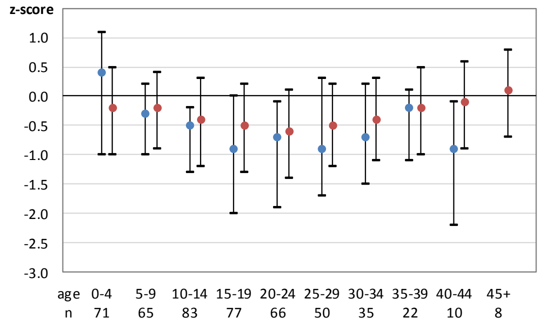


Quartiles of z-scores for weight: Greece

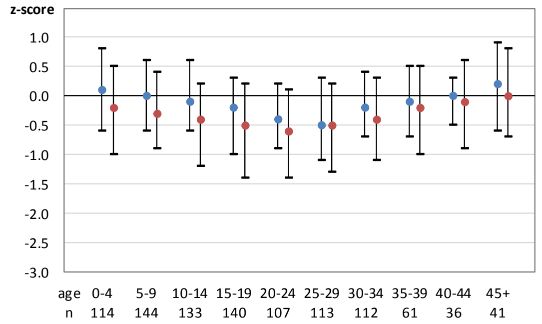


[figure 6.5 continued]

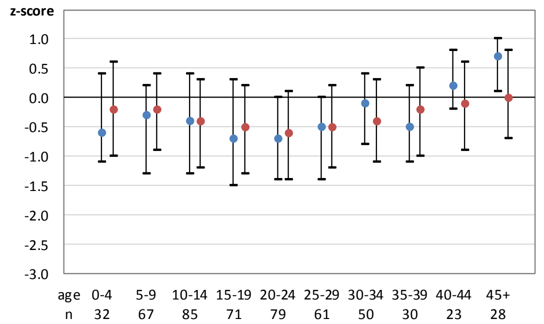
Quartiles of z-scores for weight: Hungary



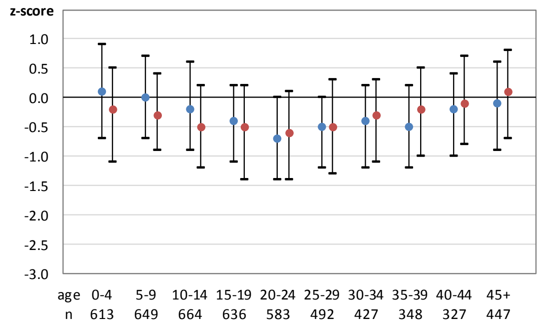
Quartiles of z-scores for weight: Ireland



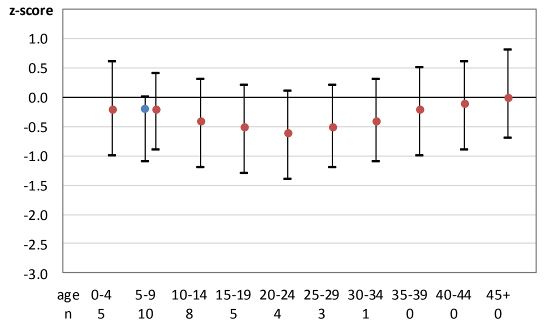
Quartiles of z-scores for weight: Israel



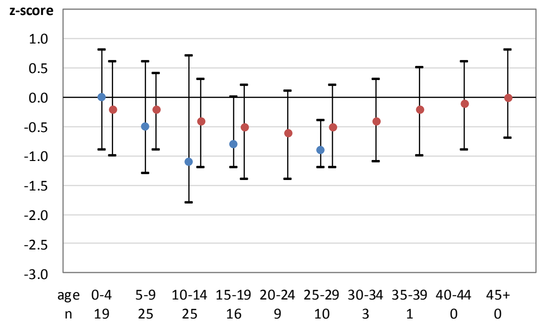
Quartiles of z-scores for weight: Italy



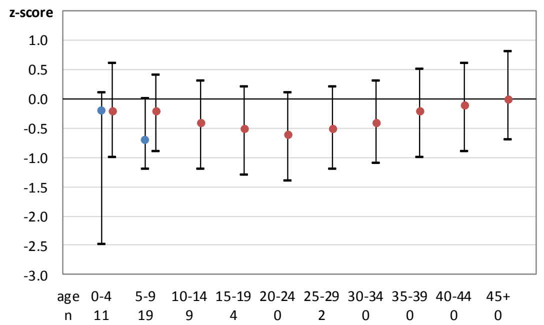
Quartiles of z-scores for weight: Latvia



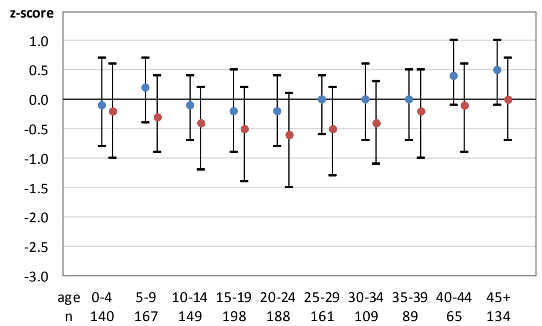
Quartiles of z-scores for weight: Rep of Macedonia



Quartiles of z-scores for weight: Rep of Moldova

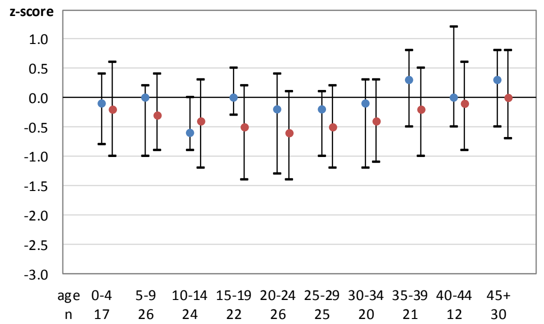


Quartiles of z-scores for weight: The Netherlands

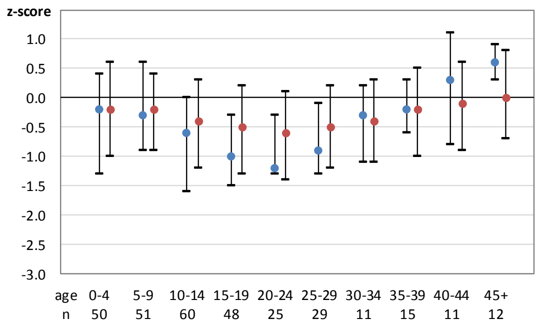


[figure 6.5 continued]

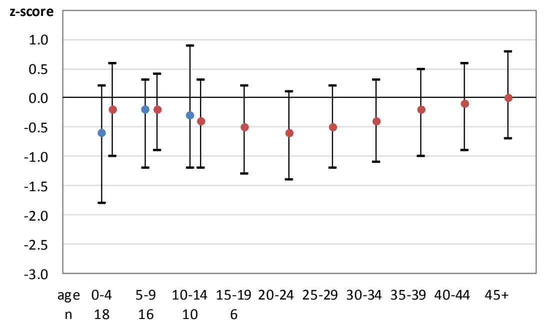
Quartiles of z-scores for weight: Norway



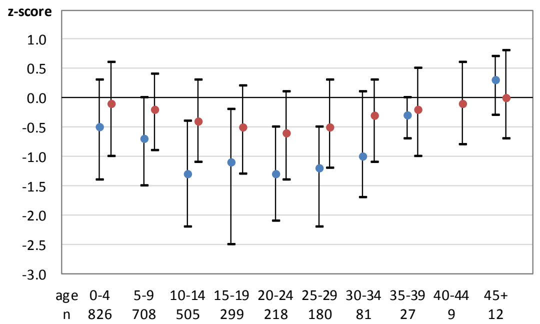
Quartiles of z-scores for weight: Portugal



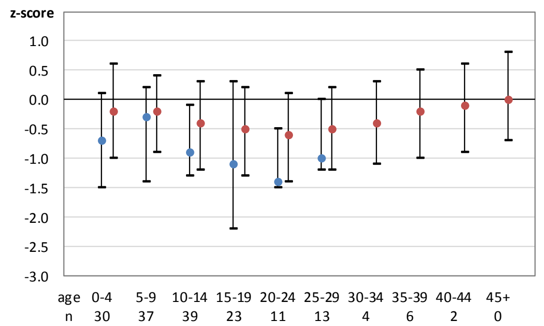
Quartiles of z-scores for weight: Romania



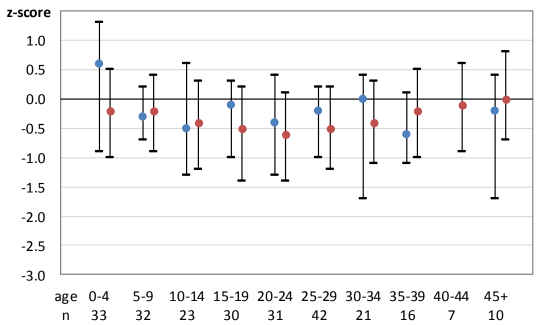
Quartiles of z-scores for weight: Russian Federation



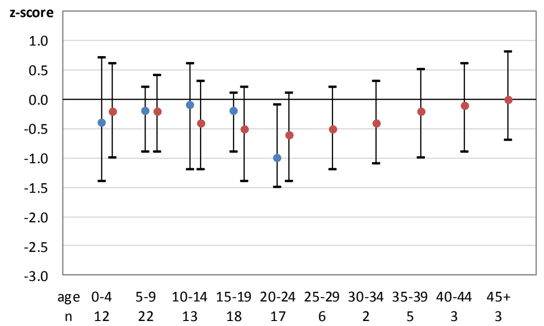
Quartiles of z-scores for weight: Serbia



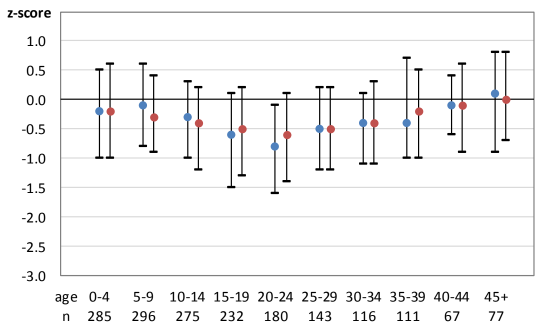
Quartiles of z-scores for weight: Slovak Republic



Quartiles of z-scores for weight: Slovenia

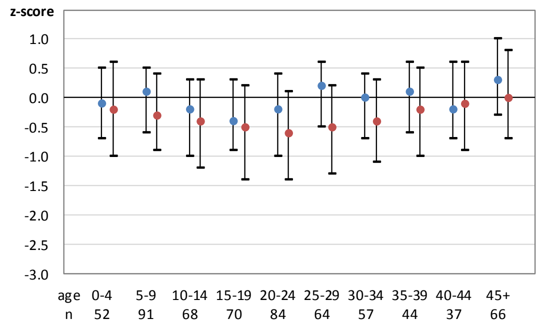


Quartiles of z-scores for weight: Spain

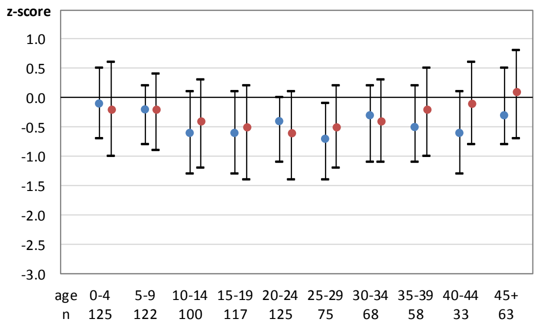


[figure 6.5 continued]

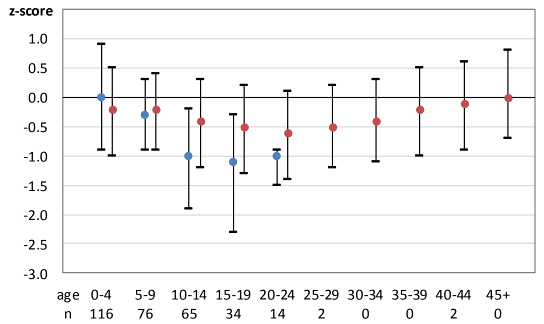
Quartiles of z-scores for weight: Sweden



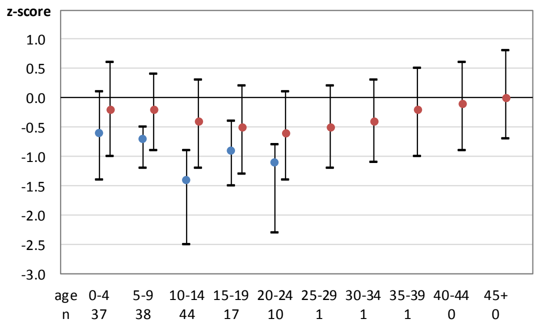
Quartiles of z-scores for weight: Switzerland



Quartiles of z-scores for weight: Turkey



Quartiles of z-scores for weight: Ukraine



Quartiles of z-scores for weight: United Kingdom

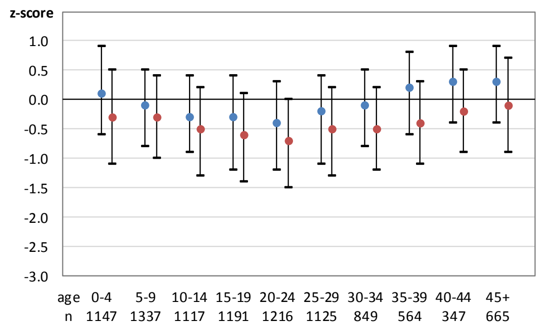


Table 6.8 Z-scores for BMI: descriptive statistics by country. All patients seen in 2016 aged 2-17 years.

Country	N	N Miss	Mean	Min	25th pctl (25% of the patients are below this z-score for BMI)	Median (50% of the patients are below this z-score for BMI)	75th pctl (75% of the patients are below this z-score for BMI)	Max
Austria	337	3	-0.4	-5.9	-1.1	-0.3	0.4	2.6
Belgium	479	0	-0.4	-4.0	-1.0	-0.3	0.3	2.4
Bulgaria	70	3	-1.3	-6.4	-2.0	-0.9	-0.1	1.0
Czech Republic	287	0	-0.3	-3.6	-1.0	-0.2	0.4	1.9
Denmark	182	0	-0.4	-4.7	-1.1	-0.2	0.3	2.1
France	2740	10	-0.4	-5.3	-1.0	-0.4	0.2	2.5
Germany	2367	12	-0.4	-5.4	-1.0	-0.3	0.3	2.4
Greece	275	0	0.2	-3.7	-0.5	0.4	0.9	2.3
Hungary	257	1	-0.8	-6.7	-1.3	-0.7	-0.1	3.3
Ireland	445	22	0.1	-4.8	-0.5	0.1	0.7	2.7
Israel	218	1	-0.2	-3.2	-1.0	-0.1	0.6	2.5
Italy	2078	11	-0.1	-5.3	-0.8	-0.1	0.6	3.2
Latvia	25	0	-0.9	-3.4	-1.6	-0.6	-0.3	1.1
Luxembourg	10	0	-0.6	-2.5	-0.9	-0.6	-0.1	1.8
Rep of Macedonia	72	0	-0.1	-3.1	-1.0	-0.1	0.6	2.5
Rep of Moldova	37	0	-0.9	-4.2	-1.8	-0.9	0.0	1.0
The Netherlands	538	1	-0.2	-4.6	-0.8	-0.2	0.4	2.2
Norway[1]	77	0	-0.3	-2.4	-0.9	-0.3	0.2	2.1
Portugal	170	0	-0.4	-3.6	-1.0	-0.4	0.3	2.0
Romania	45	0	-0.4	-3.2	-1.5	-0.3	0.2	1.9
Russian Federation	1897	12	-0.9	-9.1	-1.6	-0.7	0.0	4.4
Serbia	106	0	-0.5	-3.9	-1.3	-0.6	0.2	2.8
Slovak Republic	96	0	-0.5	-4.1	-1.1	-0.4	0.2	3.0
Slovenia	57	0	-0.5	-5.0	-1.1	-0.2	0.3	1.1
Spain	916	7	-0.2	-4.2	-0.8	-0.2	0.6	2.9
Sweden	238	0	-0.2	-3.5	-0.7	-0.2	0.3	2.0
Switzerland	383	1	-0.3	-7.5	-0.9	-0.3	0.4	2.7
Turkey	222	3	-0.7	-6.9	-1.5	-0.4	0.4	3.1
Ukraine	117	0	-1.1	-4.9	-1.8	-1.0	-0.4	3.9
United Kingdom	3935	13	0.0	-5.9	-0.6	0.1	0.7	3.2

[1] Norway: sometimes any value (instead of last of the year) for height and weight is used when no lung function test was available.

Note: Lithuania has 0% coverage for children.

This table reports the median z-score for BMI, the mean z-score for BMI and other descriptive statistics for children aged 2 to 17 years, by country.

Table 6.9 BMI: descriptive statistics by country. All patients seen in 2016 aged 18 years or older.

Country	N	N Miss	Mean	Min	25th pctl (25% of the patients are below this BMI)	Median (50% of the patients are below this BMI)	75th pctl (75% of the patients are below this BMI)	Max
Austria	351	0	21.3	13.6	19.0	21.0	23.0	36.0
Belgium	731	0	21.7	13.1	19.4	21.4	23.4	35.3
Bulgaria	61	0	19.6	13.1	17.7	19.1	21.0	38.1
Czech Republic	251	2	21.0	13.7	18.6	20.7	22.9	33.9
Denmark	270	1	22.1	13.5	19.5	21.7	24.0	36.7
France	3520	28	21.2	12.5	19.0	20.7	22.8	48.2
Germany	3031	71	21.4	13.3	19.2	21.1	23.2	46.2
Greece	291	3	21.9	15.7	19.8	21.5	23.7	36.6
Hungary	209	3	20.5	11.5	18.1	20.0	22.8	32.7
Ireland	511	86	22.6	13.1	20.4	22.2	24.3	38.1
Israel	298	0	22.5	14.7	20.0	22.0	24.6	41.7
Italy	2854	49	22.1	12.3	19.8	21.6	23.8	44.6
Latvia	10	0	20.0	17.4	18.5	19.7	21.7	23.4
Lithuania	10	0	20.1	15.3	18.3	20.3	21.8	24.7
Luxembourg	20	0	22.7	15.9	20.8	21.9	23.9	38.8
Rep of Macedonia	29	0	21.2	17.0	19.3	20.7	22.5	27.8
The Netherlands	817	1	22.1	15.2	20.1	21.7	23.6	40.7
Norway[1]	141	3	22.3	16.5	19.7	21.6	23.7	36.5
Portugal	119	2	22.4	13.7	20.0	22.0	24.4	37.8
Russian Federation	617	4	19.4	12.1	17.3	19.1	21.2	35.8
Serbia	46	0	19.6	15.0	17.9	19.1	21.2	26.6
Slovak Republic	134	0	21.4	14.5	18.9	21.2	23.4	32.4
Slovenia	41	0	19.7	13.7	18.1	19.3	21.3	27.5
Spain	762	17	22.2	14.5	19.9	21.7	23.9	41.6
Sweden	376	7	22.4	14.6	20.1	21.8	24.4	37.2
Switzerland	463	0	21.3	14.2	19.2	21.1	23.0	36.1
Turkey	26	0	20.4	17.0	18.7	19.7	22.1	28.5
Ukraine	18	0	19.4	15.5	17.7	19.3	21.1	22.9
United Kingdom	5246	8	22.9	12.9	20.2	22.3	24.8	49.8

[1] Norway: sometimes any value (instead of last of the year) for height and weight is used when no lung function test was available.

Note: Romania and Rep of Moldova have <5 patients aged 18 years or more at height measurement and are excluded from this table.

This table reports the median BMI (expressed as absolute values, not as z-scores), the mean BMI and other descriptive statistics for patients aged 18 years or older, by country.

Table 6.10 BMI: descriptive statistics by country. All male patients seen in 2016 aged 18 years or older.

Country	N	N Miss	Mean	Min	25th pctl (25% of the patients are below this BMI)	Median (50% of the patients are below this BMI)	75th pctl (75% of the patients are below this BMI)	Max
Austria	176	0	21.9	14.2	19.4	21.6	23.9	36.0
Belgium	375	0	22.0	15.0	19.7	21.8	23.8	34.2
Bulgaria	31	0	20.4	14.9	17.6	20.1	21.7	38.1
Czech Republic	122	1	21.4	15.1	18.5	21.2	23.9	33.9
Denmark	141	1	22.7	13.5	20.3	22.4	24.7	34.7
France	1855	17	21.4	12.5	19.3	21.0	23.1	43.3
Germany	1627	44	21.9	14.2	19.6	21.6	23.8	46.2
Greece	156	2	22.4	16.0	20.1	22.1	24.5	33.3
Hungary	123	2	21.0	14.7	18.6	20.8	23.3	32.7
Ireland	322	46	23.1	15.0	21.2	22.9	25.0	31.9
Israel	172	0	22.9	15.7	20.5	22.8	24.7	36.5
Italy	1506	21	22.6	13.5	20.4	22.3	24.4	44.0
Latvia	<10	0	20.9	19.0	19.0	21.0	21.9	23.4
Lithuania	<10	0	20.8	18.0	19.6	20.3	22.3	24.7
Luxembourg	11	0	22.2	15.9	21.4	22.9	23.8	24.5
Rep of Macedonia	17	0	21.8	17.0	20.2	21.9	22.7	27.8
The Netherlands	447	0	22.3	15.2	20.3	22.1	23.9	32.6
Norway[1]	74	2	23.1	16.9	20.2	22.3	25.1	36.5
Portugal	60	2	22.0	13.7	19.9	21.2	24.2	30.9
Russian Federation	329	2	19.8	12.3	17.6	19.4	21.6	34.5
Serbia	26	0	20.1	15.0	18.2	20.0	21.4	26.6
Slovak Republic	69	0	22.2	14.5	19.4	22.1	23.8	32.4
Slovenia	17	0	21.2	16.7	19.6	20.6	21.9	27.5
Spain	404	10	22.9	15.4	20.5	22.5	24.5	38.8
Sweden	206	2	23.3	14.6	20.9	22.5	25.1	37.2
Switzerland	256	0	21.7	14.5	19.8	21.7	23.4	32.7
Turkey	11	0	19.3	17.9	18.4	18.9	20.5	22.1
Ukraine	12	0	19.6	15.5	17.6	19.9	21.3	22.9
United Kingdom	2867	4	23.2	12.9	20.7	22.9	25.3	49.8

[1] Norway: sometimes any value (instead of last of the year) for height and weight is used when no lung function test was available.

Note: Romania and Rep of Moldova have <5 male patients aged 18 years or more at BMI measurement and are excluded from this table.

This table reports the median BMI (expressed as absolute values, not as z-scores), the mean BMI and other descriptive statistics for male patients aged 18 years or older, by country.

Table 6.11 BMI: descriptive statistics by country. All female patients seen in 2016 aged 18 years or older.

Country	N	N Miss	Mean	Min	25th pctl (25% of the patients are below this BMI)	Median (50% of the patients are below this BMI)	75th pctl (75% of the patients are below this BMI)	Max
Austria	175	0	20.6	13.6	18.7	20.2	22.1	35.7
Belgium	356	0	21.4	13.1	19.2	20.9	22.8	35.3
Bulgaria	30	0	18.8	13.1	17.7	18.7	19.9	27.7
Czech Republic	129	1	20.6	13.7	18.7	20.4	22.2	32.6
Denmark	129	0	21.6	14.2	19.1	20.9	23.3	36.7
France	1665	11	21.0	13.4	18.7	20.4	22.4	48.2
Germany	1404	27	20.9	13.3	18.9	20.4	22.4	39.0
Greece	135	1	21.2	15.7	19.3	21.0	23.0	36.6
Hungary	86	1	19.7	11.5	17.8	19.6	21.2	29.0
Ireland	189	40	21.8	13.1	19.8	21.2	22.9	38.1
Israel	126	0	22.0	14.7	19.6	21.3	24.3	41.7
Italy	1348	28	21.5	12.3	19.3	21.0	23.1	44.6
Luxembourg	<10	0	23.4	17.5	20.2	21.2	24.1	38.8
Rep of Macedonia	12	0	20.4	17.4	18.9	20.1	21.8	24.3
The Netherlands	370	1	21.9	15.4	19.7	21.2	23.0	40.7
Norway[1]	67	1	21.4	16.5	19.3	20.8	23.1	31.9
Portugal	59	0	22.8	16.6	20.1	22.3	24.5	37.8
Russian Federation	288	2	19.0	12.1	17.1	18.8	20.7	35.8
Serbia	20	0	18.9	15.8	17.3	18.7	20.0	25.2
Slovak Republic	65	0	20.6	15.4	18.1	20.3	22.0	27.7
Slovenia	24	0	18.7	13.7	17.8	18.6	20.4	22.3
Spain	358	7	21.5	14.5	19.5	20.9	23.0	41.6
Sweden	170	5	21.4	14.9	19.3	21.1	22.8	34.1
Switzerland	207	0	20.8	14.2	18.7	20.4	22.1	36.1
Turkey	15	0	21.2	17.0	19.0	21.7	22.5	28.5
Ukraine	<10	0	18.9	16.8	17.7	18.8	19.7	21.6
United Kingdom	2379	4	22.5	13.0	19.8	21.7	24.2	48.3

[1] Norway: sometimes any value (instead of last of the year) for height and weight is used when no lung function test was available.

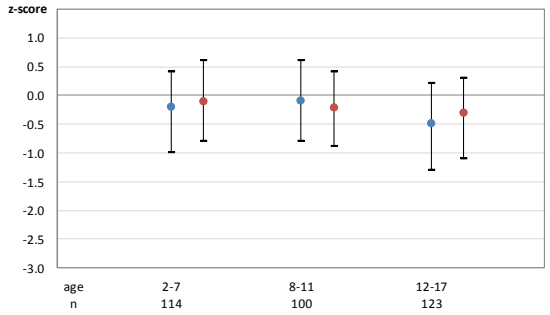
Note: Latvia, Lithuania, Rep of Moldova and Romania have <5 female patients aged 18 years or more at BMI measurement and are excluded from this table.

This table reports the median BMI (expressed as absolute values, not as z-scores), the mean BMI and other descriptive statistics for female patients aged 18 years or older, by country.

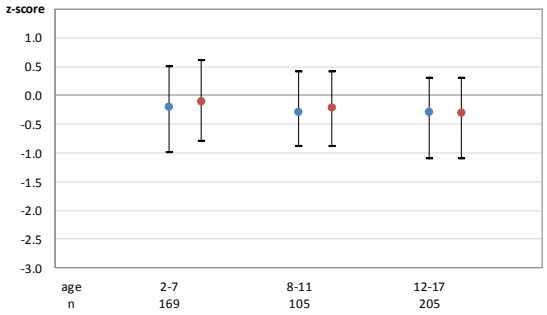
Figure 6.6 Quartiles of z-scores for BMI by age group and country. Patients aged 2-17 years in 2016.

The figures below show the z-scores for weight by country. The dot is the median, and the whiskers show the 25th and 75th percentiles. In blue are the quartiles for the country, in red are the pooled quartiles computed on all other countries (i.e. excluding that country). We did not compute quartiles where the number of patients in the age group is <10. Therefore, there are no blue dots for those age groups (the number of patients in each age group is shown underneath the horizontal axis). We therefore excluded Latvia, Lithuania and Luxembourg from the graphs because none of the age groups in these countries had more than 10 patients.

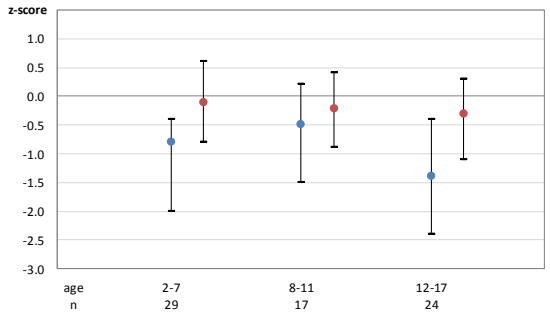
Quartiles of z-scores for BMI: Austria



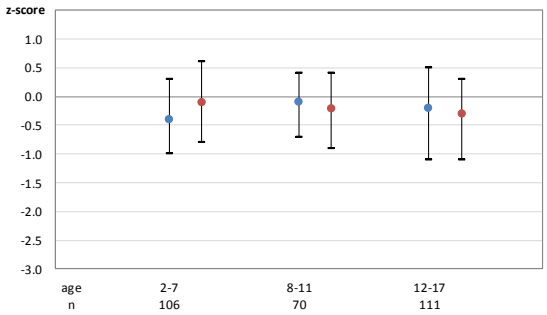
Quartiles of z-scores for BMI: Belgium



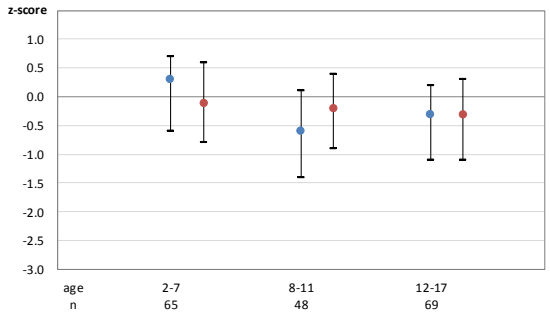
Quartiles of z-scores for BMI: Bulgaria



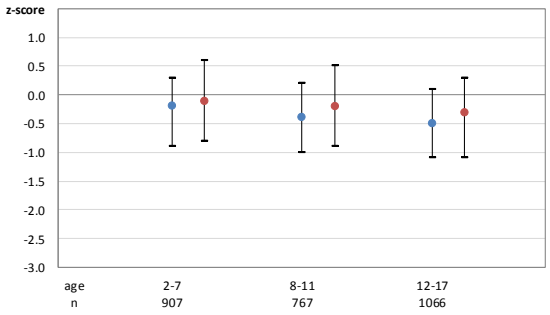
Quartiles of z-scores for BMI: Czech Republic



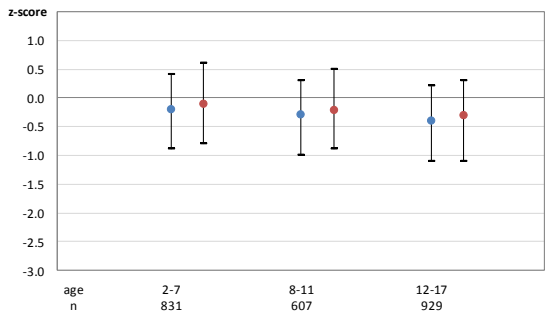
Quartiles of z-scores for BMI: Denmark



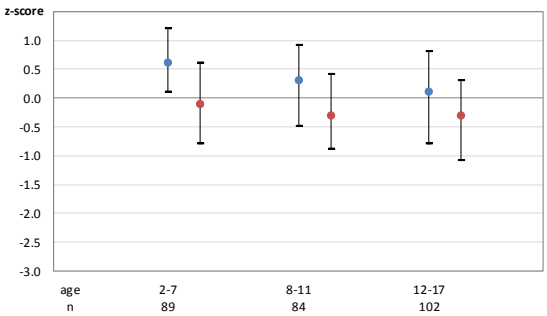
Quartiles of z-scores for BMI: France



Quartiles of z-scores for BMI: Germany

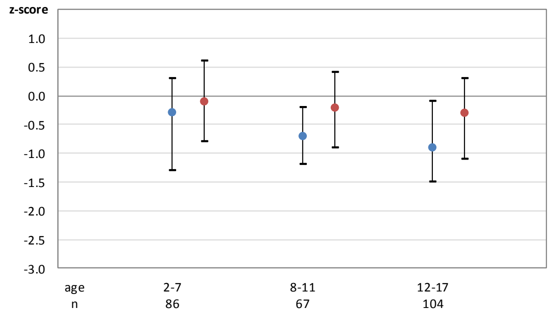


Quartiles of z-scores for BMI: Greece

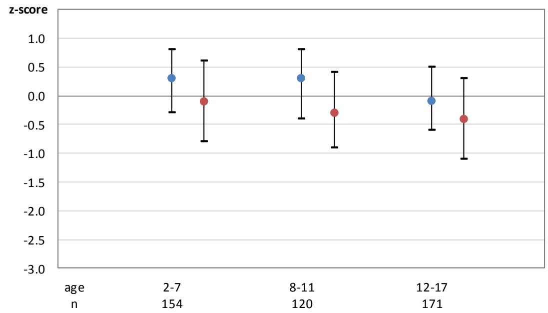


[figure 6.6 continued]

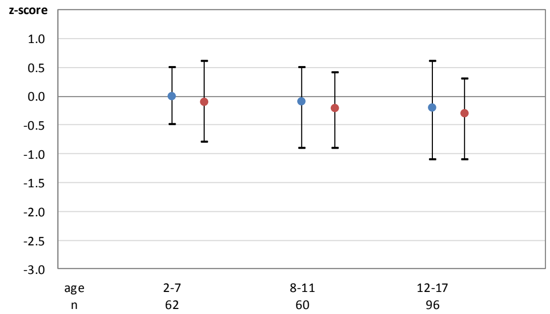
Quartiles of z-scores for BMI: Hungary



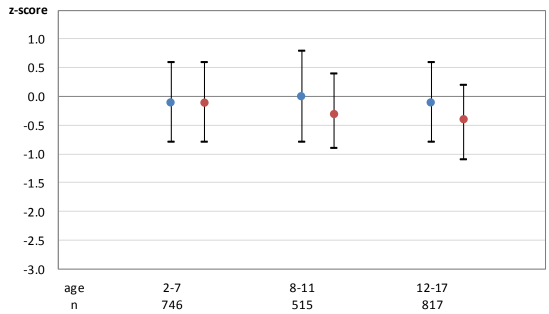
Quartiles of z-scores for BMI: Ireland



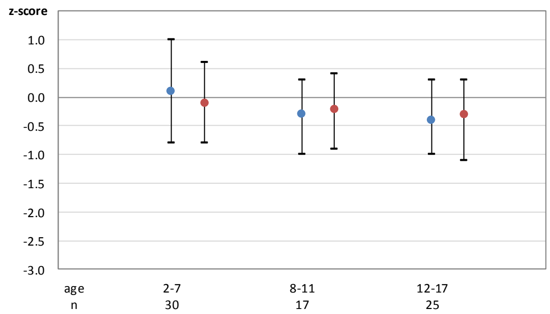
Quartiles of z-scores for BMI: Israel



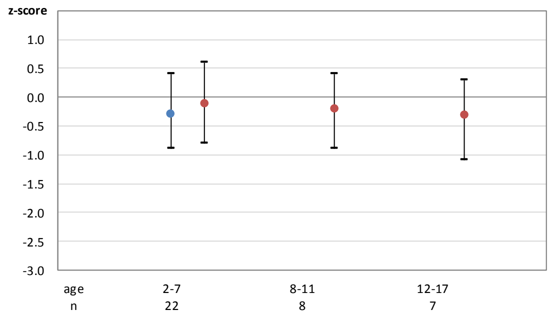
Quartiles of z-scores for BMI: Italy



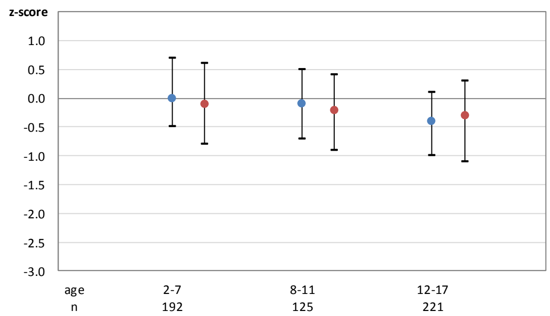
Quartiles of z-scores for BMI: Rep of Macedonia



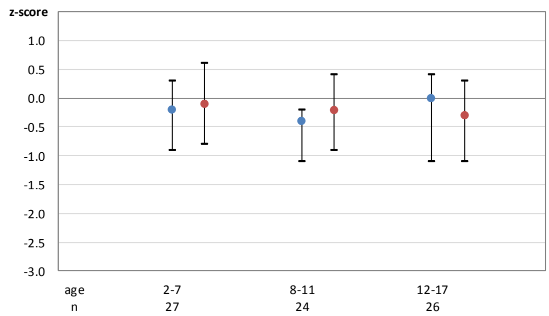
Quartiles of z-scores for BMI: Rep of Moldova



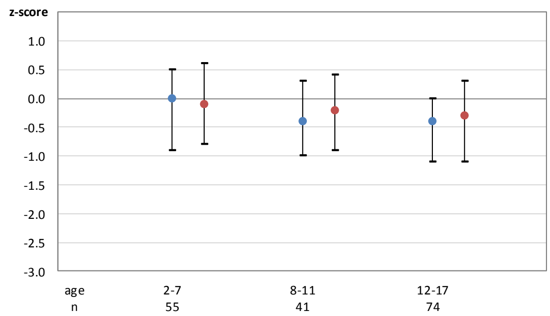
Quartiles of z-scores for BMI: The Netherlands



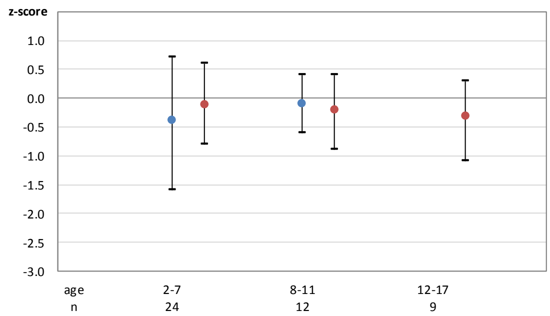
Quartiles of z-scores for BMI: Norway



Quartiles of z-scores for BMI: Portugal

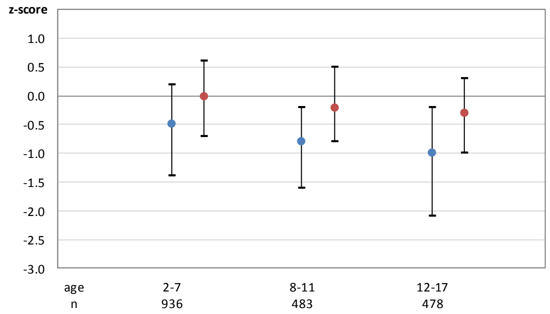


Quartiles of z-scores for BMI: Romania

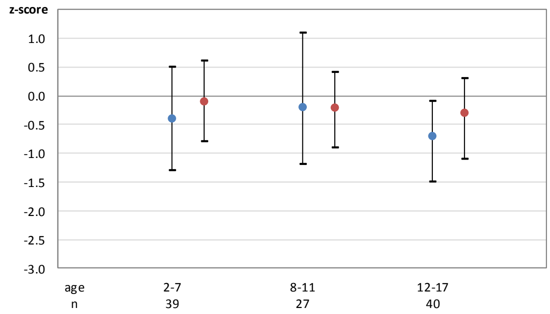


[figure 6.6 continued]

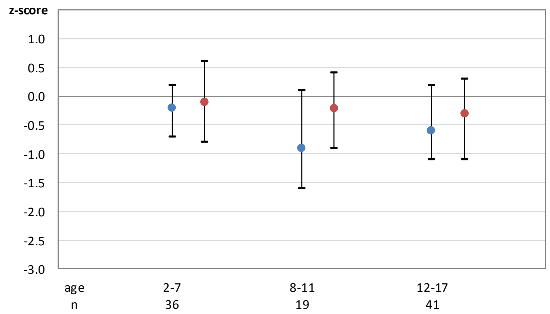
Quartiles of z-scores for BMI: Russian Federation



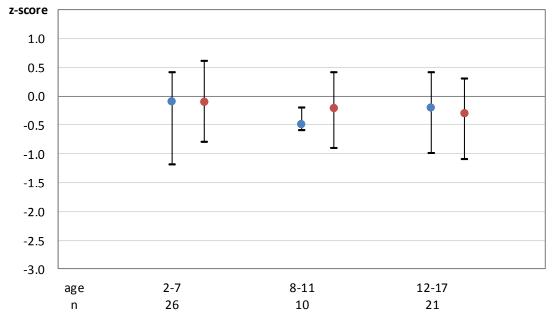
Quartiles of z-scores for BMI: Serbia



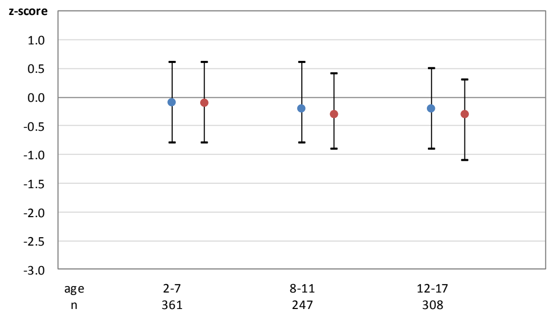
Quartiles of z-scores for BMI: Slovak Republic



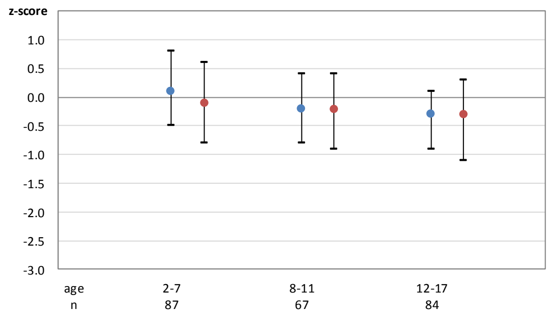
Quartiles of z-scores for BMI: Slovenia



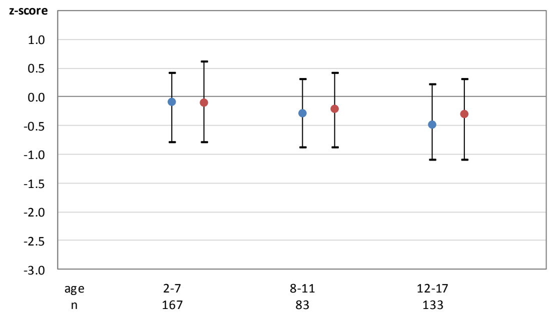
Quartiles of z-scores for BMI: Spain



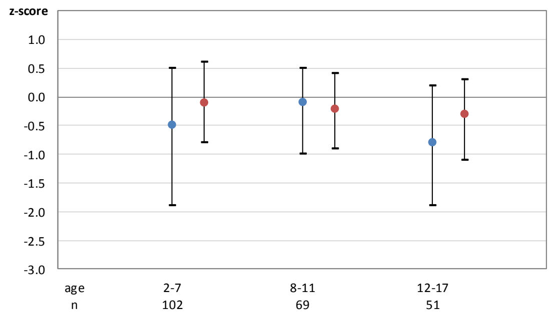
Quartiles of z-scores for BMI: Sweden



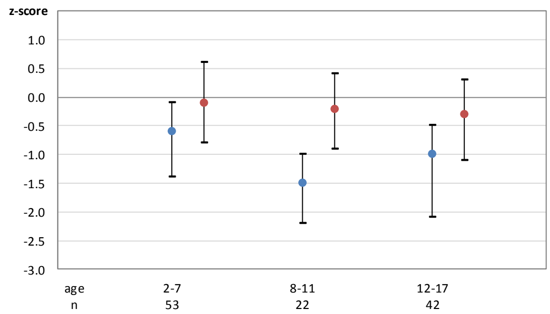
Quartiles of z-scores for BMI: Switzerland



Quartiles of z-scores for BMI: Turkey



Quartiles of z-scores for BMI: Ukraine



Quartiles of z-scores for BMI: United Kingdom

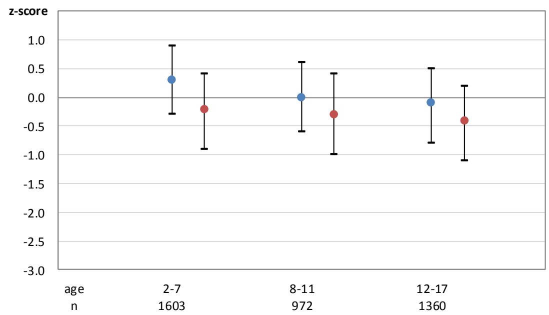
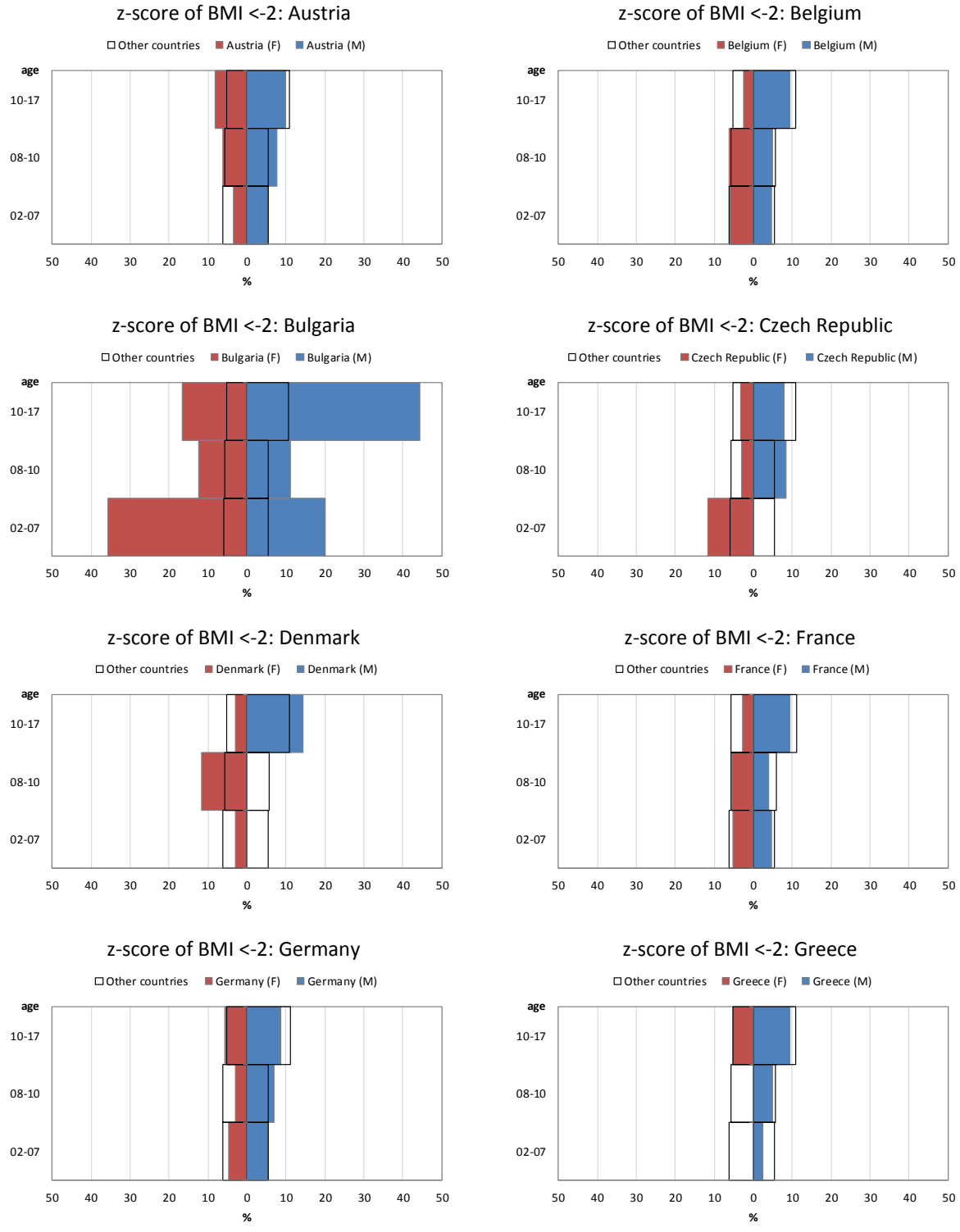
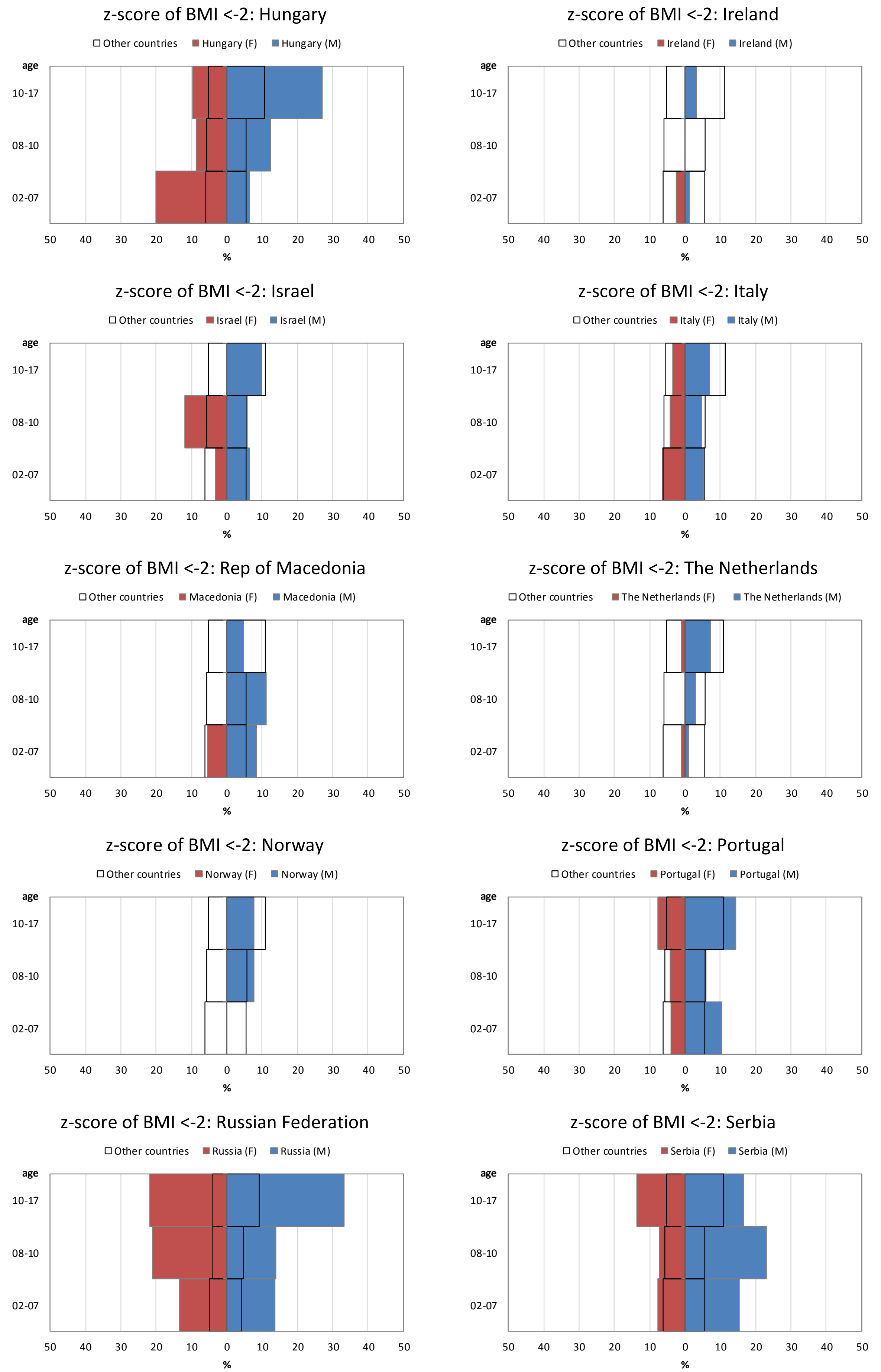


Figure 6.7 Proportion of child patients underweight (z-score of BMI<-2): age and sex pyramids, by country and overall. Patients aged 2-17 years in 2016.

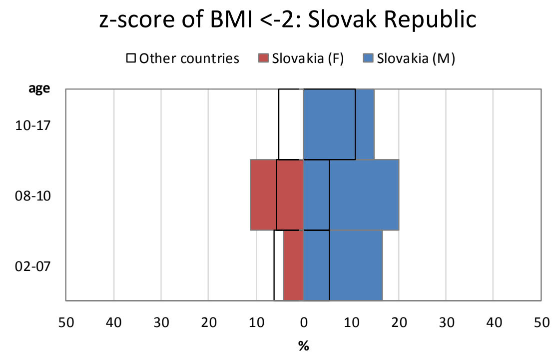
The coloured bars (red for females, blue for males) represent the percentage of underweight patients in the selected country, whereas the non-coloured bars represent the percentage of underweight patients in all the remaining countries (i.e. excluding that country). We excluded from the analyses those age groups where the number of patients was <10. We therefore excluded from the graphs Latvia, Lithuania, Luxembourg, Republic of Moldova and Romania because some of the age groups in these countries had fewer than 10 patients.

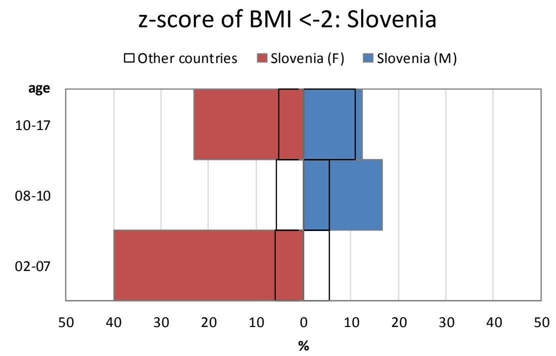


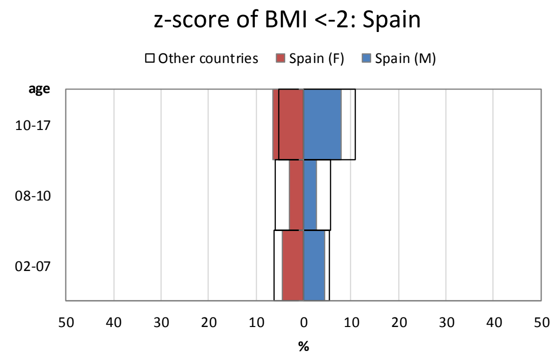
[figure 6.7 continued]

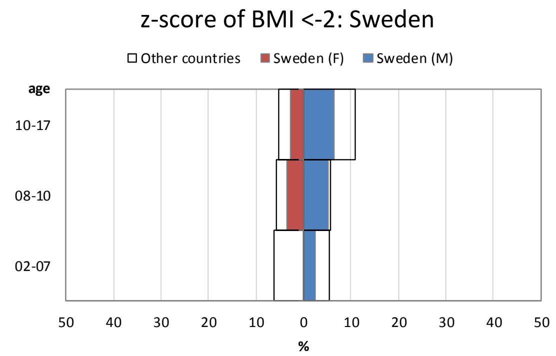


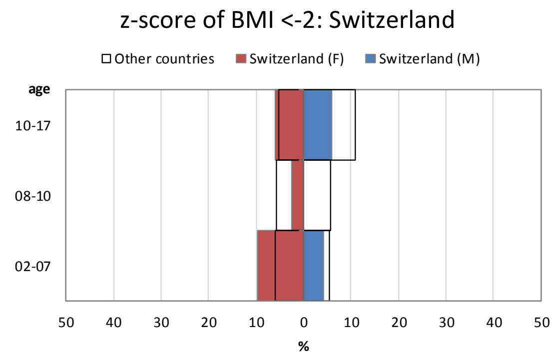
[figure 6.7 continued]

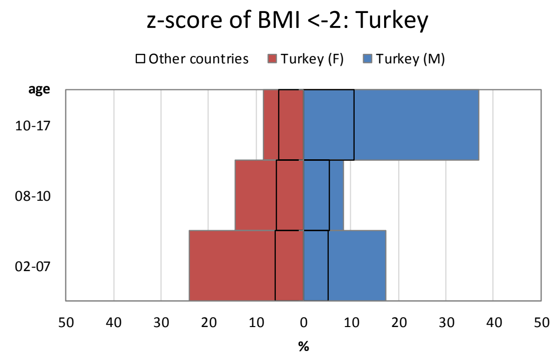


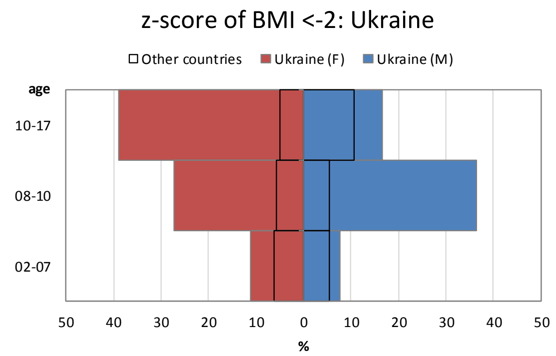












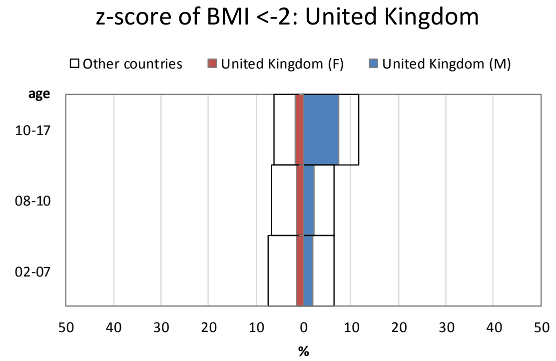
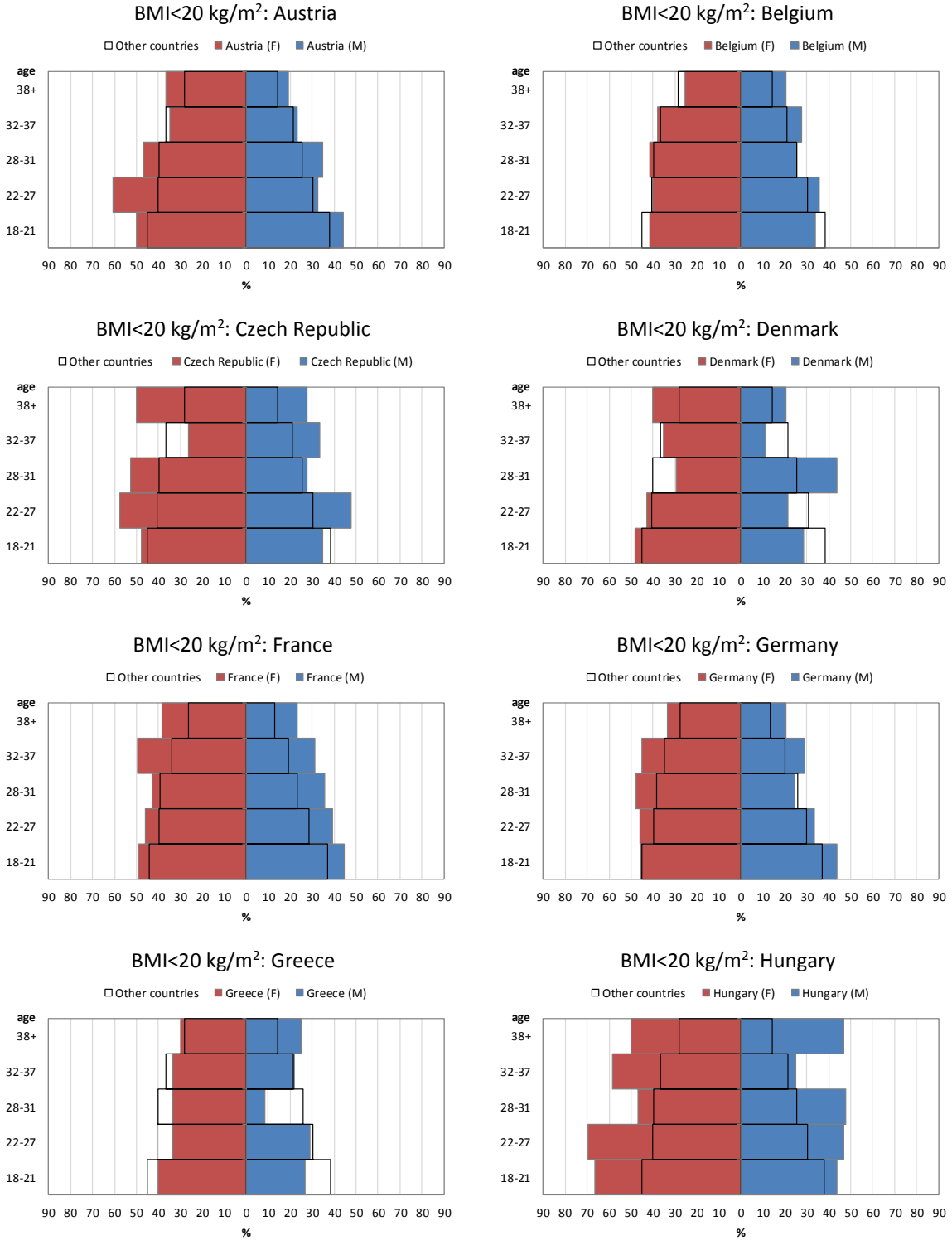


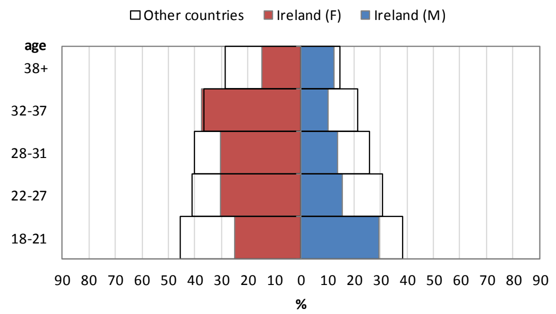
Figure 6.8 Proportion of adult patients with BMI<20: age and sex pyramids, by country and overall. Patients aged 18 years or older in 2016.

The coloured bars (red for females, blue for males) represent the percentage of underweight patients in the selected country, whereas the non-coloured bars represent the percentage of underweight patients in all the remaining countries (i.e. excluding that country). We excluded from the analyses those age groups where the number of patients was <10. We therefore excluded from the graphs Bulgaria, Latvia, Lithuania, Luxembourg, Republic of Moldova, Republic of Macedonia, Romania, Serbia, Slovenia, Turkey and Ukraine because some of the age groups in these countries had fewer than 10 patients.

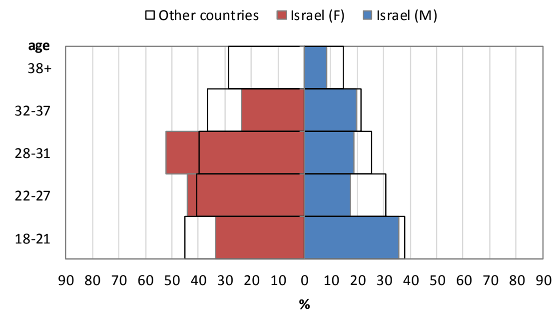


[figure 6.8 continued]

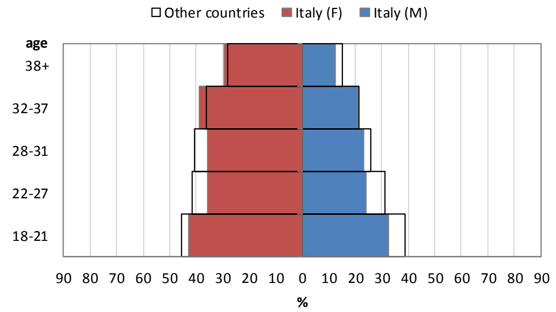
BMI<20 kg/m2: Ireland



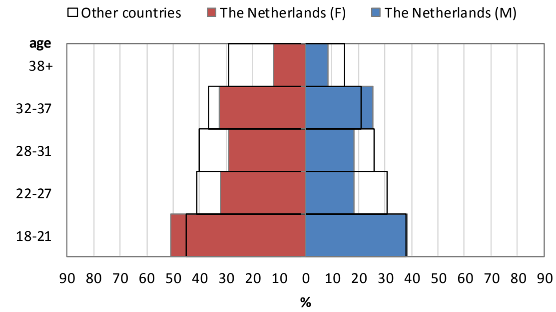
BMI<20 kg/m2: Israel



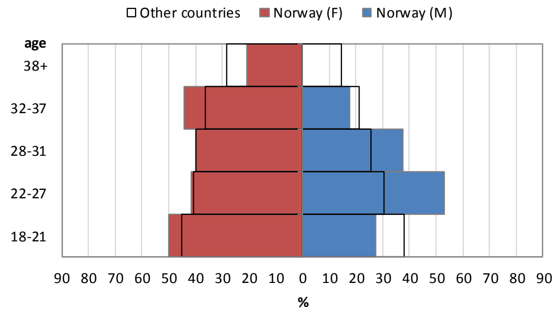
BMI<20 kg/m^2: Italy



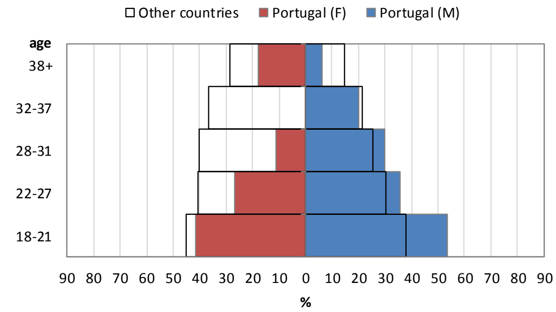
BMI<20 kg/m^2: The Netherlands



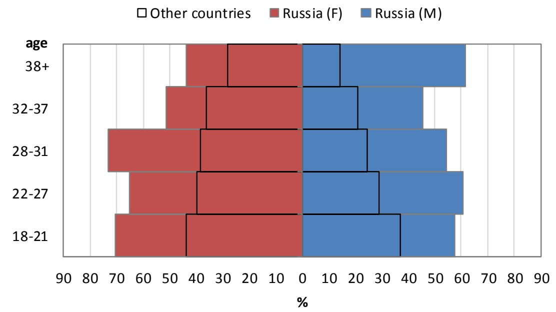
BMI<20 kg/m^2: Norway



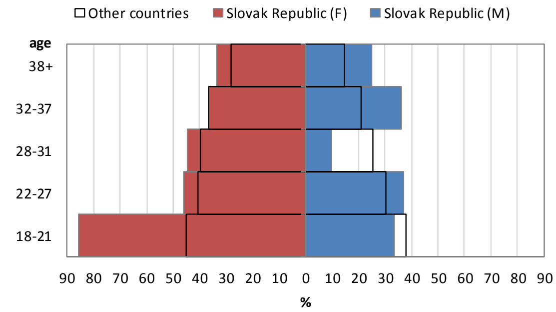
BMI<20 kg/m^2: Portugal



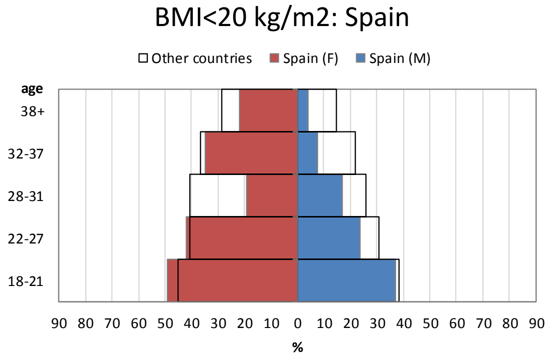
BMI<20 kg/m^2: Russian Federation

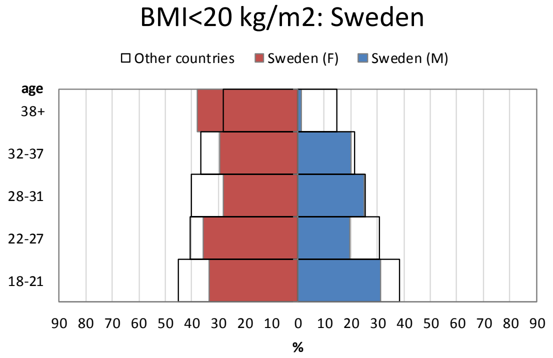


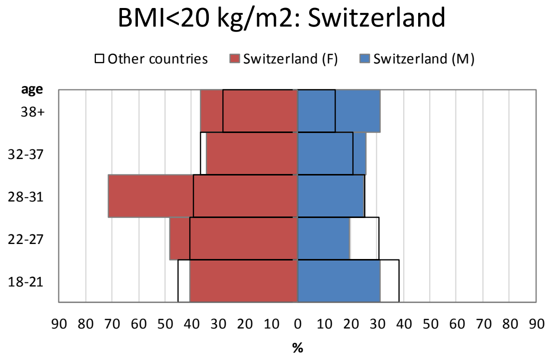
BMI<20 kg/m^2: Slovak Republic

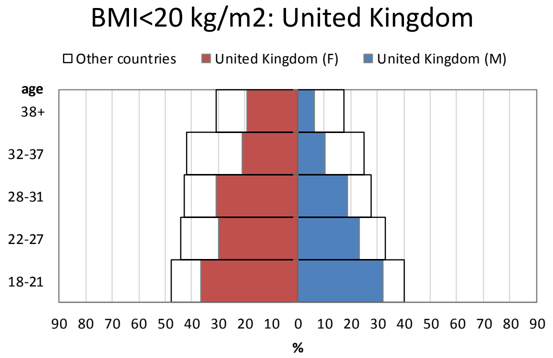


[figure 6.8 continued]









7. Complications and therapy

The information in this section should not be considered complete for several reasons: national registries may use a different definition, data about one or more complications is not collected, or the status of the complication is truly unknown (e.g. liver disease, where the definition requires ultrasound examination). In the tables, therefore, we show the number of missing values for the various complications, but in the graphs we have included only countries where less than 10% of the data was missing. For a full list of complications and definitions please see Appendix 2 on page 135.

In this section we also present data on selected therapies. We collected information on therapies using the generic name of the drug, and not the brand name. For example, instead of naming individual antibiotics, we ask whether the patient has been taking ”inhaled antibiotics for more than three months this year”.

Table 7.1 Prevalence of allergic bronchopulmonary aspergillosis (all patients seen in 2016) and CFRD treated with insulin in 2016 (patients aged 18 years or older), by country.

Country	ABPA this year number (%)			CF related diabetes with daily use of insulin this year number (%)		
	Missing/ unknown	No	Yes	Missing/ unknown	No	Yes
Austria	1 (0.14)	720 (97.29)	19 (2.57)	0 (0)	252 (69.23)	112 (30.77)
Belgium[1]	173 (13.88)	1003 (80.50)	70 (5.62)	0 (0)	552 (72.63)	208 (27.37)
Bulgaria	1 (0.71)	138 (98.58)	1 (0.71)	1 (1.59)	55 (87.30)	7 (11.11)
Czech Republic	2 (0.34)	568 (97.10)	15 (2.56)	0 (0)	170 (63.67)	97 (36.33)
Denmark	183 (37.97)	288 (59.75)	11 (2.28)	0 (0)	183 (62.46)	110 (37.54)
France[2]	0 (0)	6073 (90.47)	640 (9.53)	0 (0)	2720 (73.77)	967 (26.23)
Germany	194 (3.38)	5190 (90.45)	354 (6.17)	365 (11.17)	2165 (66.25)	738 (22.58)
Greece	115 (19.36)	470 (79.12)	9 (1.52)	0 (0)	232 (75.57)	75 (24.43)
Hungary	7 (1.38)	496 (97.83)	4 (0.79)	6 (2.59)	166 (71.55)	60 (25.86)
Ireland	<5 (0.17)	1066 (93.19)	76 (6.64)	<5 (0.31)	465 (73.12)	169 (26.57)
Israel	5 (0.93)	503 (93.49)	30 (5.58)	4 (1.29)	204 (66.02)	101 (32.69)
Italy	76 (1.42)	5132 (95.73)	153 (2.85)	31 (1.02)	2300 (75.71)	707 (23.27)
Latvia	0 (0)	36 (100)	0 (0)	0 (0)	10 (90.91)	1 (9.09)
Lithuania	0 (0)	12 (100)	0 (0)	0 (0)	11 (91.67)	1 (8.33)
Luxembourg	0 (0)	28 (87.50)	4 (12.50)	0 (0)	12 (60.00)	8 (40.00)
Rep of Macedonia	1 (0.92)	107 (98.16)	1 (0.92)	0 (0)	20 (68.97)	9 (31.03)
Rep of Moldova	1 (2.17)	45 (97.83)	0 (0)	-	-	-
The Netherlands	106 (7.51)	1205 (85.34)	101 (7.15)	57 (6.76)	521 (61.80)	265 (31.44)
Norway	16 (6.96)	213 (92.61)	1 (0.43)	11 (7.33)	111 (74.00)	28 (18.67)
Portugal	6 (1.88)	309 (96.87)	4 (1.25)	5 (3.82)	105 (80.15)	21 (16.03)
Romania	0 (0)	50 (100)	0 (0)	-	-	-
Russian Federation	99 (3.28)	2877 (95.20)	46 (1.52)	43 (5.87)	637 (86.90)	53 (7.23)
Serbia	1 (0.59)	166 (97.65)	3 (1.76)	0 (0)	37 (75.51)	12 (24.49)

[1] Belgium: ABPA is not collected for transplanted patients and most of the missing data refers to this sub-population.

[2] France: ABPA was collected as: Aspergillosis (ABPA and other) if treated.

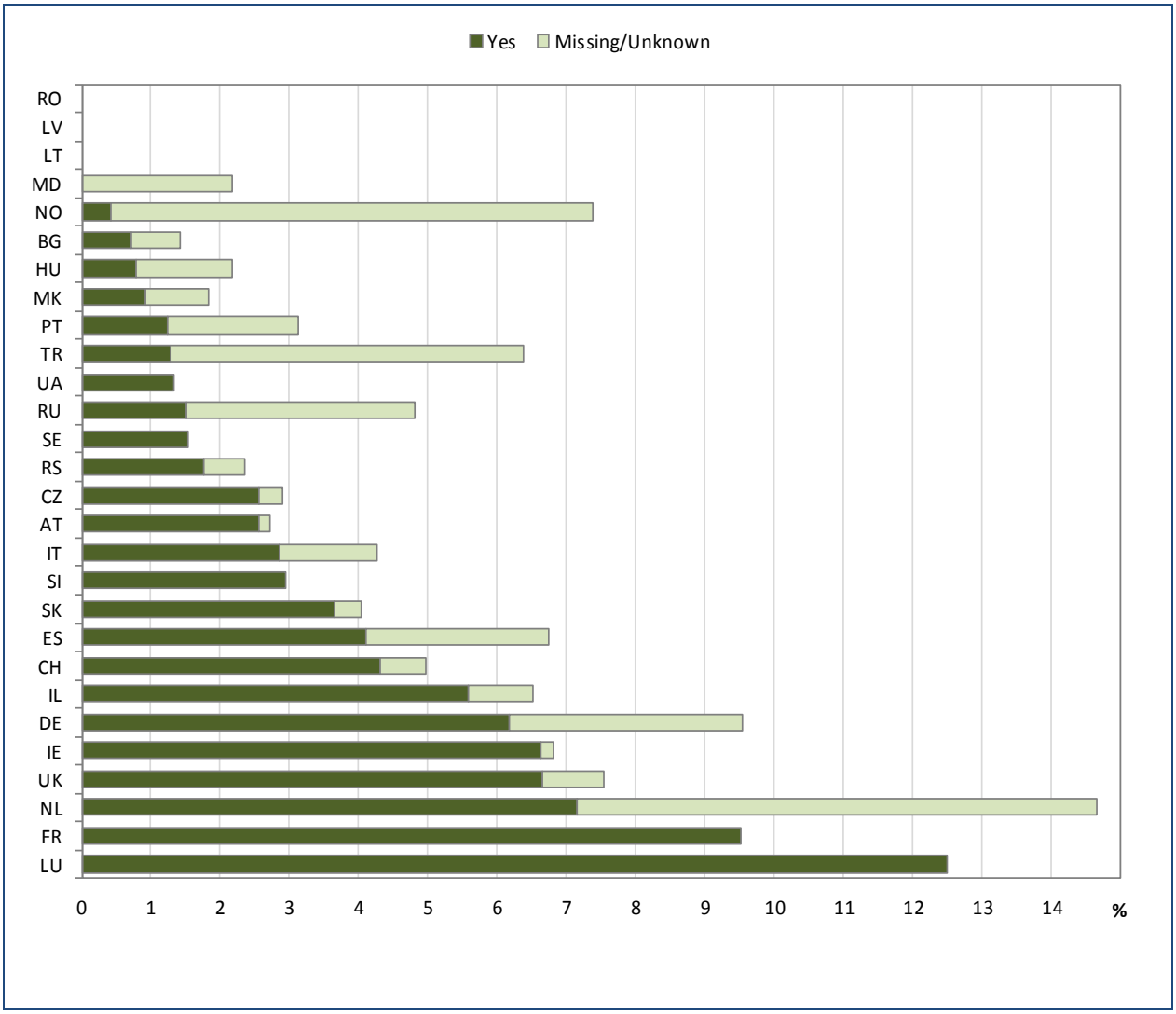
Note: Romania and Rep of Moldova have <5 patients aged 18 years or more on 31/12/2016, therefore no information is included in the table for CFRD.

[table 7.1 continued]

Country	ABPA this year number (%)			CF related diabetes with daily use of insulin this year number (%)		
	Missing/ unknown	No	Yes	Missing/ unknown	No	Yes
Slovak Republic	1 (0.40)	237 (95.96)	9 (3.64)	0 (0)	126 (90.00)	14 (10.00)
Slovenia	0 (0)	99 (97.06)	3 (2.94)	0 (0)	30 (71.43)	12 (28.57)
Spain	50 (2.63)	1770 (93.26)	78 (4.11)	27 (3.17)	600 (70.51)	224 (26.32)
Sweden	0 (0)	639 (98.46)	10 (1.54)	0 (0)	292 (73.92)	103 (26.08)
Switzerland	6 (0.66)	861 (95.04)	39 (4.30)	4 (0.82)	348 (71.76)	133 (27.42)
Turkey	16 (5.11)	293 (93.61)	4 (1.28)	0 (0)	23 (82.14)	5 (17.86)
Ukraine	0 (0)	148 (98.67)	2 (1.33)	0 (0)	21 (95.45)	1 (4.55)
United Kingdom	84 (0.87)	8965 (92.47)	646 (6.66)	34 (0.62)	3783 (68.83)	1679 (30.55)

Table 7.1 shows the frequency of allergic bronchopulmonary aspergillosis (see Appendix 2, page 135, for ABPA definitions) and CF-related diabetes (CFRD) with daily use of insulin this year, by country. For CFRD only patients 18 years and older are included.

Figure 7.1 Prevalence of allergic bronchopulmonary aspergillosis in all patients seen in 2016, by country.

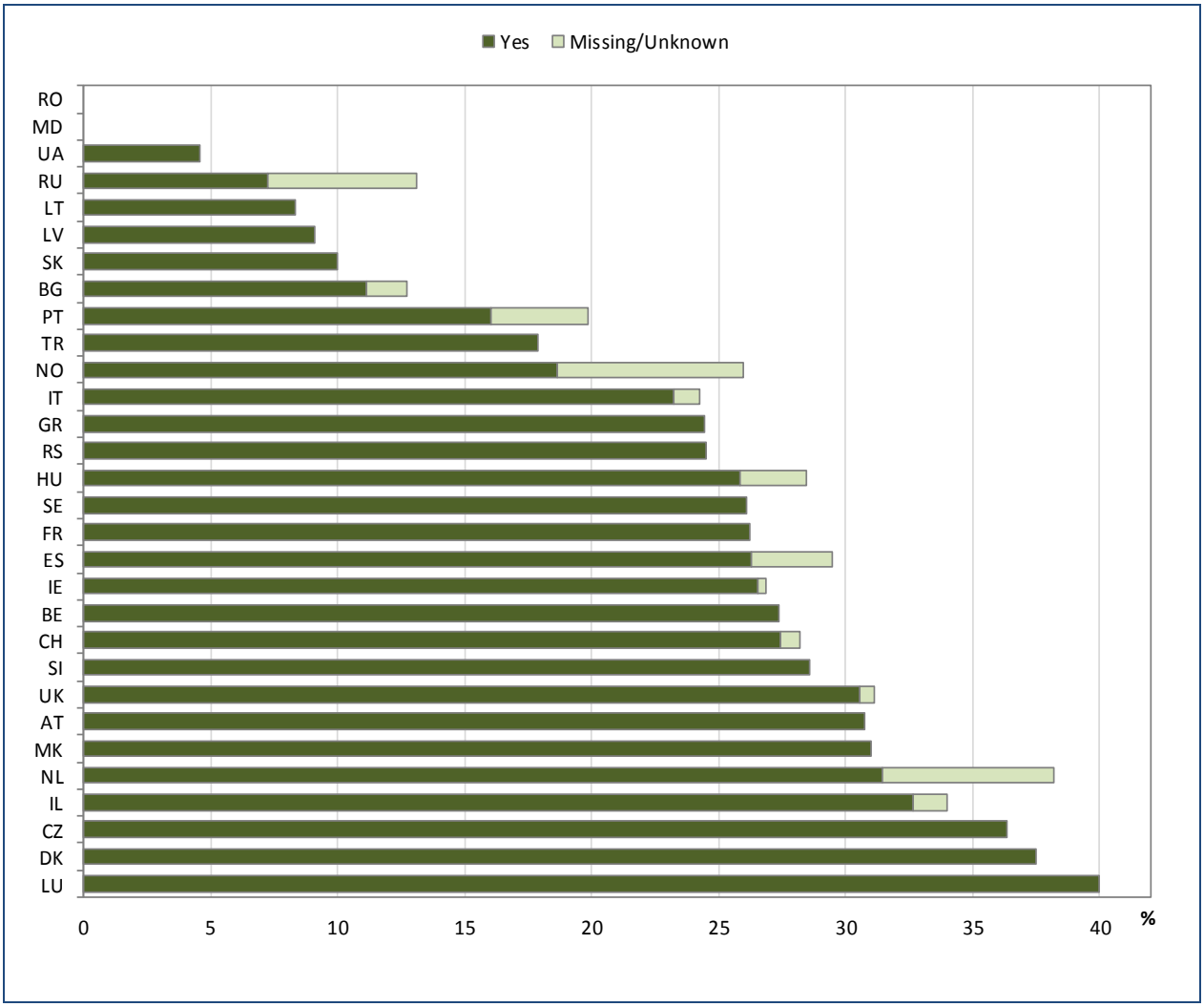


Note: We excluded from the graph the countries for which the information on allergic bronchopulmonary aspergillosis (ABPA) was missing for more than 10% of the patients.

Note: Belgium: ABPA is not collected for transplanted patients and most of the missing data refers to this sub-population.
France collected ABPA as Aspergillosis (ABPA and other) if treated.

This graph shows the frequency of allergic bronchopulmonary aspergillosis by country. For the definition of ABPA see Appendix 2, page 135. The dark green part of the bar shows the percentage of patients with ABPA, the light green part shows the percentage of patients for which this information was missing.

Figure 7.2 Prevalence of CFRD requiring daily insulin treatment, by country. All patients seen in 2016 aged 18 years or older.



Note: We excluded from the graph the countries for which the information on CFRD was missing for more than 10% of the patients.

This graph shows the prevalence of CF-related diabetes (CFRD) with daily use of insulin this year, by country. CFRD is recorded in various ways among the national registries. As a substitute marker of diabetes we collected data on the use of insulin on a daily basis, although it may not fully represent the prevalence of diabetes. The dark green part of the bar shows the percentage of patients who use insulin daily, the light green part shows the percentage of patients for whom this information was missing. Only patients aged 18 years or older were included in this graph.

Table 7.2 Prevalence of pneumothorax, haemoptysis and malignancy in all patients seen in 2016, by country.

Country	Pneumothorax requiring chest tube this year number (%)			Haemoptysis major over 250 ml this year number (%)			Malignancy occurred this year number(%)		
	Missing/ unknown	No	Yes	Missing/ unknown	No	Yes	Missing/ unknown	No	Yes
Austria	3 (0.41)	735 (99.32)	2 (0.27)	11 (1.49)	716 (96.75)	13 (1.76)	6 (0.81)	731 (98.78)	3 (0.41)
Belgium[1]	170 (13.64)	1071 (85.96)	5 (0.40)	170 (13.64)	1071 (85.96)	5 (0.40)	0 (0)	1239 (99.44)	7 (0.56)
Bulgaria	1 (0.71)	137 (97.86)	2 (1.43)	3 (2.14)	124 (88.57)	13 (9.29)	1 (0.71)	139 (99.29)	0 (0)
Czech Republic	1 (0.17)	574 (98.12)	10 (1.71)	0 (0)	577 (98.63)	8 (1.37)	0 (0)	585 (100)	0 (0)
Denmark	0 (0)	481 (99.79)	1 (0.21)	482 (100)	-	-	0 (0)	479 (99.38)	3 (0.62)
France[2]	0 (0)	6683 (99.55)	30 (0.45)	0 (0)	6359 (94.73)	354 (5.27)	0 (0)	6664 (99.27)	49 (0.73)
Germany	186 (3.24)	5498 (95.82)	54 (0.94)	253 (4.41)	5472 (95.36)	13 (0.23)	199 (3.47)	5493 (95.73)	46 (0.80)
Greece	3 (0.51)	591 (99.49)	0 (0)	2 (0.34)	586 (98.65)	6 (1.01)	2 (0.34)	591 (99.49)	1 (0.17)
Hungary	10 (1.97)	488 (96.25)	9 (1.78)	37 (7.30)	466 (91.91)	4 (0.79)	13 (2.56)	449 (88.56)	45 (8.88)
Ireland	<5 (0.17)	1140 (99.66)	<5 (0.17)	<5 (0.17)	1140 (99.66)	<5 (0.17)	<5 (0.17)	1141 (99.74)	<5 (0.09)
Israel	7 (1.30)	528 (98.14)	3 (0.56)	7 (1.30)	505 (93.87)	26 (4.83)	7 (1.30)	530 (98.51)	1 (0.19)
Italy	59 (1.10)	5286 (98.60)	16 (0.30)	74 (1.38)	5215 (97.28)	72 (1.34)	59 (1.10)	5283 (98.55)	19 (0.35)
Latvia	0 (0)	36 (100)	0 (0)	0 (0)	36 (100)	0 (0)	0 (0)	36 (100)	0 (0)
Lithuania	0 (0)	12 (100)	0 (0)	0 (0)	12 (100)	0 (0)	0 (0)	12 (100)	0 (0)
Luxembourg	0 (0)	32 (100)	0 (0)	0 (0)	32 (100)	0 (0)	0 (0)	32 (100)	0 (0)
Rep of Macedonia	1 (0.92)	108 (99.08)	0 (0)	1 (0.92)	106 (97.25)	2 (1.83)	1 (0.92)	108 (99.08)	0 (0)
Rep of Moldova	1 (2.17)	45 (97.83)	0 (0)	1 (2.17)	45 (97.83)	0 (0)	1 (2.17)	45 (97.83)	0 (0)
The Netherlands	67 (4.75)	1340 (94.90)	5 (0.35)	82 (5.81)	1224 (86.68)	106 (7.51)	59 (4.18)	1349 (95.54)	4 (0.28)
Norway	16 (6.96)	212 (92.17)	2 (0.87)	24 (10.43)	204 (88.70)	2 (0.87)	18 (7.83)	210 (91.30)	2 (0.87)
Portugal	5 (1.57)	313 (98.12)	1 (0.31)	4 (1.25)	287 (89.97)	28 (8.78)	3 (0.94)	316 (99.06)	0 (0)
Romania	0 (0)	50 (100)	0 (0)	0 (0)	49 (98.00)	1 (2.00)	0 (0)	50 (100)	0 (0)
Russian Federation	69 (2.28)	2934 (97.09)	19 (0.63)	70 (2.32)	2903 (96.06)	49 (1.62)	67 (2.22)	2949 (97.58)	6 (0.20)
Serbia	0 (0)	170 (100)	0 (0)	0 (0)	163 (95.88)	7 (4.12)	0 (0)	170 (100)	0 (0)
Slovak Republic	0 (0)	246 (99.60)	1 (0.40)	0 (0)	221 (89.47)	26 (10.53)	0 (0)	246 (99.60)	1 (0.40)

[1] Belgium: pneumothorax requiring chest tube and haemoptysis major over 250 ml are not collected for transplanted patients and most of the missing data refers to this sub-population.

[2] France: pneumothorax only; haemoptysis, no quantification.

[table 7.2 continued]

Country	Pneumothorax requiring chest tube this year number (%)			Haemoptysis major over 250 ml this year number (%)			Malignancy occurred this year number(%)		
	Missing/ unknown	No	Yes	Missing/ unknown	No	Yes	Missing/ unknown	No	Yes
Slovenia	0 (0)	101 (99.02)	1 (0.98)	0 (0)	101 (99.02)	1 (0.98)	0 (0)	101 (99.02)	1 (0.98)
Spain	34 (1.79)	1858 (97.89)	6 (0.32)	45 (2.37)	1774 (93.47)	79 (4.16)	33 (1.74)	1852 (97.58)	13 (0.68)
Sweden	0 (0)	649 (100)	0 (0)	0 (0)	649 (100)	0 (0)	0 (0)	648 (99.85)	1 (0.15)
Switzerland	8 (0.88)	895 (98.79)	3 (0.33)	10 (1.10)	861 (95.04)	35 (3.86)	8 (0.88)	897 (99.01)	1 (0.11)
Turkey	4 (1.28)	309 (98.72)	0 (0)	5 (1.60)	305 (97.44)	3 (0.96)	16 (5.11)	297 (94.89)	0 (0)
Ukraine	0 (0)	146 (97.33)	4 (2.67)	0 (0)	138 (92.00)	12 (8.00)	0 (0)	150 (100)	0 (0)
United Kingdom	84 (0.87)	9578 (98.79)	33 (0.34)	476 (4.91)	9189 (94.78)	30 (0.31)	76 (0.78)	9595 (98.97)	24 (0.25)

Table 7.2 shows the frequency of three rare complications: Pneumothorax (collapsed lung) requiring chest tube, haemoptysis (coughing up of blood) of more than 250 ml and occurrence of malignancy (cancer). All these complications are extremely rare.

Table 7.3 Prevalence of liver disease and use of ursodeoxycholic acid in all patients seen in 2016, by country.

Country	Liver disease this year number (%)						Ursodeoxycholic acid this year number (%)		
	Missing/ unknown	No liver disease	Cirrhosis			Liver disease without cirrhosis	Missing/ unknown	No	Yes
			Cirrhosis with portal hypertension/ hypersplenism	Cirrhosis no portal hypertension/ hypersplenism	Cirrhosis. portal hypertension unknown				
Austria	6 (0.81)	424 (57.31)	24 (3.24)	67 (9.05)	2 (0.27)	217 (29.32)	1 (0.14)	400 (54.05)	339 (45.81)
Belgium[1]	7 (0.56)	1169 (93.82)	70 (5.62)	-	-	-	11 (0.88)	948 (76.09)	287 (23.03)
Bulgaria	1 (0.71)	109 (77.87)	5 (3.57)	1 (0.71)	1 (0.71)	23 (16.43)	5 (3.57)	107 (76.43)	28 (20.00)
Czech Republic	167 (28.55)	284 (48.55)	5 (0.85)	4 (0.68)	0 (0)	125 (21.37)	0 (0)	385 (65.81)	200 (34.19)
Denmark	0 (0)	392 (81.33)	22 (4.56)	7 (1.45)	0 (0)	61 (12.66)	0 (0)	342 (70.95)	140 (29.05)
France[2]	0 (0)	6451 (96.10)	0 (0)	0 (0)	262 (3.90)	0 (0)	0 (0)	4671 (69.58)	2042 (30.42)
Germany	572 (9.97)	3813 (66.46)	108 (1.88)	124 (2.16)	108 (1.88)	1013 (17.65)	124 (2.16)	2826 (49.25)	2788 (48.59)
Greece	2 (0.34)	445 (74.91)	9 (1.52)	4 (0.67)	14 (2.36)	120 (20.20)	1 (0.17)	439 (73.90)	154 (25.93)
Hungary	32 (6.31)	311 (61.34)	56 (11.05)	16 (3.16)	68 (13.41)	24 (4.73)	17 (3.35)	280 (55.23)	210 (41.42)
Ireland[3]	<5 (0.17)	993 (86.81)	39 (3.41)	6 (0.52)	7 (0.61)	97 (8.48)	<5 (0.17)	1020 (89.17)	122 (10.66)
Israel	5 (0.93)	442 (82.15)	15 (2.79)	3 (0.56)	0 (0)	73 (13.57)	4 (0.74)	446 (82.90)	88 (16.36)
Italy	65 (1.21)	3863 (72.05)	63 (1.18)	46 (0.86)	16 (0.30)	1308 (24.40)	48 (0.90)	3437 (64.11)	1876 (34.99)
Latvia	0 (0)	13 (36.11)	2 (5.56)	0 (0)	1 (2.78)	20 (55.55)	0 (0)	18 (50.00)	18 (50.00)
Lithuania	0 (0)	12 (100)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	12 (100)	0 (0)
Luxembourg	0 (0)	26 (81.24)	3 (9.38)	0 (0)	0 (0)	3 (9.38)	0 (0)	16 (50.00)	16 (50.00)
Rep of Macedonia	1 (0.92)	54 (49.54)	4 (3.67)	14 (12.84)	0 (0)	36 (33.03)	1 (0.92)	55 (50.46)	53 (48.62)
Rep of Moldova	1 (2.17)	41 (89.13)	0 (0)	0 (0)	0 (0)	4 (8.70)	1 (2.17)	40 (86.96)	5 (10.87)
The Netherlands	99 (7.01)	1037 (73.43)	68 (4.82)	21 (1.49)	10 (0.71)	177 (12.54)	59 (4.18)	991 (70.18)	362 (25.64)
Norway	13 (5.65)	187 (81.30)	8 (3.48)	4 (1.74)	0 (0)	18 (7.83)	7 (3.04)	202 (87.83)	21 (9.13)
Portugal	5 (1.57)	239 (74.92)	4 (1.25)	0 (0)	0 (0)	71 (22.26)	14 (4.39)	218 (68.34)	87 (27.27)
Romania	0 (0)	44 (88.00)	0 (0)	0 (0)	0 (0)	6 (12.00)	0 (0)	44 (88.00)	6 (12.00)
Russian Federation	70 (2.32)	2227 (73.69)	118 (3.90)	94 (3.11)	15 (0.50)	498 (16.48)	66 (2.18)	316 (10.46)	2640 (87.36)

[1] Belgium: collects only cirrhosis with portal hypertension yes or no. No liver disease therefore means no cirrhosis with portal hypertension.

[2] France: collects cirrhosis/liver disease *yes* or *no* – these have been pooled under cirrhosis, portal hypertension unknown.

[3] Ireland: when the number of patients is less than 5 the information is suppressed.

[table 7.3 continued]

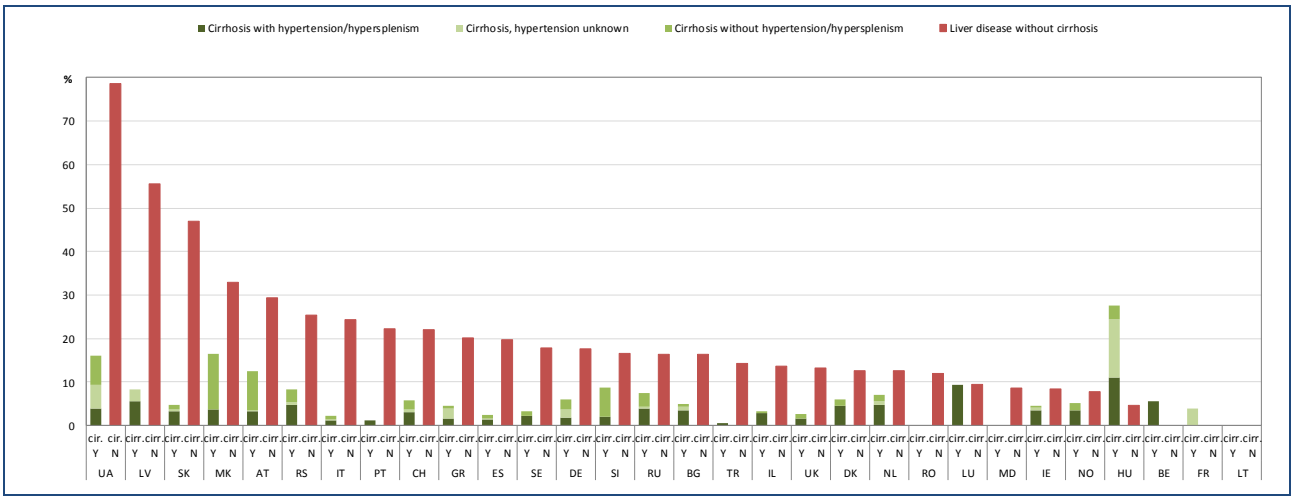
Country	Liver disease this year number (%)						Ursodeoxycholic acid this year number (%)		
	Missing/ unknown	No liver disease	Cirrhosis			Liver disease without cirrhosis	Missing/ unknown	No	Yes
			Cirrhosis with portal hypertension/ hypersplenism	Cirrhosis no portal hypertension/ hypersplenism	Cirrhosis. portal hypertension unknown				
Serbia[4]	0 (0)	113 (66.47)	8 (4.71)	5 (2.94)	1 (0.59)	43 (25.29)	0 (0)	114 (67.06)	56 (32.94)
Slovak Republic	1 (0.40)	118 (47.78)	8 (3.24)	3 (1.21)	1 (0.40)	116 (46.97)	0 (0)	123 (49.80)	124 (50.20)
Slovenia	1 (0.98)	75 (73.53)	2 (1.96)	7 (6.86)	0 (0)	17 (16.67)	2 (1.96)	50 (49.02)	50 (49.02)
Spain	43 (2.27)	1434 (75.54)	28 (1.48)	14 (0.74)	3 (0.16)	376 (19.81)	44 (2.32)	1408 (74.18)	446 (23.50)
Sweden[5]	0 (0)	512 (78.89)	14 (2.16)	7 (1.08)	0 (0)	116 (17.87)	9 (1.39)	496 (76.42)	144 (22.19)
Switzerland	31 (3.42)	624 (68.88)	27 (2.98)	19 (2.10)	6 (0.66)	199 (21.96)	9 (0.99)	639 (70.53)	258 (28.48)
Turkey	16 (5.11)	250 (79.87)	2 (0.64)	0 (0)	0 (0)	45 (14.38)	3 (0.96)	260 (83.07)	50 (15.97)
Ukraine	0 (0)	8 (5.33)	6 (4.00)	10 (6.67)	8 (5.33)	118 (78.67)	1 (0.67)	3 (2.00)	146 (97.33)
United Kingdom	34 (0.35)	8105 (83.59)	146 (1.51)	119 (1.23)	0 (0)	1291 (13.32)	<5 (0.03)	9130 (94.17)	562 (5.80)

[4] Serbia: cirrhosis without portal hypertension/hypersplenism means the presence of CF-related liver disease with normal liver function.

[5] Sweden: has only collected cirrhosis with portal hypertension yes or no this year. The rest have been set to No liver disease due to software issues. The prevalence of use of ursodeoxycholic acid could be used as an indicator of the total prevalence of liver disease of all categories.

This table shows the frequency and severity of liver disease according to the ECFSPR definitions (see Appendix 2, page 135) and use of ursodeoxycholic acid, a commonly used treatment for CF liver disease. The frequency and severity of liver disease differs greatly, and does not correspond to the number of patients on ursodeoxycholic acid.

Figure 7.3 Prevalence and severity of liver disease in all patients seen in 2016, by country.



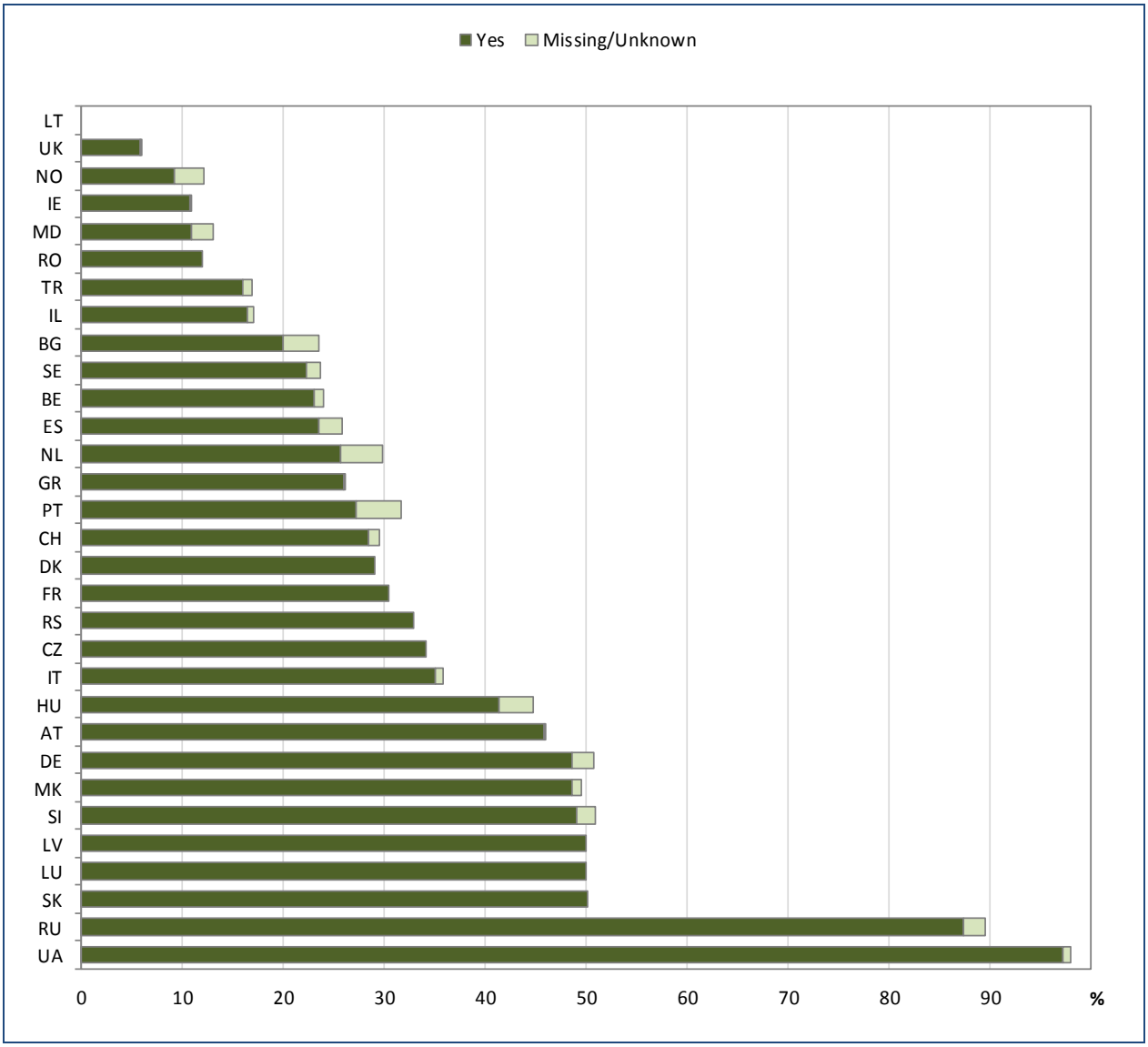
Note: We excluded from the graph the countries for which the information on liver disease was missing for more than 10% of the patients.

Note: Belgium: collects only cirrhosis with portal hypertension yes or no. No liver disease therefore means no cirrhosis with portal hypertension.
France: collects cirrhosis/liver disease *yes* or *no* – these have been pooled under cirrhosis, portal hypertension unknown.
Serbia: cirrhosis without portal hypertension/hypersplenism means the presence of CF-related disease with normal liver function.
Sweden: has only collected cirrhosis with portal hypertension yes or no this year. The rest have been set to "No liver disease" due to software issues. The prevalence of use of ursodeoxycholic acid could be used as an indicator of the total amount of liver disease of all categories.

This graph shows the frequency of liver disease by country. Liver disease is defined according to severity of portal hypertension (increased blood pressure in the liver veins, often resulting in blood shunting past the cirrhotic liver), divided into five categories, including no liver disease (see Appendix 2, page 135).

This graph emphasises better than the table the vast differences in frequency and severity, which may be due to problems in definitions and diagnostic tools.

Figure 7.4 Use of ursodeoxycholic acid in all patients seen in 2016, by country.



Note: We excluded from the graph the countries for which the information on ursodeoxycholic acid was missing for more than 10% of the patients.

This graph shows how many patients used ursodeoxycholic acid during the survey year. Ursodeoxycholic acid is used as a treatment for CF liver disease. The dark green part of the bar indicates the percentage of patients taking this drug, the light green part shows the percentage of patients for whom this information is missing.

Table 7.4 Use of hypertonic saline, rhDNase and bronchodilators in all patients seen in 2016, by country.

Country	Hypertonic saline (NaCl) inhaled > 3 months this year number (%)			rhDNase inhaled > 3 months this year number (%)			Bronchodilators inhaled > 3 months this year number (%)		
	Missing/ unknown	No	Yes	Missing/ unknown	No	Yes	Missing/ unknown	No	Yes
Austria	1 (0.14)	308 (41.62)	431 (58.24)	1 (0.14)	388 (52.43)	351 (47.43)	1 (0.14)	105 (14.19)	634 (85.67)
Belgium	0 (0)	568 (45.59)	678 (54.41)	0 (0)	351 (28.17)	895 (71.83)	0 (0)	432 (34.67)	814 (65.33)
Bulgaria	1 (0.71)	60 (42.86)	79 (56.43)	1 (0.71)	24 (17.14)	115 (82.15)	1 (0.71)	102 (72.86)	37 (26.43)
Czech Republic	0 (0)	287 (49.06)	298 (50.94)	0 (0)	230 (39.32)	355 (60.68)	0 (0)	253 (43.25)	332 (56.75)
Denmark	482 (100)	-	-	0 (0)	75 (15.56)	407 (84.44)	482 (100)	-	-
France	0 (0)	6112 (91.05)	601 (8.95)	0 (0)	3494 (52.05)	3219 (47.95)	0 (0)	3174 (47.28)	3539 (52.72)
Germany	97 (1.69)	1296 (22.59)	4345 (75.72)	126 (2.20)	2688 (46.85)	2924 (50.95)	133 (2.32)	996 (17.36)	4609 (80.32)
Greece	0 (0)	386 (64.98)	208 (35.02)	1 (0.17)	205 (34.51)	388 (65.32)	2 (0.34)	302 (50.84)	290 (48.82)
Hungary	9 (1.78)	161 (31.76)	337 (66.46)	21 (4.14)	198 (39.05)	288 (56.81)	9 (1.78)	223 (43.98)	275 (54.24)
Ireland	<5 (0.17)	545 (47.64)	597 (52.19)	<5 (0.17)	551 (48.16)	591 (51.67)	<5 (0.17)	372 (32.52)	770 (67.31)
Israel	7 (1.30)	154 (28.62)	377 (70.08)	4 (0.74)	160 (29.74)	374 (69.52)	4 (0.74)	209 (38.85)	325 (60.41)
Italy	49 (0.91)	2928 (54.62)	2384 (44.47)	53 (0.99)	3619 (67.50)	1689 (31.51)	51 (0.95)	1379 (25.72)	3931 (73.33)
Latvia	0 (0)	3 (8.33)	33 (91.67)	0 (0)	13 (36.11)	23 (63.89)	0 (0)	4 (11.11)	32 (88.89)
Lithuania	0 (0)	12 (100)	0 (0)	0 (0)	2 (16.67)	10 (83.33)	0 (0)	8 (66.67)	4 (33.33)
Luxembourg	0 (0)	12 (37.50)	20 (62.50)	0 (0)	11 (34.38)	21 (65.62)	0 (0)	12 (37.50)	20 (62.50)
Rep of Macedonia	1 (0.92)	55 (50.46)	53 (48.62)	1 (0.92)	27 (24.77)	81 (74.31)	1 (0.92)	4 (3.67)	104 (95.41)
Rep of Moldova	1 (2.17)	3 (6.52)	42 (91.31)	1 (2.17)	44 (95.66)	1 (2.17)	1 (2.17)	41 (89.13)	4 (8.70)
The Netherlands	66 (4.67)	963 (68.21)	383 (27.12)	58 (4.11)	457 (32.37)	897 (63.52)	55 (3.90)	664 (47.03)	693 (49.07)
Norway	4 (1.74)	67 (29.13)	159 (69.13)	4 (1.74)	88 (38.26)	138 (60.00)	3 (1.30)	41 (17.83)	186 (80.87)
Portugal	13 (4.08)	234 (73.35)	72 (22.57)	14 (4.39)	75 (23.51)	230 (72.10)	14 (4.39)	143 (44.83)	162 (50.78)
Romania	0 (0)	2 (4.00)	48 (96.00)	0 (0)	8 (16.00)	42 (84.00)	0 (0)	2 (4.00)	48 (96.00)
Russian Federation	93 (3.08)	1332 (44.08)	1597 (52.84)	64 (2.12)	188 (6.22)	2770 (91.66)	72 (2.38)	1244 (41.16)	1706 (56.46)
Serbia	0 (0)	10 (5.88)	160 (94.12)	0 (0)	83 (48.82)	87 (51.18)	0 (0)	1 (0.59)	169 (99.41)
Slovak Republic	0 (0)	233 (94.33)	14 (5.67)	0 (0)	98 (39.68)	149 (60.32)	0 (0)	109 (44.13)	138 (55.87)
Slovenia	0 (0)	13 (12.75)	89 (87.25)	0 (0)	71 (69.61)	31 (30.39)	2 (1.96)	80 (78.43)	20 (19.61)
Spain	31 (1.63)	752 (39.62)	1115 (58.75)	32 (1.69)	1316 (69.33)	550 (28.98)	32 (1.69)	626 (32.98)	1240 (65.33)

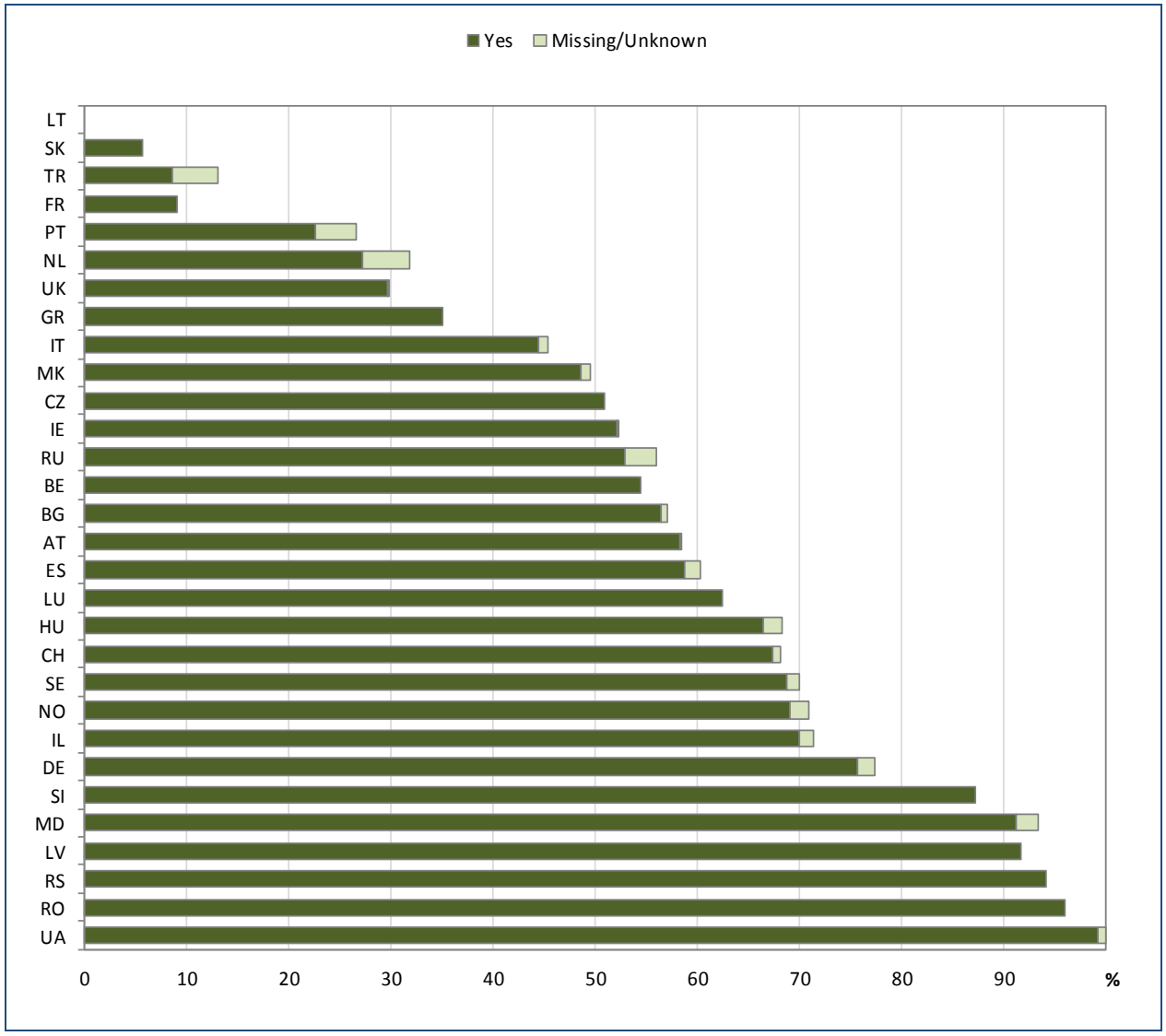
[table 7.4 continued]

Country	Hypertonic saline (NaCl) inhaled > 3 months this year number (%)			rhDNase inhaled > 3 months this year number (%)			Bronchodilators inhaled > 3 months this year number (%)		
	Missing/ unknown	No	Yes	Missing/ unknown	No	Yes	Missing/ unknown	No	Yes
Sweden	8 (1.23)	195 (30.05)	446 (68.72)	6 (0.92)	473 (72.89)	170 (26.19)	9 (1.39)	75 (11.56)	565 (87.05)
Switzerland	7 (0.77)	288 (31.79)	611 (67.44)	5 (0.55)	508 (56.07)	393 (43.38)	6 (0.66)	132 (14.57)	768 (84.77)
Turkey	14 (4.47)	272 (86.90)	27 (8.63)	2 (0.64)	31 (9.90)	280 (89.46)	2 (0.64)	107 (34.19)	204 (65.17)
Ukraine	1 (0.67)	0 (0)	149 (99.33)	3 (2.00)	63 (42.00)	84 (56.00)	1 (0.67)	5 (3.33)	144 (96.00)
United Kingdom[1]	<5 (0.03)	6823 (70.38)	2869 (29.59)	<5 (0.03)	3860 (39.81)	5832 (60.16)	<5 (0.03)	4333 (44.69)	5359 (55.28)

[1] United Kingdom: the duration of use of inhaled hypertonic saline and of bronchodilators is not specified.

Table 7.4 shows the use of three different inhaled medications: hypertonic saline, rhDNase (Pulmozyme®) and bronchodilators (see page 12 for abbreviations).

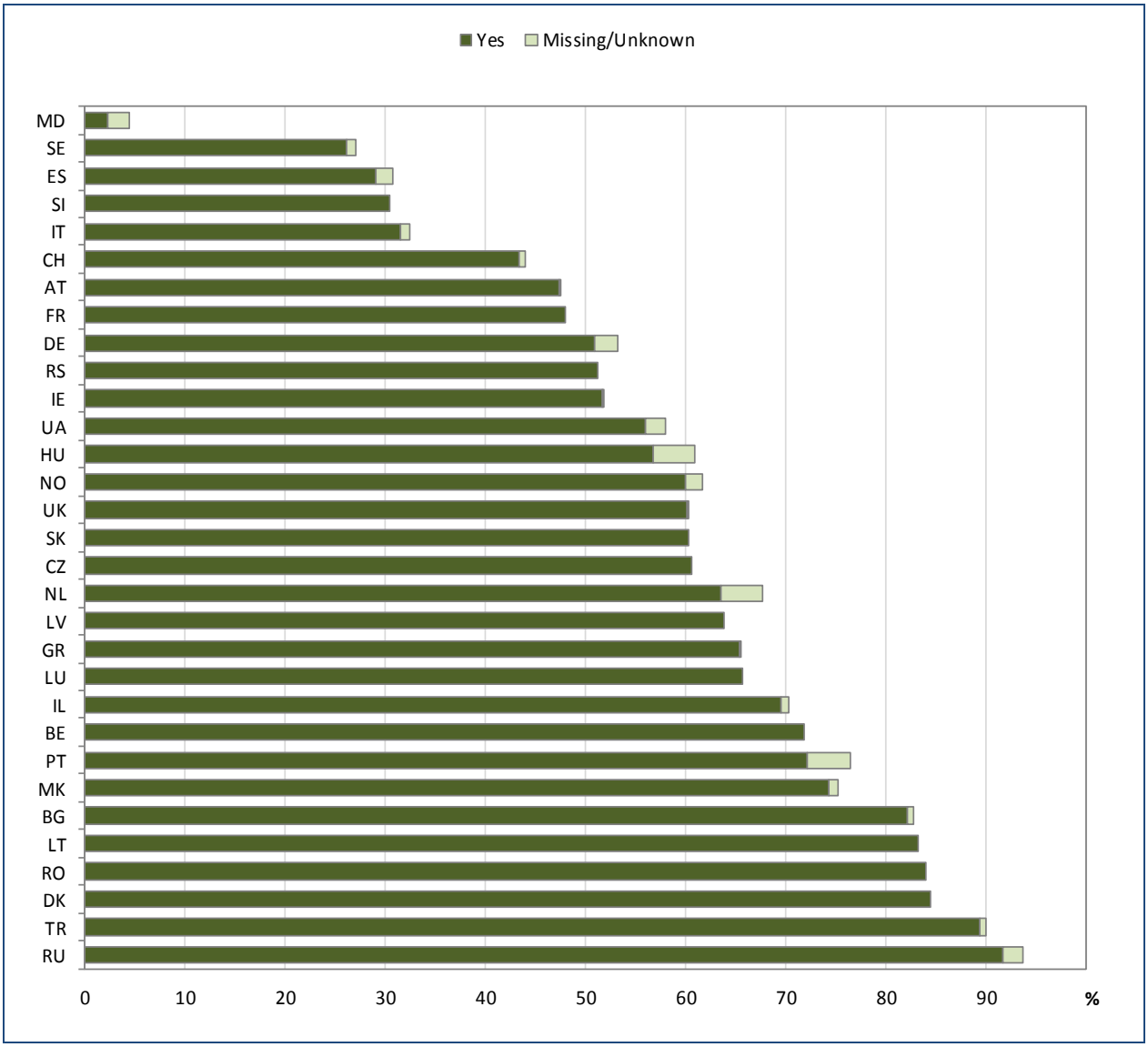
Figure 7.5 Use of inhaled hypertonic saline in all patients seen in 2016, by country.



Note: We excluded from the graph the countries for which the information on inhaled hypertonic saline was missing for more than 10% of the patients.
Note: United Kingdom: the duration of use of inhaled hypertonic saline is not specified.

This table shows the use of inhaled hypertonic saline for more than three months during the survey year. The dark green part of the bar indicates the percentage of patients taking the medication, the light green part shows the percentage of patients for whom this information is missing.

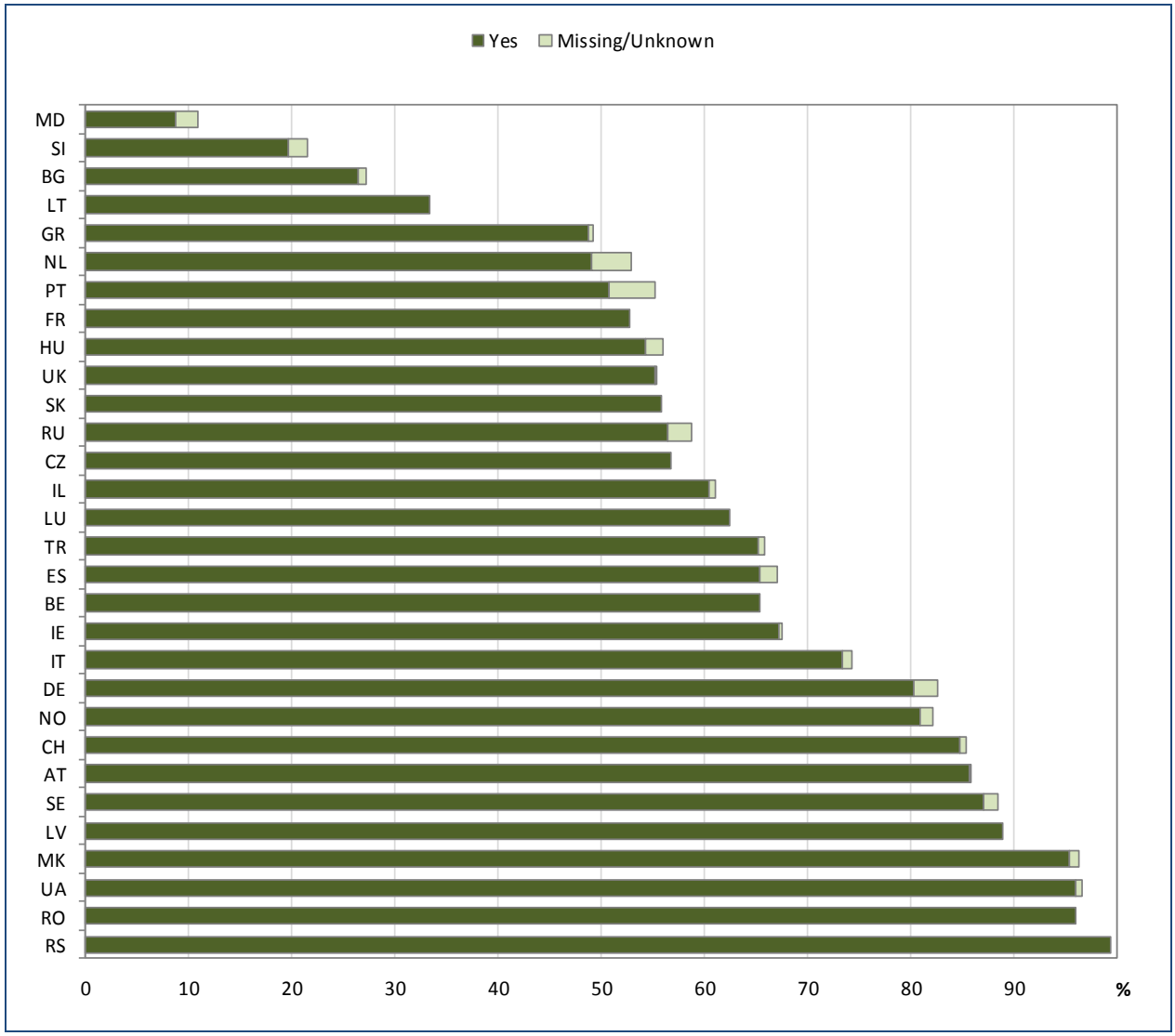
Figure 7.6 Use of rhDNase in all patients seen in 2016, by country.



Note: We excluded from the graph the countries for which the information on rhDNase was missing for more than 10% of the patients.

This graph shows the use of rhDNase (marketed as Pulmozyme®) as inhalations for more than 3 months during the survey year. The dark green part of the bar indicates the percentage of patients taking this drug, the light green part shows the percentage of patients for whom this information is missing.

Figure 7.7 Use of bronchodilators in all patients seen in 2016, by country.



Note: We excluded from the graph the countries for which the information on use of bronchodilators was missing for more than 10% of the patients.

Note: United Kingdom: the duration of use of bronchodilators is not specified.

This graph shows the use of bronchodilators for more than three months during the survey year. This is the most widely used inhaled medication, but still there are significant differences in frequency of use between countries. The dark green part of the bar indicates the percentage of patients taking this drug, the light green part shows the percentage of patients for whom this information is missing.

Table 7.5 Use of inhaled antibiotics, oxygen and macrolides in all patients seen in 2016, by country.

Country	Inhaled antibiotics inhaled > 3 months this year number (%)			Oxygen therapy this year number (%)			Macrolides > 3 months this year number (%)		
	Missing/ unknown	No	Yes	Missing/ unknown	No	Yes	Missing/ unknown	No	Yes
Austria	2 (0.27)	479 (64.73)	259 (35.00)	0 (0)	714 (96.49)	26 (3.51)	2 (0.27)	678 (91.62)	60 (8.11)
Belgium[1]	170 (13.64)	476 (38.20)	600 (48.16)	11 (0.88)	1205 (96.71)	30 (2.41)	0 (0)	548 (43.98)	698 (56.02)
Bulgaria	1 (0.71)	53 (37.86)	86 (61.43)	1 (0.71)	128 (91.43)	11 (7.86)	2 (1.43)	133 (95.00)	5 (3.57)
Czech Republic	0 (0)	434 (74.19)	151 (25.81)	0 (0)	559 (95.56)	26 (4.44)	0 (0)	515 (88.03)	70 (11.97)
Denmark	482 (100)	-	-	0 (0)	469 (97.30)	13 (2.70)	482 (100)	-	-
France[2]	0 (0)	4131 (61.54)	2582 (38.46)	0 (0)	6402 (95.37)	311 (4.63)	0 (0)	3848 (57.32)	2865 (42.68)
Germany	127 (2.21)	2949 (51.40)	2662 (46.39)	124 (2.16)	5206 (90.73)	408 (7.11)	141 (2.46)	4559 (79.45)	1038 (18.09)
Greece	0 (0)	244 (41.08)	350 (58.92)	2 (0.34)	566 (95.28)	26 (4.38)	0 (0)	366 (61.62)	228 (38.38)
Hungary	8 (1.58)	290 (57.20)	209 (41.22)	19 (3.75)	443 (87.37)	45 (8.88)	17 (3.35)	359 (70.81)	131 (25.84)
Ireland	2 (0.17)	599 (52.36)	543 (47.47)	2 (0.17)	1046 (91.44)	96 (8.39)	2 (0.17)	590 (51.58)	552 (48.25)
Israel	4 (0.74)	236 (43.87)	298 (55.39)	4 (0.74)	516 (95.91)	18 (3.35)	6 (1.12)	267 (49.62)	265 (49.26)
Italy	48 (0.90)	3102 (57.86)	2211 (41.24)	49 (0.91)	5025 (93.74)	287 (5.35)	49 (0.91)	3591 (66.99)	1721 (32.10)
Latvia	0 (0)	20 (55.56)	16 (44.44)	0 (0)	35 (97.22)	1 (2.78)	0 (0)	27 (75.00)	9 (25.00)
Lithuania	0 (0)	11 (91.67)	1 (8.33)	0 (0)	11 (91.67)	1 (8.33)	0 (0)	11 (91.67)	1 (8.33)
Luxembourg	0 (0)	18 (56.25)	14 (43.75)	0 (0)	32 (100)	0 (0)	0 (0)	18 (56.25)	14 (43.75)
Rep of Macedonia	1 (0.92)	60 (55.04)	48 (44.04)	1 (0.92)	106 (97.25)	2 (1.83)	1 (0.92)	89 (81.65)	19 (17.43)
Rep of Moldova	1 (2.17)	23 (50.00)	22 (47.83)	1 (2.17)	44 (95.66)	1 (2.17)	1 (2.17)	43 (93.48)	2 (4.35)
The Netherlands	47 (3.33)	827 (58.57)	538 (38.10)	56 (3.97)	1304 (92.35)	52 (3.68)	59 (4.18)	799 (56.58)	554 (39.24)
Norway	9 (3.91)	171 (74.35)	50 (21.74)	3 (1.30)	222 (96.53)	5 (2.17)	203 (88.26)	0 (0)	27 (11.74)
Portugal	6 (1.88)	155 (48.59)	158 (49.53)	16 (5.02)	287 (89.96)	16 (5.02)	15 (4.70)	213 (66.77)	91 (28.53)
Romania	0 (0)	24 (48.00)	26 (52.00)	0 (0)	50 (100)	0 (0)	0 (0)	39 (78.00)	11 (22.00)
Russian Federation	73 (2.42)	1543 (51.05)	1406 (46.53)	66 (2.18)	2796 (92.53)	160 (5.29)	70 (2.32)	2026 (67.04)	926 (30.64)
Serbia	0 (0)	103 (60.59)	67 (39.41)	0 (0)	167 (98.24)	3 (1.76)	0 (0)	155 (91.18)	15 (8.82)
Slovak Republic	0 (0)	112 (45.34)	135 (54.66)	0 (0)	237 (95.95)	10 (4.05)	0 (0)	158 (63.97)	89 (36.03)

[1] Belgium: inhaled antibiotics is not collected for transplanted patients and most of the missing data refers to this sub-population.

[2] France: collects only use of azithromycin for macrolides.

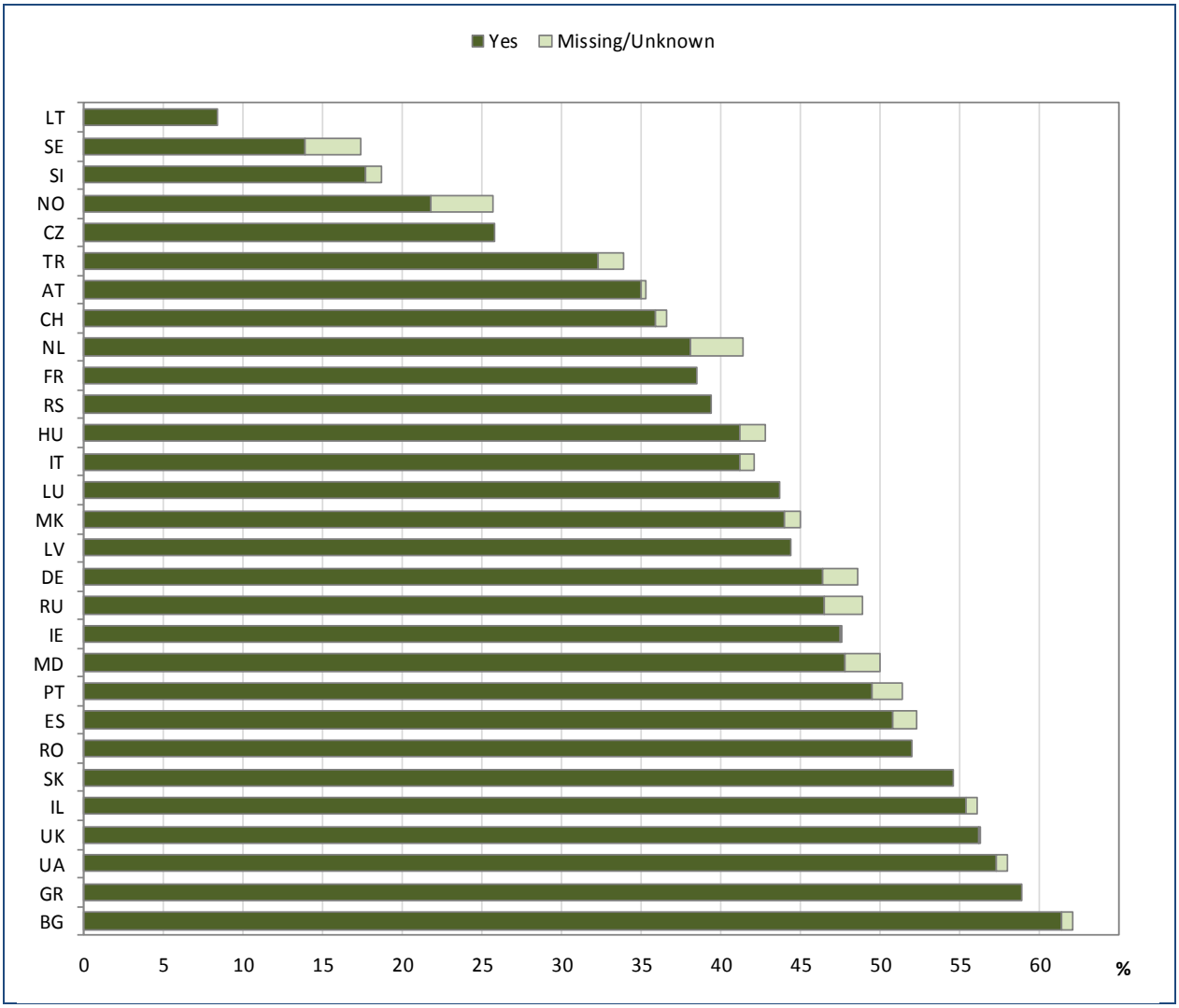
[table 7.5 continued]

Country	Inhaled antibiotics inhaled > 3 months this year number (%)			Oxygen therapy this year number (%)			Macrolides > 3 months this year number (%)		
	Missing/ unknown	No	Yes	Missing/ unknown	No	Yes	Missing/ unknown	No	Yes
Slovenia	1 (0.98)	83 (81.37)	18 (17.65)	0 (0)	98 (96.08)	4 (3.92)	1 (0.98)	94 (92.16)	7 (6.86)
Spain	28 (1.48)	905 (47.68)	965 (50.84)	32 (1.69)	1803 (94.99)	63 (3.32)	31 (1.63)	1154 (60.80)	713 (37.57)
Sweden	23 (3.54)	536 (82.59)	90 (13.87)	6 (0.92)	629 (96.92)	14 (2.16)	10 (1.54)	441 (67.95)	198 (30.51)
Switzerland	7 (0.77)	574 (63.36)	325 (35.87)	8 (0.88)	865 (95.48)	33 (3.64)	8 (0.88)	632 (69.76)	266 (29.36)
Turkey	5 (1.60)	207 (66.13)	101 (32.27)	2 (0.64)	306 (97.76)	5 (1.60)	102 (32.59)	190 (60.70)	21 (6.71)
Ukraine	1 (0.67)	63 (42.00)	86 (57.33)	1 (0.67)	135 (90.00)	14 (9.33)	1 (0.67)	5 (3.33)	144 (96.00)
United Kingdom[4]	<5 (0.03)	4238 (43.71)	5454 (56.26)	306 (3.16)	8751 (90.26)	638 (6.58)	<5 (0.03)	5845 (60.29)	3847 (39.68)

[4] United Kingdom: the duration of use of macrolides is not specified.

This table shows the use of three treatments: inhaled antibiotics for more than 3 months during the survey year (any kind); macrolides (e.g. azithromycin) for more than three months; oxygen for home treatment. Both inhaled antibiotics and macrolides are frequently used but with marked differences between countries. Oxygen is used less frequently (severe lung disease).

Figure 7.8 Use of inhaled antibiotics in all patients seen in 2016, by country.

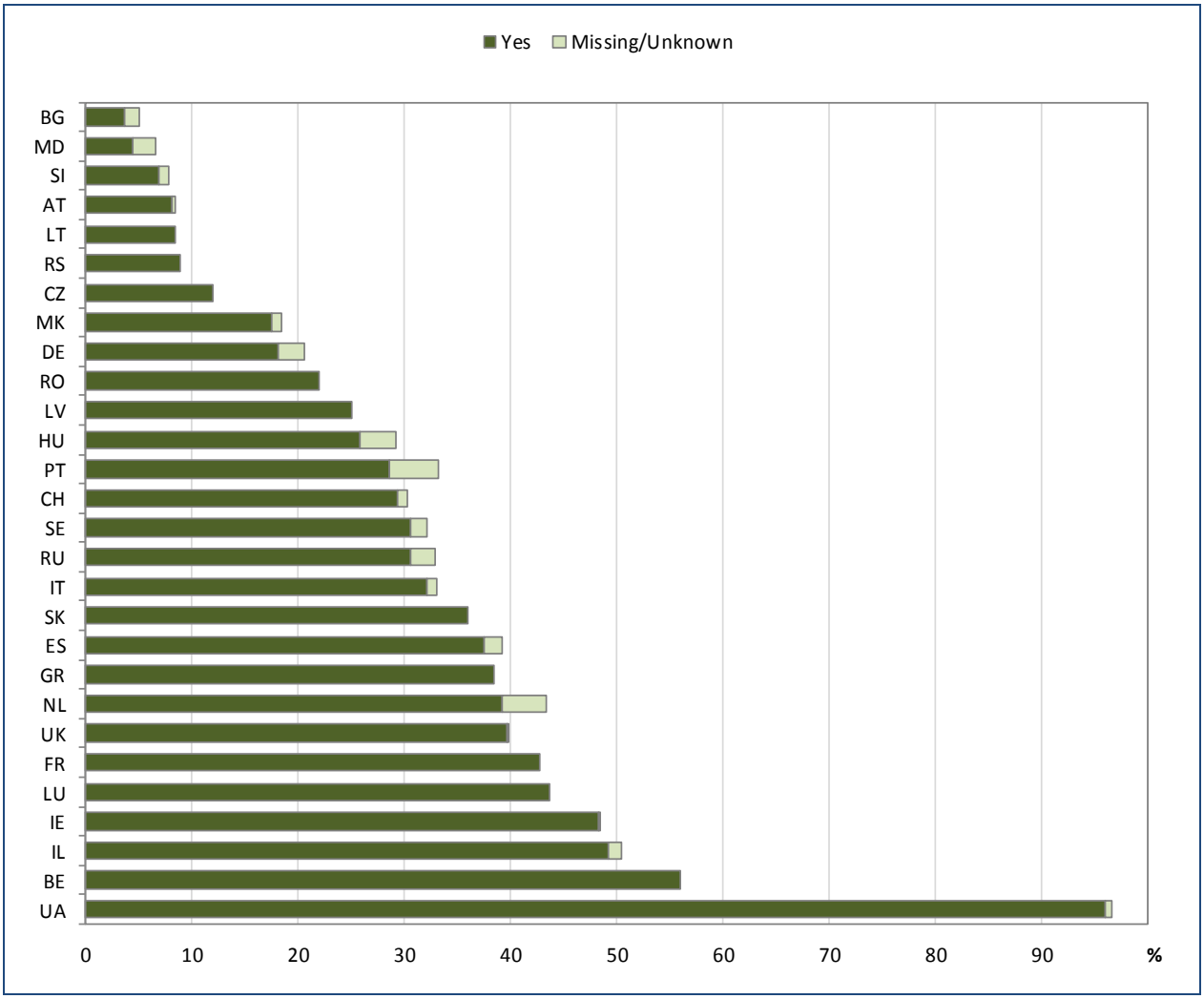


Note: We excluded from the graph the countries for which the information on inhaled antibiotics was missing for more than 10% of the patients.

Note: Belgium: inhaled antibiotics is not collected for transplanted patients and most of the missing data refers to this sub-population.

This graph shows the use of inhaled antibiotics (of any kind) for more than three months during the survey year. The frequency varies considerably, from 8 to 61%. The dark green part of the bar shows the percentage of patients taking this drug, the light green part shows the percentage of patients for whom this information is missing.

Figure 7.9 Use of macrolides in all patients seen in 2016, by country.

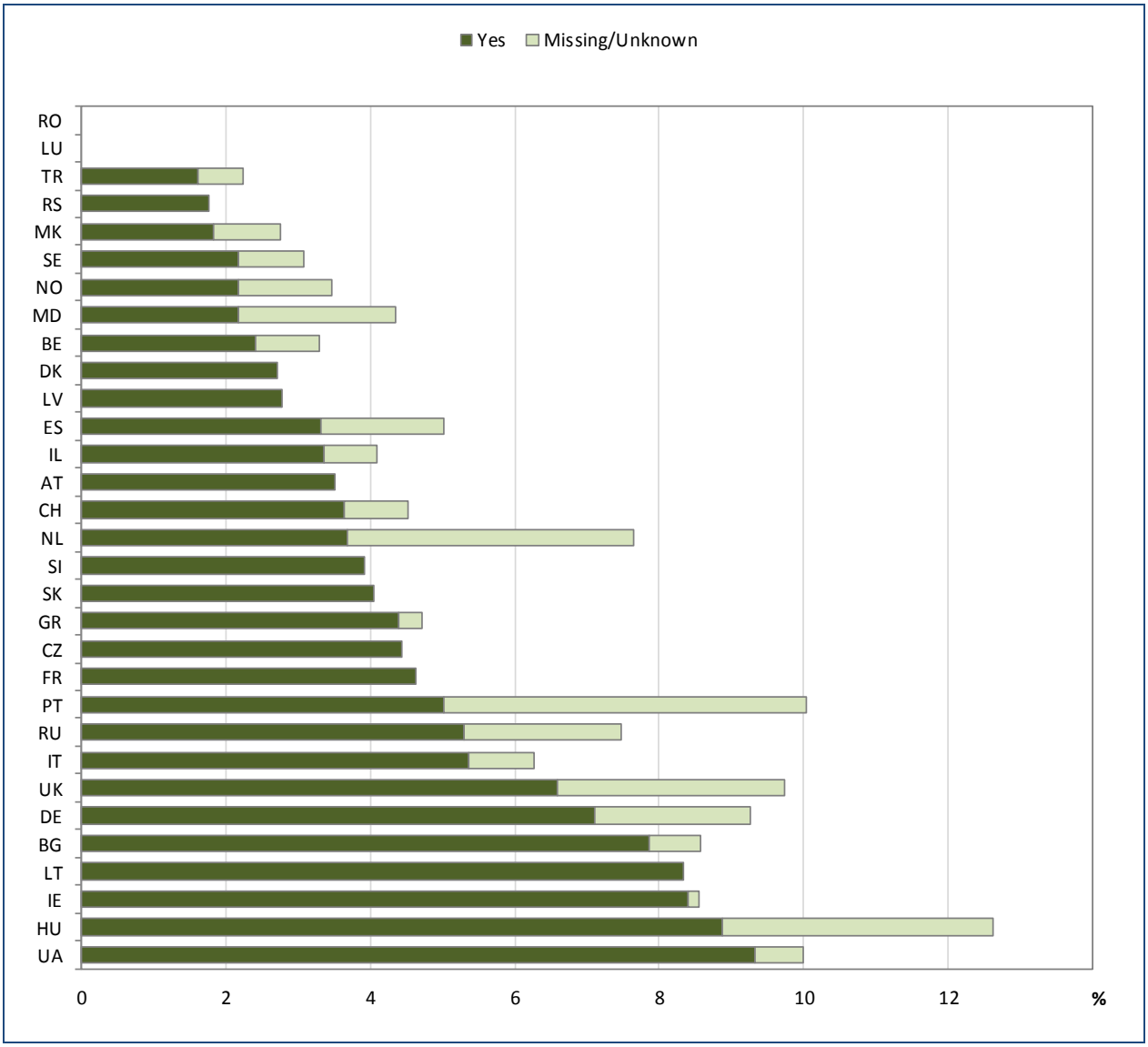


Note: We excluded from the graph the countries for which the information on use of macrolides was missing for more than 10% of the patients.

Note: France: collects only use of azithromycin for macrolides.
United Kingdom: the duration of use of macrolides is not specified.

This graph shows the use of macrolides (e.g. azithromycin) for more than 3 months during the survey year. Macrolides are antibiotics, but taken continuously they also modulate the immune system. The dark green part of the bar indicates the percentage of patients taking this drug, the light green part shows the percentage of patients for whom this information is missing.

Figure 7.10 Use of oxygen in all patients seen in 2016, by country.



Note: We excluded from the graph the countries for which the information on the use of oxygen was missing for more than 10% of the patients.

This graph shows the use of oxygen at home during the survey year. Oxygen is used for severe lung disease. The dark green part of the bar indicates the percentage of patients using oxygen supplementation, the light green part shows the percentage of patients for whom this information is missing.

8. Transplantation

We ask the countries whether their patients are transplanted or not, and if they are, in which year they had their (latest) transplant.

In some countries transplanted patients are no longer registered in the CF centres' database and the CF national registry, because the patients have been transferred to a transplant centre. For this reason, the figures below may report a lower number of transplanted patients than the true number, but it has not been possible to acquire more accurate data.

Table 8.1 Number of patients living in 2016 with transplanted lungs, by age and sex.

Age	Males	Females	Total	Transplants performed during the survey year
5-9	2	0	2	1
10-14	8	14	22	9
15-19	50	51	101	33
20-24	84	134	218	48
25-29	169	215	384	49
30-34	238	227	465	66
35-39	206	211	417	35
40-44	161	142	303	25
45+	244	158	402	18
Total	1162	1152	2314	284

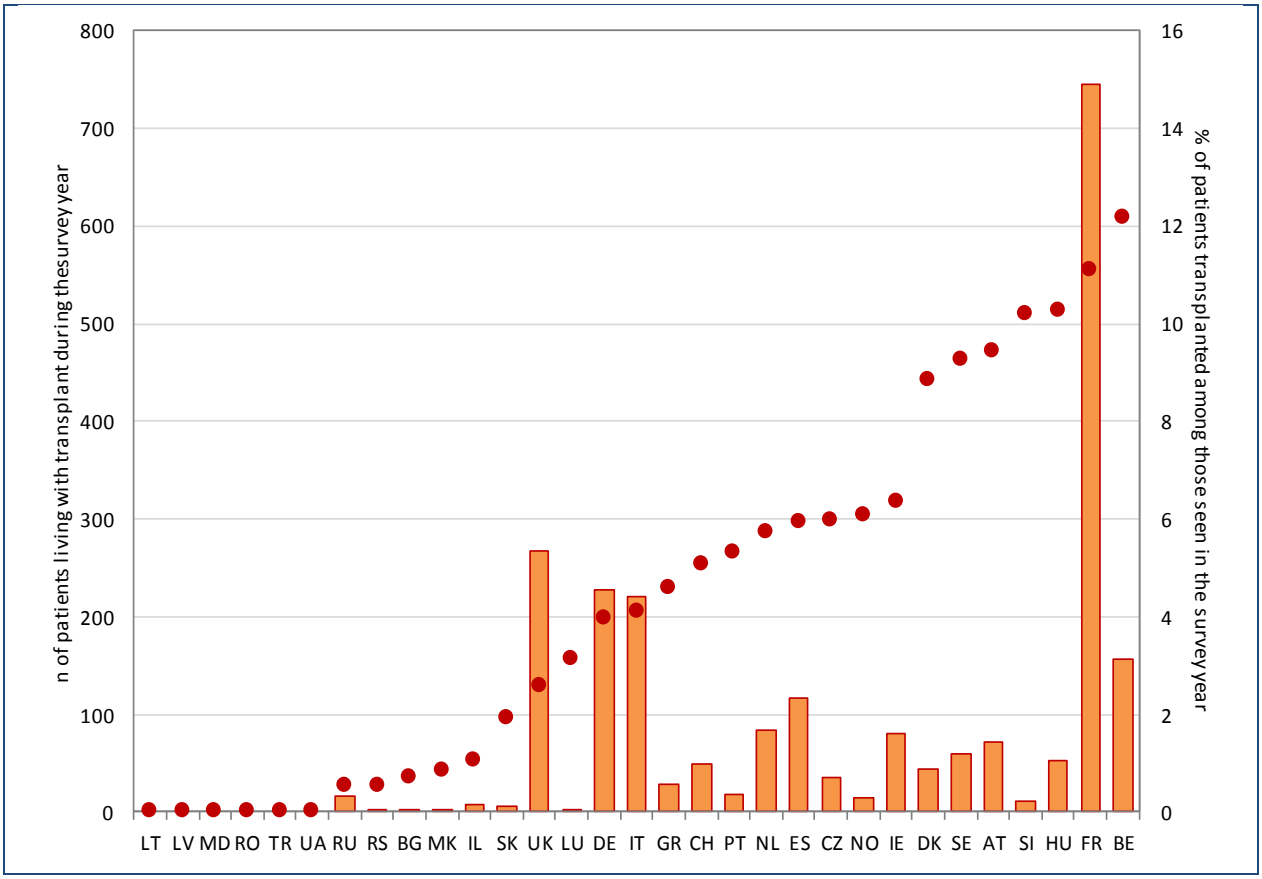
This table shows the number of patients alive in 2016 who have had a lung transplant at some time in their life, by age group, as well as the number of patients transplanted during 2016.

Table 8.2 Number of patients living in 2016 with transplanted liver, by age and sex.

Age	Males	Females	Total	Transplants performed during the survey year
0-4	1	1	2	1
5-9	3	1	4	0
10-14	12	9	21	2
15-19	25	13	38	3
20-24	30	16	46	2
25-29	30	18	48	4
30-34	25	16	41	2
35-39	13	8	21	2
40-44	10	5	15	0
45+	8	3	11	1
Total	157	90	247	17

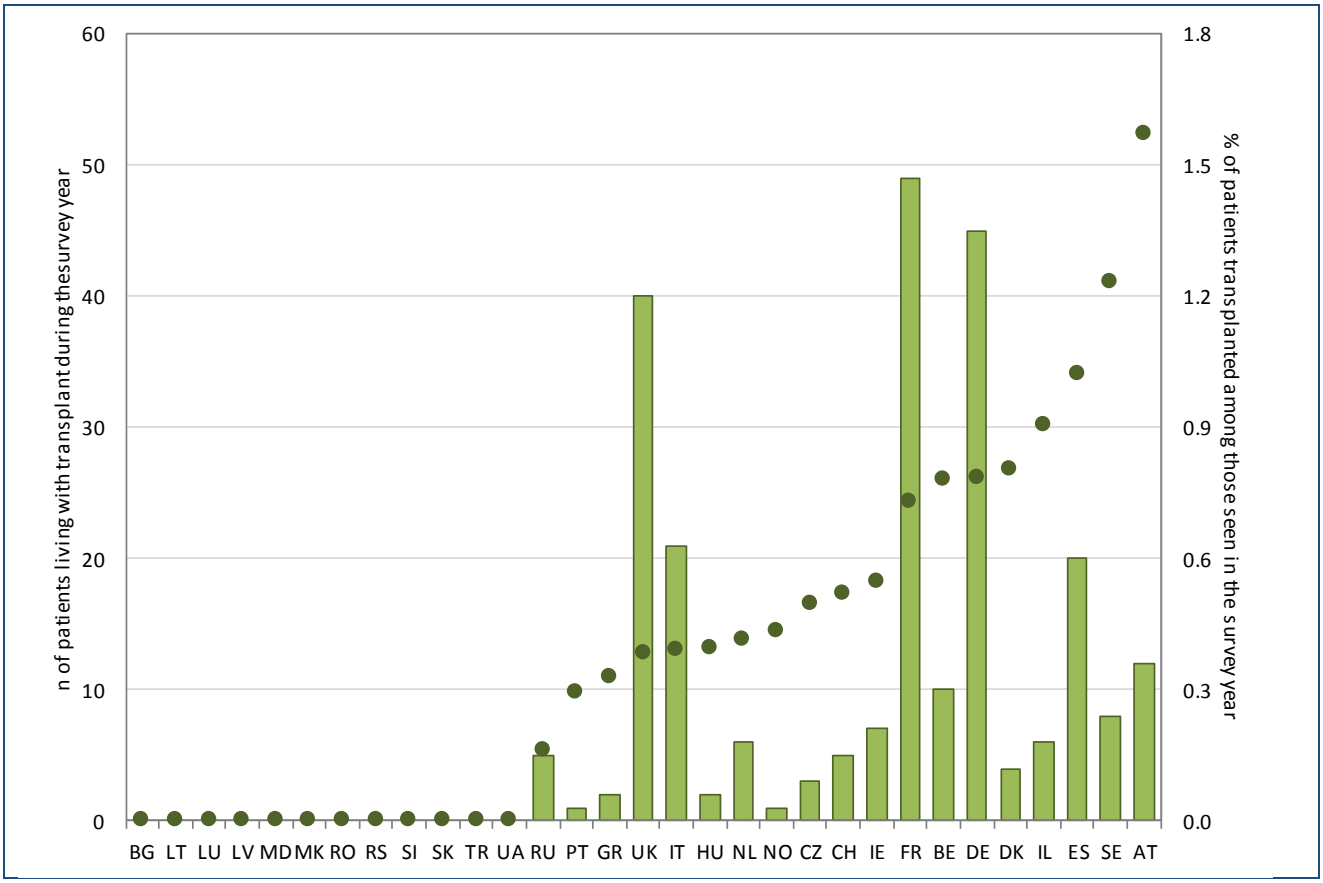
This table shows the number of patients alive in 2016 who have had a liver transplant at some time in their life, by age group, as well as the number of patients transplanted during 2016.

Figure 8.1 Number of patients living in 2016 with transplanted lungs, by country.



This graph shows the number of patients alive at 31/12/2016 who have had a lung transplant (orange bars) at some point in their life. The red dots (right axis) show the percentage of patients that are living with lung transplant in 2016 among the patients that were seen in 2016.

Figure 8.2 Number of patients living in 2016 with transplanted liver, by country.



This graph shows the number of patients alive at 31/12/2016 who have had a liver transplant (green bars) at some point in their life. The dark green dots (right axis) show the percentage of patients that are living with liver transplant in 2016 among the patients that were seen in 2016.

Note that on the vertical axis the number of patients with liver transplant is much lower than the number with lung transplant. The main reason for this is that liver disease is only found in a subset of CF patients, whereas lung disease affects almost all patients.

9. Mortality

Table 9.1 Number of deaths in 2016, by age and sex.

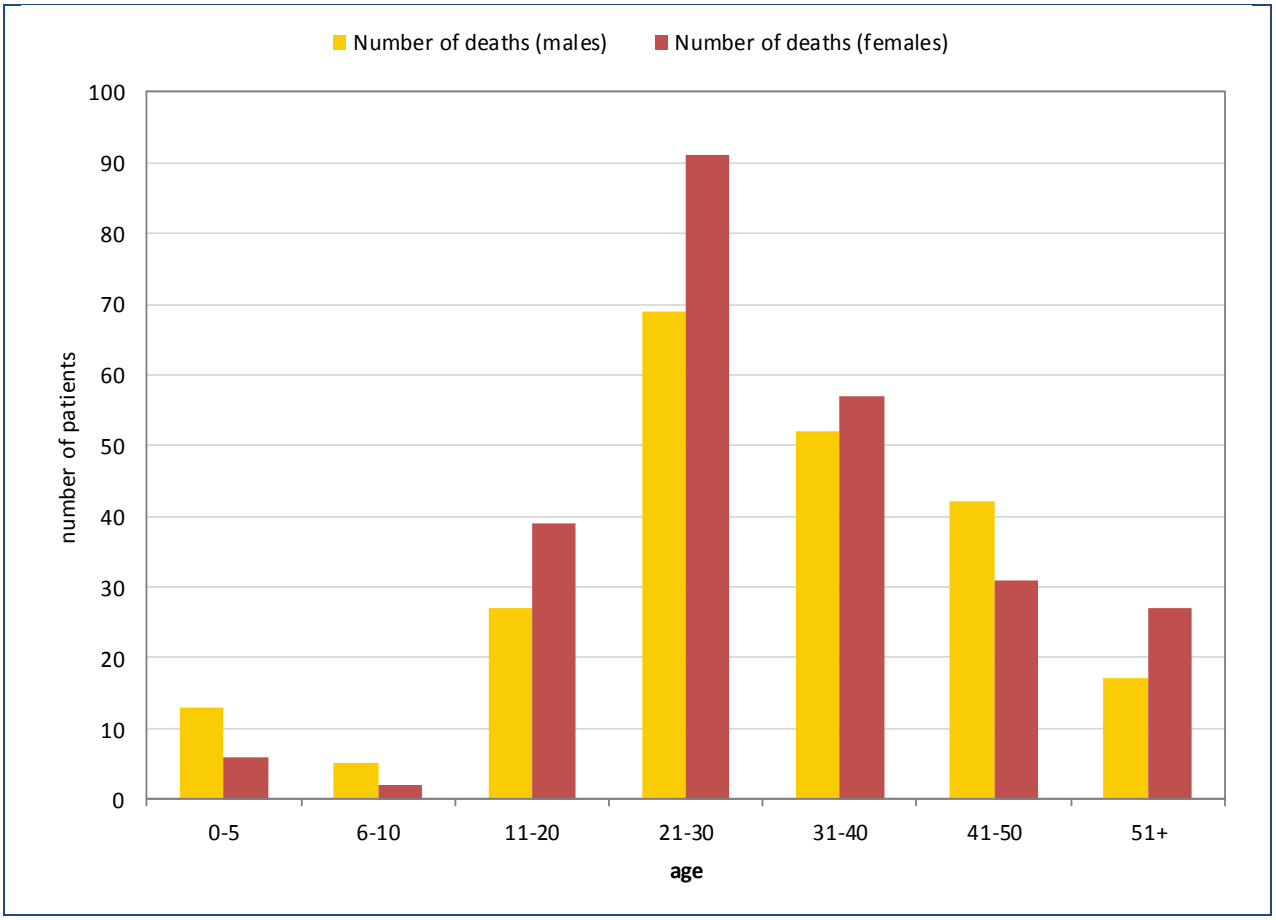
Age at death	Number of male patients	% of deaths in this age group of all male deaths	Number of female patients	% of deaths in this age group of all female deaths	Total	% Total
0-5	13	5.78	6	2.37	19	3.97
6-10	5	2.22	2	0.79	7	1.46
11-20	27	12.00	39	15.42	66	13.81
21-30	69	30.67	91	35.97	160	33.47
31-40	52	23.11	57	22.53	109	22.80
41-50	42	18.67	31	12.25	73	15.27
51+	17	7.56	27	10.67	44	9.21
Total	225	0.98	254	1.22	479	1.09

Note: For the United Kingdom, all patients with confirmed diagnosis of CF were included (N=10,465). The total number of patients presented is 43,956.
Note: For 1 female patient date at death, and thereby age at death, is unknown.

This table shows the number of deaths in 2016 by age group and sex. Death in small children is very rare, and the most frequent range of age of death for both sexes is 21-30 years.

Please note: it is possible that the number of deceased patients is under reported because some of the patients were not seen at the centre during the year, and therefore the information may not have been recorded.

Figure 9.1 Age at death distribution of patients deceased in 2016, by sex.



Note: For the United Kingdom, all patients with confirmed diagnosis of CF were included (N=10,465). The total number of patients presented is 43,956.
Note: For 1 female patient date at death, and thereby age at death, was unknown.

This graph shows the distribution of age at death of patients who died in 2016, separately by males (yellow) and females (red).

Table 9.2 Cause of death distribution of deaths in 2016.

Cause of death	Number of deaths	Percentage of all deaths
Respiratory disease	283	59.08
Transplantation related	62	12.94
Non-CF related	28	5.85
Liver-GI related	10	2.09
Trauma	2	0.42
Unknown	94	19.62
Total	479	100.00

Note: United Kingdom collects cause of death “respiratory disease” as “cardio/respiratory”.

This table shows cause of death for the deceased patients. The most frequent cause of death is respiratory disease. Please note that only a limited number of causes of death are collected, therefore if some deaths are due to rare complications of CF, they may have been classified as “Unknown”.

Publications

The ECFSPR data has been actively used for research. Data applications are handled in accordance with the ECFSPR guidelines, for more information we refer you to the webpage www.ecfs.eu/projects/ecfs-patient-registry/data-request-application.

In the period 2011-2017 we received 65 applications for data. The majority of these requests originated from researchers (85%), from within and outside of the European Cystic Fibrosis Society; and 15% of the applications derived from the Industry.

Several of these research projects have resulted in publications and others are in the pipeline. Brief synopses and links to the published articles you will find on the website www.ecfs.eu/projects/ecfs-patient-registry/articles.

An overview of the approved applications for data so far unrelated to any publications can also be found on the website www.ecfs.eu/projects/ecfs-patient-registry/overview-data-applications.

Partners

Contributors

Appendix 1: Technical notes

Patient inclusion criteria

The ECFSPR registers patients diagnosed with CF in accordance with agreed definitions (see Appendix 2). Data of patients with a diagnosis that does not meet the agreed definitions are accepted in the database but not included in the analyses.

Data manipulation

To ensure that data was anonymous, we collected only year and month of birth and the day of birth was set to the 15th of the month.
Unknown dates of lung function tests and of height/weight measurements were set to July 1st of the survey year.
For pre-natal diagnoses, we set age at diagnosis equal to 0.

We checked for outliers and, whenever possible, we corrected the values according to the national registries'/individual centres' instructions. If, after the data quality controls, aberrant values were still present in the database, we set them to missing for the purposes of this report.

Reference populations used for computing z-scores

The value of a z-score depends on the reference anthropometric chart: if different reference values are used, the same value of height (or weight or BMI) will result in different values of z-scores, and these differences might be of clinical importance. To compare the nutritional status of CF patients with that of healthy individuals an appropriate reference population must be used: ideally, a fair comparison requires that CF patients and healthy individuals belong to the same population. This implies the availability of a national reference.

The lack of a national reference for most countries participating in the ECFSPR obliged us to use an international reference to compute z-scores for height, weight and BMI. We decided to use the CDC 2000 reference charts (Kuczmarski RJ, Ogden CL, Guo SS et al. 2000 CDC Growth Charts for the United States: Methods and Development. National Centre for Health Statistics. Vital Health Stat 2002; 11(246):1-190.), which were derived from samples of U.S. healthy individuals[1]. The choice of CDC charts as a reference, although not the most suitable to assess the nutritional status of European CF patients, is justified by the widespread use of these charts at international level.

Reference populations used for computing FEV_1 predicted values

We computed the percent of predicted values for FEV_1 and FVC using:
The multi-ethnic reference values for spirometry for the 3-95-yr age range: the global lung function 2012 equations. Eur Respir J 2012; 40: 1324–1343.

Software used for data management and statistical analyses

SAS software, Version 9.4. Copyright, SAS Institute Inc. SAS and all other SAS Institute Inc. product or service names are registered trademarks or trademarks of SAS Institute Inc., Cary, NC, USA.

[1] For details on the target population, please see www.cdc.gov/growthcharts/2000growthchart-us.pdf.

Appendix 2: List of variables, inclusion criteria and definitions used by the ECFSPR

List of variables

Demographics
CF centre code
Patient code
Year of follow-up
Date of birth (year and month)
Gender
Status of patient
Cause of death
Date of death

Therapy
Inhaled continuous hypertonic NaCl this year
Inhaled continuous antibiotic this year
Inhaled continuous bronchodilators this year
In Oxygen therapy this year
Use of rhDNase this year
Use of continuous azithromycin (or other macrolide) this year
Use of ursodeoxycholic acid this year
Use of pancreatic enzymes this year

Diagnosis
Diagnosis confirmed
Age at diagnosis
Type of sweat test
Electrolytes
Chloride value
Meconium Ileus
Neonatal screening

Complications
Allergic bronchopulmonary aspergillosis this year
Diabetes: daily insulin treated this year
Pneumothorax requiring chest drain this year
Liver disease this year
Haemoptysis major over 250 ml this year
Pancreatic status: faecal elastase
Pancreatic status: faecal fat
Occurrence of malignancy this year

Genotype
First mutation
Second mutation

Microbiology
Chronic *Burkholderia cepacia complex*
Nontuberculous mycobacteria this year
Chronic *Pseudomonas aeruginosa*
Chronic *Staphylococcus aureus*
Stenotrophomonas maltophilia this year

Follow-up
Date of best FEV_1 recorded this year
Value of best FEV_1 recorded this year
Value of best FVC recorded this year
Height measured at date of best FEV_1 (or in case of no FEV_1 last height of the year)
Weight measured at date of best FEV_1 (or in case of no FEV_1 last height of the year)

Transplant
Liver transplant
Year of latest liver transplant (if occurred before or during this year)
Lung transplant
Year of latest lung transplant (if occurred before or during this year)

Inclusion criteria

Only patients who fulfil the diagnostic criteria below should be included in the registry.

a. **Two sweat tests value > 60 mmol/L chloride**: CF diagnosis accepted
b. **One sweat test value > 60 mmol/L chloride and DNA Analysis/Genotyping – two identified disease-causing CF mutations**: CF diagnosis accepted
c. **Sweat value less than or equal to 60 mmol/L chloride**: if the sweat value is less than or equal to 60 mmol/L chloride, then at least 2 of these should be met:
    i. DNA Analysis/Genotyping – two identified disease-causing CF mutations.
    ii. Transepithelial (Nasal) Potential Difference – study consistent with a diagnosis of CF.
    iii. Clinical Presentation – typical features of CF.
d. **Diagnosis reversal**: if the patient's CF diagnosis reversed during the year, identify the reason from the following options:
    i. DNA Analysis – unable to identify two disease-causing CF mutations.
    ii. Transepithelial (Nasal) Potential Difference – study not consistent with a diagnosis of CF.
    iii. Repeat normal sweat testing – confirm with clinical team.

Definitions for EFCSPR

SWEAT TEST

If a sweat test was not performed on a patient, record "not done". If a sweat test is "not done" then two known genotype mutations must be reported.

i. Sweat Test: record the patient's sweat test.
ii. Electrolytes: Chloride concentration measurement is the preferred analysis.
iii. Chloride value: report the Chloride value in millimols per litre (mmol/L). If duplicate tests were completed on the same day, report the highest positive value.

NOTE: The acceptable range for Chloride values is 1-160 mmol/L. Anyone who has a Chloride value above 160 mmol/L must be re-tested.

SPIROMETRY

The purpose of recording data on spirometry values for the ECFS Patient Registry is to obtain standardised comparable data for comparison with other centres/countries and for use in specific epidemiological studies. Some of the conditions for this (see below) may not be met at every clinic visit for all patients. Therefore, for the purpose of the registry, only the spirometry tests fulfilling the criteria should be recorded/extracted for the ECFS Patient Registry. For all tests the spirometry should be performed according to the common ATS/ERS guidelines: (www.thoracic.org/statements/resources/pfet/PFT2.pdf).

Furthermore for the values reported to the registry the following criteria should be met

1. Pre-test:
    a. date of birth, gender and height should be recorded for calculation of predicted values
    b. all recorded spirometry tests should be pre-bronchodilator* values
        i. short-acting bronchodilators: at least 4 hours pre-test
        ii. long-acting bronchodilators: at least 12 hours pre-test

    *This was decided according to the PortCF official definitions.
2. Reported values:
    a. for values reported to national registries or to centres and extracted to the ECFS Patient Registry, the value in litres of the highest available value of FEV_1% of predicted (according to local references) of the year should be extracted
    b. each patient's FVC and FEV_1 measurement must be reported in litres (L), with up to two places to the right of the decimal
    c. the FVC measurement must be greater than or equal to the FEV_1 measurement
    d. for each reported spirometry value, the date of the test and the patient's height at that date should be reported in order to perform the calculation of percent of predicted values
    e. only tests deemed valid according to ATS/ERS guidelines should be reported
3. Calculation of percent of predicted values:
    A common set of reference values is used: Global Lung Function Initiative equations described by Quanjer PH et al. (Multi-ethnic reference values for spirometry for the 3-95-yr age range: the global lung function 2012 equations. Eur Respir J 2012; 40: 1324–1343).

The ECFSPR Definition Group considered the issue of race-specific reference values and decided not to do this calculation and not to record race for European patients.

References:
a) Miller et al. Standardisation of spirometry. Eur Respir J 2005; 26: 319–338
b) Miller et al. General considerations for lung function testing. Eur Respir J 2005; 26: 153–161
c) Cystic Fibrosis Foundation Patient Registry User's Guide, Version 4.0. 2006
d) Rosenfeld et al. Task Force to Evaluate Choice of Spirometric Reference Equations for the National Patient Registry: Summary and Recommendations. Cystic Fibrosis Foundation Registry Committee; 2005
e) Hankinson JL, Odencrantz RJ, Fedan KB. Spirometric reference values from a sample of the general U.S. population. Am J Respr Crit Care Med 1999;159:179-87
f) Wang X, Dockery DW, Wypij D, Fay ME, Ferris BG. Pulmonary function between 6 and 18 years of age. Pediatr Pulmonol 1993;15:75-88.

NUTRITION

Measurements: weight and height are measured according to EuroCareCF guidelines

a. weight: removal of outer clothing, shoes and socks
b. height: without shoes and socks - stadiometer - top of head in contact with head board, slight pressure
c. it should be the value at the day of the recorded FEV_1

z-scores for height, weight and BMI will be calculated using the CDC reference values [Kuczmarski et al (2002)]

References:
a) Kromeyer-Hauschild K, Wabitsch M, Kunze D, Geller F, Geiss HC, Hesse V *et al.* Percentiles of body mass index in children and adolescents evaluated from different regional German studies. Monatsschr Kinderheilkd 2001; 149:807-818
b) Lai H-C, Corey M, FitzSimmons S, Kosorok MR, Farrell M. Comparision of growth status of patients with cystic fibrosis between the United States and Canada. Am J Clin Nutr 1999; 69:531-538
c) Public Use File BGS98, German National Health Interview and Examination Survey 1998, Robert-Koch-Institut, Berlin, Germany, 2000
d) Wiedemann B, Paul KD, Stern M, Wagner TO, Hirche TO, on behalf of the German CFQA Group. Evaluation of body mass index percentiles for assessment of malnutrition in children with cystic fibrosis. Eur J Clin Nutr 2007; 61, 759-768
e) Kuczmarski RJ, Ogden CL, Guo SS et al. 2000 CDC Growth Charts for the United States: methods and development. Vital Health Stat 2002; 11(246): 1-190.

DEFINITION OF CHRONIC INFECTION IN THE LOWER AIRWAYS

1. Chronic PA infection should be defined by local physician according to modified Leeds criteria[a] and/or anti-pseudomonas antibodies[b]. Patient should be defined as chronically infected if he/she fulfils the criteria now or has done so in recent years and the physician has no reason to think the status has changed:
   a. modified Leeds criteria, chronic infection: >50% of the sputum samples, collected during the last 12 months were positive. At least 4 sputum samples during that period;
   b. and/or significantly raised anti-pseudomonas antibodies according to local laboratories.
2. Chronic infection with other gram-negative bacteria should be recorded by the same criteria as above.

References:
a) Lee TWR, Brownlee KG, Conway SP, Denton M, Littlewood JM. Evaluation of a new definition for chronic Pseudomonas aeruginosa in cystic fibrosis patients. J Cystic Fibrosis
b) Proesmans M, Balinska-Miskiewiscz, Dupont L et al. Evaluating the "Leeds criteria" for Pseudomonas aeruginosa infection in a cystic fibrosis centre. Eur Resp J 2006;27:937-943.
c) Doring G, Conway SP, Heijerman HG, et al. Antibiotic therapy against Pseudomonas aeruginosa in cystic fibrosis: a European consensus. Eur Respir J 2000;16:749-767.

ALLERGIC BRONCHOPULMONARY ASPERGILLOSIS (ABPA)

Diagnostic criteria:

1. Acute or subacute clinical deterioration (cough, wheeze, exercise intolerance, exercise-induced asthma, change in pulmonary function, or increased sputum production) not attributable to another etiology.
2. Total IgE > 500 IU/ml.
3. Positive skin prick test for Aspergillus antigen (> 3 mm) or positive specific IgE for *A. fumigatus*.
4. Either:
   a. precipitins to *A. fumigatus* or in vitro demonstration of IgG antibody to *A. fumigatus*;
   b. or new or recent abnormalities on chest radiography (infiltrates or mucus plugging) or chest CT (characteristic changes) that have not cleared with antibiotics and standard physiotherapy.

References:
Stevens DA, Moss RB, Kurup VP, Knutsen AP, Greenberger P, Judson MA, Denning DW, Crameri R, Brody AS, Light M, Skov M, Maish W, Mastella G; Participants in the Cystic Fibrosis Foundation Consensus Conference. Allergic bronchopulmonary aspergillosis in cystic fibrosis--state of the art: Cystic Fibrosis Foundation Consensus Conference. Clin Infect Dis. 2003 Oct 1;37 Suppl 3:S225-64.

LIVER DISEASE

We adopt the definitions for Liver Disease used by the UK Registry. These definitions discriminate patients with severe liver disease (with portal hypertension) from milder cases (cirrhosis without portal hypertension).

Cirrhosis with Hypertension: scaring of the liver related to underlying CF, typically in a biliary pattern. Severe liver disease may include portal hypertension and/or hypersplenism.

Cirrhosis without Hypertension: scaring of the liver relating to underlying CF.

Liver disease without cirrhosis: this includes fatty liver or viral hepatitis but not biliary cirrhosis.

PANCREATIC STATUS

Definition:
Stool fat (van de Kamer) > 4-5 g/d in young children, > 7g/d in children above 10 yrs and adults and/or faecal pancreatic elastase-1 < 200 ug/g.
Two determinations are mandatory. Faecal fat excretion values of infants below 3 months are contradictory. Other than pancreatic causes of steatorrhoea must have been excluded.
Pancreatic status will be assessed at the registry level, according to the following:

Pancreatic insufficiency

Faecal elastase <200 µg/g (twice) and Faecal fat high (twice)*

Pancreatic sufficiency

Faecal elastase ≥200 µg/g (twice) and Faecal fat normal (twice)*

*according to definition above

References:
a) Sinaasappel M, Stern M, Littlewood J, Wolfe S, Steinkamp G, Heijerman HGM, Robberecht E, Döring G. Nutrition in patients with cystic fibrosis. A European consensus. J Cystic Fibrosis 2002; 1:51-75.
b) Walkowiak J, Nousia-Arvanitakis S, Henker J, Stern M, Sinaasappel M, Dodge JA. Invited review: Indirect pancreatic function tests in children. J Pediatr Gastroenterol Nutr 2005; 40:107-114.