

Online Supplement

GLOBAL STROKE STATISTICS

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Supplementary Methods

Availability of hospital-based stroke services

Two searches were conducted, the first on 25/05/2018 and the second on 21/06/2018 to determine the availability of hospital-based stroke services (Box 1). All literature published in English up to these dates were included.

Box 1. PubMed search

Search 1 conducted on 25/05/2018

((("Stroke unit"[All Fields] OR "thrombolytic therapy"[MeSH Terms]) OR "mechanical thrombolysis"[MeSH Terms]) OR "telemedicine"[MeSH Terms]) AND "stroke"[MeSH Terms]) AND English[Language]

Search 2 conducted on 21/06/2018

((("stroke centre"[All Fields]) AND "stroke"[MeSH Terms]) AND English[Language])

Manuscripts were excluded based on their titles if they were unrelated to the proportion of patients in a country provided acute stroke care. For example, guidelines, protocols, cohort studies conducted on patients in a stroke unit, and studies investigating the effectiveness of stroke unit care (clinical trials and meta analyses) were excluded. Abstracts were excluded if there was no information on stroke units or the location of stroke units. Information about stroke units that were dedicated to rehabilitation were not considered.

Information on the proportion of patients treated in a stroke unit and the components of stroke units were summarised for 205 countries as listed in www.infoplease.com/countries.html.

Supplementary Table 1. Ideal' Criteria for Stroke Incidence Studies ¹⁻⁴

Standard Definitions

- Stroke: World Health Organization definition ²
- 1st ever in a life-time stroke

Methods

- Complete community-based ascertainment (hospital and non-hospital sources)
- Multiple overlapping sources
- Supplementary methods of case ascertainment, including referrals for imaging and follow-up of patients referred with transient ischaemic attack
- Prospective design using hot pursuit
- Population base should be large and stable
- Pathological subtyping by imaging in at least 90% of cases
- Time period should include whole years (because of the seasonality of stroke)

Data Presentation

- Standardisation of rates to standard populations
- Age bands should comprise mid-decade age bands
- Confidence intervals (95%) should be provided
- Male and female data should be presented separately

Supplementary Table 2. International disease classification codes used to estimate stroke mortality rates

International Disease Classification code	Codes used for mortality estimates by country	Comment
ICD9	For ICD9, the code used was B29, which is the code obtained from the basic tabulation list, was used. For China the code used was C051.	These codes equate to ICD9 codes 430-438.
ICD10	The codes used in the ICD10 database were: I60, I600, I601, I602, I603, I604, I605, I606, I607, I608, I609, I61, I610, I611, I612, I613, I614, I615, I616, I618, I619, I62, I620, I621, I629, I63, I630, I631, I632, I633, I634, I635, I636, I638, I639, I64, I67, I670, I671, I672, I673, I674, I675, I676, I677, I678, I679, I69, I690, I691, I692, I693, I694, I698.	These codes equate to ICD10 codes I60, I61, I62, I63, I64, I67, and I69.
ICD10	Code I69 was used for some countries without the above range of codes.	This code equates to I60 to I69.

Supplementary Table 3. Studies of stroke Incidence: crude incidence rates (men and women combined)

Country	Study Period	Incidence (95% CI)	Age range (years)	Standard criteria met*
Armenia ⁵	2010	141.7 (-)	All ages	No
Australia (Adelaide) ⁶	2009-2010	161 (141-183)	All ages	Yes
Australia (Melbourne) ⁷	1996-1997	206 (182-231)	All ages	Yes
Australia (Perth) ⁸	2000-2001	128 (109-146)	All ages	Yes
Bahrain ⁹	1995	57 (-)	Ages 20+	Yes
Belarus (Grodno) ¹⁰	2001-2003	222 (212-233)	Crude	Yes
Brazil (Matão) ⁸	2003-2004	108 (84-131)	All ages	Yes
Bulgaria ¹¹	2002	622 (560-690)	Ages 45-84	No
Chile (Iquique) ⁸	2000-2002	74 (65-82)	All ages	Yes
China (Beijing) ¹²	2000	177.9 (-)	Crude	No
China (Changsha) ¹²	2000	201.3 (-)	Crude	No
China (Shanghai) ¹²	2000	159.8 (-)	Crude	No
Columbia (Sabaneta) ¹³	1992-1993	89 (-)	Crude	No
Croatia (Varaždin county) ¹⁴	2007-2009	276 (260-294)	All ages	No
Denmark ¹⁵	2007-2009	322 (316-329)	Ages 25+	Yes
Denmark (Frederiksberg) ⁸	1989-1990	306 (269-344)	All ages	Yes
Egypt (Al Quseir City) ¹⁶	2010-2011	181 (122-141)	Ages 20+	Yes
Estonia (Tartu) ⁸	2001-2003	223 (202-244)	All ages	Yes
Finland (Espoo-Kauniainen), ⁸	1989-1991	220 (203-238)	Ages 15+	Yes
Finland (Turku) ⁸	1992	451 (412-490)	Ages 25+	Yes
France (Dijon) ¹⁷	2000-2006	114 (107-120)	All ages	Yes
French West Indies (Martinique) ¹⁸	2004-2008	147 (134-159)	All ages	Yes
French West Indies (Martinique) ⁸	1998-1999	167 (154-181)	All ages	Yes
Georgia (Tbilisi) ⁸	2000-2003	165 (144-186)	All ages	Yes
Germany (Erlangen) ⁸	1994-1996	175 (156-193)	All ages	Yes
Greece (Arcadia) ⁸	1993-1995	344 (315-372)	Ages 18+	Yes
India (Ludhiana) ¹⁹	2012-2013	140 (133-147)	Ages 18+	Yes
India (Mumbai) ⁸	2005-2006	145 (132-159)	Ages 25+	Yes
India (Rohtak) ⁸	1971-1974	27 (21-33)	All ages	Yes
India (Trivandrum, rural) ²⁰	2005	119.4 (-)	All ages	No
India (Trivandrum, urban) ²⁰	2005	116.4 (-)	All ages	No
Iran (Mashhad) ²¹	2006-2007	139 (128-149)	All ages	Yes
Ireland (North Dublin), ²²	2005-2006	165 (150-179)	All ages	Yes
Italy (Belluno) ⁸	1992-1993	224 (204-244)	All ages	Yes
Italy (L'Aquila) ⁸	1994	275 (256-294)	All ages	Yes
Italy (Sesto Fiorentino) ²³	2004-2006	170.4 (-)	Crude	Yes
Italy (Umbria) ⁸	1986-1989	254 (228-280)	All ages	Yes

Italy (Valley d' Aosta) ²⁴	2004-2008	212 (200-223)	All ages	Yes
Italy (Valley d' Aosta) ¹⁷	2004-2005	223 (197-249)	All ages	Yes
Italy (Vibo Valentia) ⁸	1996	179 (159-199)	All ages	Yes
Japan (Iwate State) ²⁵	2004-2008	290 (282-299)	All ages	Yes
Japan (Okinawa) ²⁶	2002-2005	220 (-)	Crude	No
Japan (Oyabe) ⁸	1987-1991	411 (381-442)	Ages 25+	Yes
Japan (Saku) ⁸	1971-1974	205 (190-220)	All ages	Yes
Japan (Shibata) ⁸	1976-1978	261 (236-286)	Ages 20+	Yes
Lithuania (Kaunas) ²³	2004	223.44 (-)	Crude	Yes
Mexico ²⁷	2011	232 (-)	Ages 25+	No
Mongolia (Ulan Bator) ⁸	1971-1974	50 (46-54)	All ages	Yes
The Netherlands, (Tilburg) ⁸	1978-1980	289 (262-316)	All ages	Yes
New Zealand (Auckland) ²⁸	2011-2012	147 (140-150)	Ages 15+	Yes
New Zealand (Auckland) ⁸	2002-2003	158 (150-166)	Ages 15+	Yes
Nigeria (Lagos) † ²⁹	2007-2008	25.2 (21.6-28.8)	All ages	No†
Nigeria (Ibadan) ⁸	1971-1974	15 (13-17)	All ages	Yes
Norway (Innherred) ³⁰	1994-1996	312 (284-342)	Ages 15+	Yes
Pakistan ³¹	Unknown	250	All	No
Peru (Cuzco) ¹³	1988	183 (-)	Crude	No
Poland (Warsaw) ³²	2005	106 (87-124)	Crude	Yes
Portugal (Porto, rural) ⁸	1998-2000	305 (265-344)	All ages	Yes
Portugal (Porto, urban) ⁸	1998-2000	268 (244-293)	All ages	Yes
Qatar ⁹	1997	41 (30.2-52.4)	Crude	No
Russia (Krasnoyarsk) ⁸	1987-1988	217 (197-237)	All ages	Yes
Saudi Arabia (Eastern Province) ³³	1989, 1992, 1993	29.8 (-)	All ages	No
South Africa (Rural Agincourt subdistrict) ³⁴	2011	259 (-)	All ages	No
South Africa ³⁵	1984-1985	101 (-)	Ages 20+	No
Spain (Castilla y Leon, Extremadura, and Coununitat Valenciana regions) ¹⁷	2005	141 (125-158)	Ages 14+	No
Spain (La Rioja) ³⁶	2009	304 (286-324)	All ages	No
Spain (Menorca) ²³	2004-2006	113.8 (-)	Crude	No
Sri Lanka (Colombo) ⁸	1971-1974	24 (20-27)	All ages	Yes
Sweden (Lund-Orup) ⁸	2001-2002	194 (177-212)	All ages	Yes
Sweden (Malmö) ⁸	1989	225 (206-244)	All ages	Yes
Sweden (Örebro) ⁸	1999-2000	314 (279-349)	All ages	Yes
Sweden (Söderhamn), ⁸	1983-1986	353 (317-390)	Ages 25+	Yes
Tanzania (Dar-es-Salaam, urban) ¹¹	2003-2006	108 (88-130)	All ages	No†
Tanzania (Hai, rural) ¹¹	2003-2006	95 (76-115)	All ages	No†
Ukraine (Uzhhorod) ⁸	1999-2000	281 (248-313)	All ages	Yes
United Kingdom (East Lancashire) ⁸	1994-1995	158 (146-171)	All ages	Yes
United Kingdom (London) ²³	2004-2006	70.36 (-)	All ages	No
United Kingdom (Oxfordshire) ⁸	2002-2004	145 (127-162)	All ages	Yes

United Kingdom (Scottish Borders) ³⁷	1998-2000	280 (258-304)	All ages	Yes
United Kingdom (South London) ⁸	1995-1996	130 (120-144)	All ages	Yes
USA (Barbados) ³⁸	2001-2002	140 (125-155)	All ages	Yes
USA (Greater Cincinnati) ⁸	1999	193 (186-201)	All ages	Yes

*Standard criteria = multiple overlapping sources, World Health Organisation definition of stroke,

incidence cases, no upper age limit, and prospective design;

† Substantial under-reporting

‡ Recurrent events included

Grey shade = Incidence reported in new studies (April 2016 – October 2018)

Supplementary Table 4. Studies of stroke Incidence: crude incidence rates in men and women

Country, Study Period	Incidence (95% Confidence Interval)		Age range (years)	Standard criteria met*
	Men	Women		
Australia (Adelaide), 2009-10 ⁶	176 (147-201)	146 (120-176)	All	Yes
Bahrain, 1995 ⁹	59 (-)	55	Ages 20+	No
Barbados, 1999-2000 ³⁸	115 (95-135)	163 (141-187)	All ages	Yes
Belarus (Grodno), 2001-3 ¹⁰	234 (220-248)	211 (198-224)	All ages	Yes
Croatia (Varaždin county), 2007-9 ¹⁴	265 (241-290)	287 (264-312)	All ages	Yes
Egypt (Al Quseir City), 2010-11 ¹⁶	212 (121-302)	150 (75-227)	Ages 20+	Yes
France (Dijon), 2000-6 ¹⁷	116 (106-126)	112 (103-121)	All ages	Yes
French West Indies (Martinique), 2011-12 ¹⁸	171 (152-190)	126 (110-141)	All ages	Yes
India (Trivandrum, rural), 2005 ³⁹	131.6	105.2	All ages	Yes
India (Trivandrum, urban), 2005 ³⁹	110.5	121.6	All ages	Yes
Iran (Mashhad), 2006-7 ²¹	144 (128-159)	133 (118-148)	All ages	Yes
Ireland (North Dublin), 2005-6 ²²	166 (145-187)	163 (142-185)	All ages	Yes
Italy (Valley d' Aosta), 2004-8 ²⁴	211 (195-228)	213 (197-229)	All ages	Yes
Italy (Valley d' Aosta), 2004-5 ¹⁷	224 (186-261)	223 (186-260)	All ages	Yes
Japan (Iwate State), 2004-8 ²⁵	307 (295-320)	275 (264-286)	All ages	Yes
Japan (Okinawa), 2002-5 ²⁶	238	206	Age 30+	No
Kuwait, 1989, 1992, 1993 ⁴⁰	35.5	16.7	All ages	No
Libya (Ahmadi), 1991-3 ⁹	52	42	All ages	No
New Zealand (Auckland), 2011-12 ²⁸	148 (137-158)	146 (136-156)	Ages 15+	Yes
Nigeria (Ibadan), 1973-5 ⁴¹	25	13	All ages	Yes
Nigeria (Lagos), 2007-8 ²⁹	28	21	All ages	No†
Norway (Innherred) 1994-1996 ³⁰	285 (247-328)	338 (298-383)	All ages	Yes
Poland (Warsaw), 2005 ³²	109 (82-136)	103 (78-127)	All ages	Yes
Qatar, 1997 ⁹	46	33 (23-49)	All ages	No
Saudi Arabia, 1989-1993 ⁹	8.84	13.24	All ages	No
South Africa (Rural Agincourt subdistrict), 2011 ³⁴	213 (198-243)	298 (296-372)	All ages	No
South Africa, 1984-5 ³⁵	84 (-)	90 (-)	Ages 20+	No
Spain (Castilla y Leon, Extremadura, and Coumunitat Valenciana regions), 2005 ¹⁷	148 (124-172)	134 (112-157)	Ages 14+	No
Spain (La Rioja), 2009 ³⁶	300 (273-326)	310 (282-337)	All ages	No
Zimbabwe, 1991 ³⁵	20	32	Ages 20 +	No

*Standard criteria = multiple overlapping sources, World Health Organisation definition of stroke, incidence cases, no upper age limit, and prospective design;

† Substantial under-reporting

Grey shade = Incidence reported in new studies (April 2016 – October 2018)

Supplementary Table 5. Adjusted incidence of stroke in men and women combined.

Country, Study Period	Incidence Rate per 100,000 population (95% Confidence Interval)	Standard criteria met*
Adjusted to European standard population		
Belarus (Grodno), 2001-2003 ¹⁰	287 (274-301)	Yes
Croatia (Varaždin county), 2007-2009 ¹⁴	223.6 (209.7-238.1)	No
France (Dijon), 2000-2006 ⁴²	85 (79.8-90.3)	Yes
Italy (Valley d' Aosta), 2004-2005 ⁴³	126 (106-146)	Yes
Kuwait, 1989, 1992, 1993 ⁹	27.59 (-)	No
Poland (Warsaw), 2005 ³²	129 (122-136)	Yes
Spain (Castilla y Leon, Extremadura, and Coumunitat Valenciana regions), 2005 ⁴⁴	83 (72-94)	No
Spain (La Rioja), 2009 ³⁶	171.1 (160.4-181.8)	No
USA (Barbados), 1999-2000 ³⁸	135 (112-158)	Yes
Adjusted to Segi World population		
China (Beijing), 2000 ¹²	135 (126.5-144.6)	No
China (Changsha), 2000 ¹²	150 (141.3-160)	No
China (Shanghai), 2000 ¹²	76.1 (70.6-82.6)	No
France (Dijon), 2000-2006 ⁴²	57.9 (54-61.8)	Yes
Iran , 2006-2007 ²¹	203 (175-231)	Yes
United Kingdom (Scottish Borders), 1998-2000 ⁴⁵	110 (90-133)	Yes
USA (Barbados), 1999-2000 ³⁸	88 (70-106)	Yes
Adjusted to WHO World standard population		
Australia (Adelaide), 2009-2010 ⁶	76 (59-94)	Yes
Australia (Melbourne), 1996-1997 ⁸	100 (95-105)	Yes
Australia (Perth), 2000-2001 ⁸	67 (56-79)	Yes
Belarus (Grodno), 2001-2003 ¹⁰	220 (210-231)	Yes
Brazil (Matão), 2003-2004 ⁴⁶	137 (112-166)	Yes
Chile (Iquique), 2000-2002 ⁸	86 (76-95)	Yes
China (Tianjin), 2014 ⁴⁷	297.4 (-)	Yes
China, 1980-2013 ⁴⁸	120 (26.17, 215)	Yes
Croatia (Varaždin county), 2007-2009 ¹⁴	169.6 (159.8-181.4)	Yes
Denmark (Copenhagen), 1971-1974 ⁸	80 (74-85)	Yes

Denmark (Frederiksberg), 1989-1990 ⁸	106 (89-123)	Yes
Estonia (Tartu), 2001-2003 ⁸	125 (113-138)	Yes
Finland (North Karelia), 1971-1974 ⁸	141 (132-150)	Yes
France (Dijon), 2002-2004 ⁸	58 (53-63)	Yes
French West Indies (Martinique), 1998-1999 ⁸	102 (99-105)	Yes
French West Indies (Martinique), 2011-2012 ¹⁸	77 (70-84)	Yes
Georgia (Tbilisi), 2000-2003 ⁸	103 (72-133)	Yes
Germany (Erlangen), 1994-1996 ⁸	85 (76-95)	Yes
India (Ludhiana), 2012-2013 ¹⁹	130 (123-137)	Yes
India (Rohtak), 1971-1974 ⁸	48 (38-59)	Yes
India (Kolkata), 2003-04 ⁴⁹	145 (120-175)	Yes
India (Trivandrum, rural), 2005 ³⁹	138 (112-164)	Yes
India (Trivandrum, urban), 2005 ³⁹	135 (122-148)	Yes
Ireland (Dublin), 1971-1974 ⁸	118 (108-128)	Yes
Ireland (North Dublin), 2005-2006 ²²	118 (107-129)	Yes
Italy (Belluno), 1992-1993 ⁸	110 (100-121)	Yes
Italy (L'Aquila), 1994 ⁸	113 (105-122)	Yes
Italy (Umbria), 1986-1989 ⁸	105 (92-118)	Yes
Italy (Valley d' Aosta), 2004-2008 ²⁴	80 (73-87)	Yes
Italy (Valley d' Aosta), 2004-2005 ⁸	82 (61-98)	Yes
Italy (Valley d' Aosta), 2004-2005 ⁴³	97 (80-114)	Yes
Italy (Vibo Valente), 1996 ⁸	87 (78-97)	Yes
Japan (Iwate State), 2004-2008 ²⁵	146 (130-163)	Yes
Japan (Saku), 1971-1974 ⁸	153 (142-165)	Yes
Mongolia (Ulan Bator), 1971-1974 ⁸	78 (71-84)	Yes
Netherlands, The (Tilburg), 1978-80 ⁸	100 (81-119)	Yes
Nigeria (Ibadan), 1971-1974 ⁸	41 (36-45)	Yes
Nigeria (Lagos), 2007-2008 ²⁹	54 (-)	No
Portugal (Porto, rural), 1998-2000 ⁸	261 (249-273)	Yes
Portugal (Porto, urban), 1998-2000 ⁸	118 (112-124)	Yes
Russia (Krasnoyarsk), 1987-1988 ⁸	233 (212-256)	Yes
Spain (La Rioja), 2009 ³⁶	108 (101-115)	No
Sri Lanka (Colombo), 1971-1974 ⁸	41 (35-47)	Yes
Sweden (Malmo), 1989 ⁸	83 (74-91)	Yes
Sweden (Orebro), 1999-2000 ⁸	126 (111-140)	Yes

Tanzania (Dar-es-Salaam, urban), 2003-2006 ¹¹	315.9 (282.43-353.34)	No†
Tanzania (Hai, rural), 2003-2006 ¹¹	108.6 (89.55-131.71)	No†
United Kingdom (East Lancashire), 1994-1995 ⁸	74 (67-80)	Yes
United Kingdom (Oxfordshire), 2002-2004 ⁸	73 (64-83)	Yes
United Kingdom (South London), 1995-1996 ⁸	82 (80-84)	Yes
USA (Barbados), 2001 ⁸	88 (79-98)	Yes
USA (Greater Cincinnati/Northern Kentucky), 1999 ⁸	113 (102-126)	Yes
USA (Rochester), 1985-1989 ⁸	102 (92-112)	Yes
West Ukraine (Uzhhorod), 1999-2000 ⁸	238 (213-263)	Yes
Adjusted to WHO World standard population, 15+ years		
Finland (Espoo-Kauniainen), 1989-1991 ⁸	100 (91-110)	Yes
New Zealand (Auckland), 2011-2012 ²⁸	119 (114-125)	Yes
New Zealand (Auckland), 2002-2003 ⁸	126 (119-133)	Yes
Norway (Innherrred), 1994-1996 ⁸	154 (138-171)	Yes
Adjusted to WHO World standard population, 18+ years		
Greece (Arcadia), 1993-1995 ⁸	133 (120-146)	Yes
Adjusted to WHO World standard population, 20+ years		
Japan (Shibata), 1976-1978 ⁸	223 (194-252)	Yes
Adjusted to WHO World standard population, 25+ years		
Finland (Turku), 1992 ⁸	314 (283-344)	Yes
India (Mumbai), 2005-2006 ⁸	151 (137-165)	Yes
Japan (Oyabe), 1987-1991 ⁸	260 (254-265)	Yes
Mozambique (Maputo) hospitalised cases, 2005-2006 ⁵⁰	260.1 (-)	No
Sweden (Söderham), 1983-1986 ⁸	312 (278-347)	Yes
Sweden (Lund-Orup), 2001-2002 ⁸	133 (119-146)	Yes

*Standard criteria = multiple overlapping sources, World Health Organisation definition of stroke, incidence cases, no upper age limit, and prospective design. Grey shade = Incidence reported in new studies (April 2016 – October 2019).

† Recurrent events included

Supplementary Table 6. Adjusted incidence of stroke in men and women.

Country, Study Period	Incidence Rate per 100,000 population (95% Confidence Interval)		Standard criteria met*
	Men	Women	
Age adjusted to the European standard population			
Belarus (Grodno), 2001-2003 ¹⁰	356 (334-377)	236 (222-250)	Yes
Croatia (Varaždin county), 2007-2009 ¹⁴	282 (256-309.9)	181.1 (165.6-197.6)	No
France (Dijon), 2000-2006 ⁴²	107.5 (98.3-116.8)	68.9 (62.7-75)	Yes
Italy (Sesto Fiorentino), 2004-2006 ^{51, 52}	101.2 (82.5-123)	63 (48.5-80.7)	Yes
Italy (Valley d' Aosta), 2004-2005 ⁴³	159 (127-190)	100 (75-125)	Yes
Kuwait, 1989, 1992, 1993 ⁵³	35.48 (35.39-35.56)	16.66 (16.59-16.73)	No
Lithuania (Kaunas), 2004 ⁵⁴	239.3 (209.9-271.6)	158.7 (135-185.4)	Yes
Poland (Warsaw), 2005 ³²	140 (132-147)	120 (114-127)	Yes
Spain (Castilla y Leon, Extremadura, and Coumunitat Valenciana regions), 2005 ⁴⁴	99 (81-117)	66 (53-80)	No
Spain (Menorca), 2004-2006 ^{51, 52}	116.3 (96.1-139.5)	65.8 (50.9-83.8)	No
Spain (La Rioja), 2009 ³⁶	206 (187.7-224.4)	139.3 (127.0-151.5)	No
United Kingdom (South London), 2004-2006 ²³	121.1 (100.5-144.7)	78.1 (61.8-97.5)	Yes
Age adjusted to Segi's World population			
China (Beijing), 2000 ¹²	147.6 (134.6-162.6)	124 (113-137.4)	No
China (Changsha), 2000 ¹²	190 (175.2-207.3)	119.1 (108.5-132.3)	No
China (Shanghai), 2000 ¹²	87.3 (78.5-98.2)	68.1 (61-77.3)	No
France (Dijon), 2000-2006 ⁴²	72.5 (65.9-79.1)	47.3 (45.5-52)	Yes
Iran (Mashhad), 2006-2007 ²¹	208 (180-236)	198 (170-226)	Yes
Age adjusted to WHO World standard population			
Australia (Adelaide), 2009-2010 ⁶	91 (73-112)	61 (47-78)	Yes
Belarus (Grodno), 2001-2003 ¹⁰	266 (250-282)	180 (169-191)	Yes
Bulgaria (Rural), 2002 ⁵⁵	909 (729.67-1132.41)	667 (529.24-840.61)	No
Bulgaria (Urban), 2002 ⁵⁵	597 (491.2-725.59)	322 (255.14-406.637)	No
China (Tianjin), 2014 ⁴⁷	280 (-)	308.8 (-)	Yes
Croatia (Varaždin county), 2007-2009 ¹⁴	213.1 (194-233.3)	137.6 (126.3-150.9)	Yes
India (Ludhiana), 2012-2013 ¹⁹	151 (141-161)	106 (97-115)	Yes
India (Trivandrum, rural), 2005 ³⁹	163.4 (122.4-204.4)	115.3 (83-147.6)	Yes

India (Trivandrum, urban), 2005 ³⁹	141.7 (122.1-161.3)	130.1 (113.3-146.9)	Yes
India (Kolkata), 2003-2005 ⁴⁹	117.1 (87.8-152.6)	178.0 (102.4-223.2)	Yes
Italy (Valley d' Aosta), 2004-2005 ⁴³	122 (94-150)	77 (55-99)	Yes
Italy (Valley d' Aosta), 2004-2008 ²⁴	100 (89-112)	62 (53-71)	Yes
Japan (Iwate State) ²⁵	190 (172-209)	104 (91-118)	Yes
Martinique (Caribbean) ¹⁸	90 (79-101)	110 (103-119)	Yes
New Zealand (Auckland) ²⁸	129 (120-138)	110 (103-119)	Yes
Spain (La Rioja) ³⁶	131.0 (119.3-142.6)	86.2 (78.6-93.8)	No

*Standard criteria = multiple overlapping sources, World Health Organisation definition of stroke, incidence cases, no upper age limit, and prospective design. Grey shade = Incidence reported in new studies (April 2016 – October 2019).

Supplementary Table 7. Latest year available for mortality and population data:

Year of Mortality Data	Countries		ICD-9	ICD-10	Population Database Used	
	n	(%)			WHO	UN
1980	1	0.74	1	—	1	—
1983	1	0.74	1	—	1	—
1987	1	0.74	1	—	1	—
1990	1	0.74	1	—	—	1
1994	2	1.48	2	—	—	2
2000	1	0.74	—	1	1	—
2001	1	0.74	1	—	—	1
2003	1	0.74	1	—	—	1
2004	1	0.74	1	—	—	1
2006	1	0.74	1	—	—	1
2007	1	0.74	1	—	1	—
2008	1	0.74	1	—	—	1
2009	1	0.74	1	—	1	—
2010	2	1.48	1	1	2	—
2011	1	0.74	—	1	1	—
2012	5	3.70	—	5	1	4
2013	7	5.19	—	7	2	5
2014	17	12.59	—	17	9	8
2015	39	28.89	—	39	29	10
2016	43	31.85	—	43	24	19
2017	7	5.19	—	7	5	2
Total	135	100	14	121	79	56

WHO, World Health Organization; UN, United Nations

Supplementary Table 8. Mortality of stroke in countries that have reported both mortality and population data to the World Health Organisation* since 1980: data are reported as crude rates, and rates age-adjusted to the New World population.

Country, year	ICD Code Used	Crude Mortality per 100,000 population		Mortality age adjusted to the WHO World Population per 100,000 population	
		Women	Men	Women	Men
Albania, 2010†	ICD-9	87.8	75.3	62.1	68.5
Andorra, 2015†	ICD-10	15.8	20.3	–	–
Antigua and Barbuda, 2016	ICD-10	48.1	50.1	47.6	64.4
Argentina, 2016	ICD-10	48.6	49.9	27.7	46.4
Armenia, 2016	ICD-10	89.7	74.0	50.6	60.8
Aruba, 2016	ICD-10	43.8	50.4	27.9	43.0
Australia, 2015	ICD-10	54.4	36.9	18.3	19.7
Austria, 2017	ICD-10	64.8	42.8	17.1	20.0
Azerbaijan, 2007	ICD-10	117.9	93.6	132.1	142.9
Bahamas, 2014	ICD-10	40.5	32.7	32.7	37.6
Bahrain, 2014	ICD-10	6.1	6.2	13.5	14.7
Barbados, 2013	ICD-10	94.6	78.6	45.1	59.5
Belarus, 2014†	ICD-10	155.9	131.9	64.9	105.5
Belgium, 2015	ICD-10	72.3	49.3	19.5	23.5
Belize, 2016	ICD-10	30.5	36.3	74.5	81.1
Bolivia, 2003	ICD-10	8.5	9.5	11.9	15.5
Bosnia and Herzegovina, 2014	ICD-10	117.4	101.0	56.7	68.3
Brazil, 2016	ICD-10	48.9	51.1	41.8	60.4
Brunei Darussalam, 2016	ICD-10	24.3	33.7	28.3	42.8
Bulgaria, 2014	ICD-10	327.6	294.7	109.9	154.5
Canada, 2015	ICD-10	44.3	32.3	15.0	16.7
Cape Verde, 2012	ICD-10	61.7	58.5	81.6	109.0
Chile, 2016	ICD-10	47.8	47.2	27.5	42.7
China, Macao SAR, 1994†	ICD-9	34.7	36.4	36.9	50.2
China, selected urban areas, 2000†	ICD-9	120.5	135.1	110.8	154.8
China, selected rural areas, 2000†	ICD-9	105.9	124.0	117.5	172.8
China, selected urban & rural areas, 2000†	ICD-9	114.0	130.2	113.3	162.0
Colombia, 2015	ICD-10	33.4	29.3	32.8	37.9
Costa Rica, 2014	ICD-10	28.4	28.1	21.6	27.2
Croatia, 2016	ICD-10	179.2	135.2	51.9	69.6
Cuba, 2016	ICD-10	81.3	83.7	38.0	50.6
Cyprus, 2016	ICD-10	45.9	39.4	20.4	23.2
Czech Republic, 2016	ICD-10	94.7	71.4	30.6	41.7
Denmark, 2015	ICD-10	66.2	53.1	20.8	26.9
Dominican Republic, 2013	ICD-10	30.5	35.3	31.8	42.4
Ecuador, 2016	ICD-10	26.6	26.6	26.9	32.6
Egypt, 2015	ICD-10	39.4	44.1	72.6	76.6
El Salvador, 2014	ICD-10	16.9	16.7	15.6	18.8

Estonia, 2016	ICD-10	79.9	61.7	22.5	37.6
Falkland Islands (Malvinas), 1983†	ICD-9	200.0	200.0	165.0	165.0
Fiji, 2012	ICD-10	18.1	17.3	26.3	36.5
Finland, 2015	ICD-10	90.0	67.0	24.6	32.9
France, 2015	ICD-10	55.9	41.3	13.9	18.8
French Guiana, 2015	ICD-10	19.3	28.3	27.4	46.7
Georgia, 2015	ICD-10	175.8	162.6	75.5	123.4
Germany, 2015	ICD-10	80.9	58.2	19.6	25.0
Greece, 2015	ICD-10	149.9	116.0	36.4	42.5
Grenada, 2017	ICD-10	97.7	72.8	78.3	95.8
Guadeloupe, 2015	ICD-10	39.4	45.0	13.6	23.4
Guatemala, 2016	ICD-10	19.0	18.9	28.9	34.7
Guyana, 2014	ICD-10	75.0	65.4	125.2	113.5
Haiti, 2004	ICD-10	2.0	1.4	3.3	2.6
Honduras, 2013	ICD-10	5.0	4.3	7.7	8.0
Hong Kong SAR, 2015	ICD-10	40.5	49.6	15.6	24.7
Hungary, 2016	ICD-10	116.7	100.7	38.1	59.9
Iceland, 2017	ICD-10	41.4	32.7	15.0	18.3
Iran (Islamic Republic of), 2015	ICD-10	33.3	35.7	55.0	53.4
Iraq, 2008	ICD-10	29.1	29.3	68.0	88.1
Ireland, 2015	ICD-10	47.0	36.5	21.3	26.5
Israel, 2015	ICD-10	32.1	26.4	16.4	20.5
Italy, 2015	ICD-10	119.8	82.6	24.2	30.6
Jamaica, 2014	ICD-10	96.3	87.3	65.7	76.9
Japan, 2015	ICD-10	90.8	87.8	17.2	31.5
Jordan, 2012	ICD-10	25.4	24.6	67.4	70.1
Kazakhstan, 2015	ICD-10	74.9	68.5	69.5	98.0
Kiribati, 2001	ICD-10	23.4	57.7	41.2	110.6
Kuwait, 2014	ICD-10	10.2	10.2	32.1	32.4
Kyrgyzstan, 2016	ICD-10	63.4	70.4	83.8	129.4
Latvia, 2015	ICD-10	315.9	190.6	85.2	117.6
Lithuania, 2017	ICD-10	224.3	149.5	57.7	84.7
Luxembourg, 2015	ICD-10	44.7	36.4	15.5	22.0
Malaysia, 2014	ICD-10	15.5	20.0	20.0	27.1
Maldives, 2015	ICD-10	18.2	35.2	29.0	54.0
Malta, 2015	ICD-10	70.9	58.3	23.8	31.6
Martinique, 2015	ICD-10	65.8	58.5	19.4	26.5
Mauritius, 2017	ICD-10	61.4	71.1	42.4	66.6
Mayotte, 2015	ICD-10	22.1	27.1	42.9	54.4
Mexico, 2016	ICD-10	27.7	26.4	27.7	33.4
Mongolia, 2016	ICD-10	56.7	74.3	86.0	142.8
Montenegro, 2009	ICD-10	99.0	65.2	56.9	50.6
Morocco, 2014	ICD-10	6.8	7.1	9.6	13.1
Netherlands, 2016	ICD-10	65.0	46.5	20.1	23.2
New Zealand, 2014	ICD-10	67.5	47.7	27.7	28.1
Nicaragua, 2017	ICD-10	23.7	21.1	29.0	33.6
Norway, 2016	ICD-10	54.1	37.9	16.4	19.8
Occupied Palestinian Territory, part, 2016	ICD-10	34.0	28.6	73.9	83.6
Oman, 2014	ICD-10	8.6	7.4	17.1	20.1
Pakistan, survey, 1994†	ICD-9	0.1	0.0	0.1	0.1

Panama, 2016	ICD-10	37.9	43.1	31.8	45.0
Papua New Guinea, 1980†	ICD-9	0.3	0.8	–	–
Paraguay, 2016	ICD-10	34.5	34.8	41.6	50.0
Peru, 2015	ICD-10	14.3	14.7	14.3	18.7
Philippines, 2011	ICD-10	54.9	68.5	79.5	119.8
Poland, 2015	ICD-10	88.3	71.6	31.9	46.9
Portugal, 2016	ICD-10	122.3	104.1	30.2	43.2
Puerto Rico, 2016	ICD-10	31.8	31.5	12.9	20.0
Qatar, 2016	ICD-10	3.9	3.9	11.0	16.9
Republic of Korea, 2016	ICD-10	47.4	44.2	21.9	34.6
Republic of Moldova, 2016	ICD-10	166.9	150.7	98.6	137.9
Reunion, 2015	ICD-10	33.5	34.2	19.6	30.4
Rodrigues, 2017	ICD-10	46.1	47.7	40.4	49.0
Romania, 2016	ICD-10	236.2	198.1	81.1	110.9
Russian Federation, 2013†	ICD-10	247.6	180.2	105.4	154.6
Saint Lucia, 2014	ICD-10	68.6	70.3	48.5	62.6
Saint Vincent and Grenadines, 2016	ICD-10	77.4	59.8	73.2	69.2
San Marino, 2015†	ICD-10	47.9	24.7	–	–
Sao Tome and Principe, 1987†	ICD-9	24.9	19.7	39.5	42.6
Saudi Arabia, 2012	ICD-10	8.8	8.8	20.6	25.4
Serbia, 2015	ICD-10	193.6	159.2	69.4	81.8
Seychelles, 2015†	ICD-10	55.2	69.1	39.4	67.5
Singapore, 2016	ICD-10	32.3	31.4	17.9	23.3
Slovakia, 2014	ICD-10	101.8	89.3	44.0	68.7
Slovenia, 2015	ICD-10	114.3	75.9	31.5	40.6
South Africa, 2015	ICD-10	46.8	36.0	61.5	67.3
Spain, 2016	ICD-10	65.9	50.7	16.1	22.3
Sri Lanka, 2006	ICD-10	12.7	21.2	13.8	25.0
Suriname, 2014	ICD-10	58.5	68.0	60.7	90.5
Sweden, 2016	ICD-10	68.7	54.4	17.7	23.4
Switzerland, 2015	ICD-10	51.6	36.4	14.2	17.6
Syrian Arab Republic, 2010	ICD-10	15.3	18.8	30.1	31.3
Tajikistan, 2016	ICD-10	33.6	43.7	68.3	96.1
TFYR Macedonia, 2013	ICD-10	180.1	168.9	111.1	139.0
Thailand, 2016	ICD-10	40.5	57.3	28.0	48.3
Trinidad and Tobago, 2012	ICD-10	70.8	76.7	59.5	94.6
Tunisia, 2013	ICD-10	18.7	20.1	16.4	21.9
Turkey, 2016	ICD-10	54.0	44.3	43.9	51.6
Turkmenistan, 2015†	ICD-10	67.6	79.7	101.0	147.1
Ukraine, 2015†	ICD-10	204.2	166.9	78.3	120.0
United Kingdom, England and Wales, 2016	ICD-10	63.5	48.1	20.1	22.6
United Kingdom, Northern Ireland, 2015	ICD-10	60.4	46.1	22.0	25.7
United Kingdom, Scotland, 2016	ICD-10	87.5	65.2	28.2	31.2
United States of America, 2016	ICD-10	51.2	37.5	20.2	22.8
Uruguay, 2016	ICD-10	86.1	65.2	31.4	44.8
Uzbekistan, 2016	ICD-10	40.0	48.2	56.4	86.9
Venezuela, 2013	ICD-10	35.5	36.2	38.0	53.4
Virgin Islands (USA), 2016	ICD-10	27.3	39.9	13.3	25.4
Zimbabwe, 1990†	ICD-9	10.4	12.7	24.4	32.3

*When the population data from the World Health Organization were more than 2 years away from the mortality data for the same country, we used population data from the United Nations. Thus all population data were within 2 years of the corresponding mortality data.

†Codes for deaths include all cerebrovascular disease deaths, and so may over-estimate stroke death rates.

Data for China are only for selected urban and rural areas and represent less than 10% of all deaths occurring in the country, Grey shade = mortality data that have not been update since previous review.

Supplementary Table 9. Case-fatality rates of stroke in countries reported at 28 days by stroke type and/or ages.

Country, year	Type of Stroke			Age range (years)
	All	Haemorrhagic	Ischaemic	
Estonia (Tartu), 2001-2003 ⁵⁶	28	44% SAH 40% ICH	22% BI	All ages
Ghana (Kumasi) ⁵⁷	-	70.2	17.5	Ages 15+
Mozambique (Maputo), 2005-06 ⁵⁸	-	53.6	19.1	Ages <44
	-	44.5	20.8	Ages 45-54
	-	56.0	28.4	Ages 55-64
	-	56.1	31	Ages 65+
Netherlands, 2005 ⁵⁹				
Male	4.3			Ages 35-64
	6.9			Ages 65-74
	11.9			Ages 75-84
	24.1			Ages 85-94
Female	3.5			Age 35-64
	7.0			Ages 65-74
	12.9			Ages 75-84
	23.1			Ages 85-94
Norway (Tromso), 1995-2010 ⁶⁰				
Male	5.7			Ages 30-84
	20.3			Ages 85+
Female	9.2			Ages 30-84
	19.4			Ages 85+
Japan (Takashima), 2001-2005 ⁶¹				
Male	14.5			Ages 65-
	(7.4-25.7)			
	14.0			Ages 65+
	(9.8-19.5)			
Female	13.3			Ages 65-
	(3.7-26.2)			
	13.3			Ages 65+
	(9.9-19.2)			

SAH: subarachnoid haemorrhage; ICH: intracerebral haemorrhage; BI: brain infarction; Grey shade = case-fatality reported in new studies (April 2016 – October 2019).

Supplementary Online Table 10. Crude case-fatality (%) of stroke in countries: reported at 28 to 30* days

Country	Overall % (CI)	Men % (CI)	Women % (CI)
Australia (Adelaide), 2009-2010 ⁶	18 (14-24)		
Australia (Melbourne), 1997-1999 ⁶²	22.5 (20.0-25.1)	18.3 (14.7-21.8)	25.8 (22.3-29.4)
Australia (Perth), 1989-1990 ⁶³	24 (20-28)		
Belarus (Grodno), 2001-2003 ¹⁰	26.1	24.4	27.8
Brazil (Matao), 2003-2004 ^{46*}	18.5 (10.7-28.7)		
Chile (Iquique), 2000-2002 ^{64*}	23.3 (18.1-29.5)	26.2 (18.9-35.3)	24.2 (16.4-34.4)
Croatia (Varaždin County), 2007-2009 ^{14*}	23.5	23.6	23.4
Estonia (Tartu), 2001-03 ^{56, 65}	26	24	28
France (Dijon), 1989-1989 ⁶⁶	17.8 (15.4-20.5)		
France (Dijon), 1990-1994 ⁶⁶	16.6 (14.4-19.1)		
France (Dijon), 1995-1999 ⁶⁶	13.9 (11.8-16.3)		
France (Dijon), 2000-2004 ⁶⁶	10 (8.3-12.1)		
French West Indies (Martinique), 1998-1999 ^{18*}	19.3 (15.5-24.1)	17.9 (12.9-24.8)	20.7 (15.3-28.0)
French West Indies (Martinique), 2011-2012 ^{18*}	17.6 (13.3-23.4)	15.1 (9.2-24.6)	20.6 (14.8-28.7)
Georgia (Tbilisi), 2000-2003 ^{67*}	34.8 (28.7-41.3)		
Germany (Erlangen), 1994-96 ⁶⁸	19.4 (16.1-23.3)		
Greece (Arcadia), 1993-1995 ⁶⁹	26.6 (22.9-32.2)	26.3 (21.3-31.1)	27.1 (21.4-32.6)
India (Ludhiana), 2012-2013 ¹⁹	22		
India (Kolkata), 2003-2010 ⁷⁰	42 (38.6-45.6)		
India (Trivandrum, rural), 2005 ³⁹	37.1		
India (Trivandrum, urban), 2005 ³⁹	24.5		
Ireland (North Dublin), 2005-06 ²²	21 (17.6-24.9)		
Italy (Aeolian Islands), 1999-2002 ^{71*}	24.2 (19.2-36.8)	23.1 (9.0-43.7)	25 (12.2-42.2)
Italy (Belluno), 1992-1993 ^{72*}	33		
Italy (L'Aquila), 1994-1998 ^{73*}	25.6 (22.8-28.7)		
Italy (Udine), 2007-2009 ⁷⁴	20.6 (17.8-23.8)		
Italy (Umbria), 1986-1989 ^{75*}	20.3 (16.2-24.3)		
Italy (Valle d'Aosta), 1989 ^{76*}	31		
Italy (Valle d'Aosta), 2004-2008 ²⁴	19		
Italy (Vibo Valentia), 1996 ⁷⁷	23.7 (19.0-28.3)		
Japan (Oyabe), 1977-81 ⁷⁸		18 (19.2-21.8)	26.8 (22.1-31.5)
Japan (Oyabe), 1982-86 ⁷⁸		16.3 (12.2-19.8)	24.5 (19.4-29.6)
Japan (Oyabe), 1987-91 ⁷⁸		14.2 (10.4-17.4)	19.1 (14.9-23.3)
Libya (Beghazi), 1983-1984 ^{79*}	17.3		
New Zealand (Auckland), 1981 ⁸⁰	32.2 (28.4-36.5)	27.1 (21.7-32.6)	37.6 (31.8-43.5)
New Zealand (Auckland), 1991 ⁸⁰	24.1 (21.4-26.7)	21.9 (18.1-25.7)	25.8 (22.3-29.4)
Portugal (Porto, rural), 1999-2000 ^{81*}	14.6 (10.2-19.3)		
Portugal (Porto, urban), 1999-2000 ^{81*}	16.9 (13.7-20.6)		
Russia (Novosibirsk), 1990 ^{82*}	32.3 (25.8-38.8)	39.4 (27.0-51.7)	28.4 (20.7-36.2)
Russia (Novosibirsk), 1992 ^{82*}	22.7 (17.7-27.7)	29.1 (19.2-39.0)	19.1 (13.3-24.9)
Sweden (Enköping-Håbo), 1986-88 ⁸³		21	22
Sweden (Orebro), 1999-2000 ⁸⁴	19		
United Kingdom (Scottish Borders), 1998-2000 ⁴⁵	15.9		
United Kingdom (East Lancashire), 1994-1995 ⁸⁵	33.8		
USA (Barbados), 2001-02 ³⁸	27.8 (24.9-34.8)		

* 30-Day case-fatality

Supplementary Table 11. Presence and access to stroke units by region

European countries	Asian countries	Other countries
No information about access, but presence of stroke units noted		
- Albania Belgium - Greece - Iceland - Luxembourg - Macedonia - Malta - Portugal - Ukraine	- China - India - Japan - South Korea - Pakistan - Qatar - Saudi Arabia - Singapore - Sri Lanka	- Brazil - Central African Republic - Chile - Columbia - Egypt - Ghana - Mauritania - Nigeria - South Africa - USA
Information about access		
Scandinavian countries	Other countries	European and Other countries
Denmark 51% Finland 62% Norway 90% Sweden 87.5%	Austria 67% - Belarus 60% - Bosnia and Herzegovina 35% Bulgaria 10% Croatia 50% Czech Republic 85% Estonia 61% France 33% - Georgia 1% Germany 70% Hungary 30% Ireland 54% Israel 5% Italy 33% Latvia 77% Lithuania 20% - Moldova 20% Poland 70% - Romania 1% - Russia 13% Serbia 40% - Slovakia 20% - Slovenia 35% Spain 23% - Turkey 30% UK 83%	- Argentina 5.7% - Australia 49.5% - Canada 23% - New Zealand 39% - Thailand 25%

These data reflect the best estimate of the proportion of patients with stroke that are treated in stroke units within these countries. Bolded estimates were obtained from <http://strokeeurope.eu/>.

Supplementary results

The search conducted on 25/05/2018 returned 7035 articles and the search conducted on 21/06/2018 returned 220 articles. After removing duplicates, there were 7177 articles that were screened for title and abstract exclusion. There were 6459 title exclusions and 601 abstract exclusions. There were 118 manuscripts that underwent full review for information about the proportion of patients treated in a stroke unit within a country. Additionally, information from three reports found in the complementary search were utilised (Supplementary Figure 1).

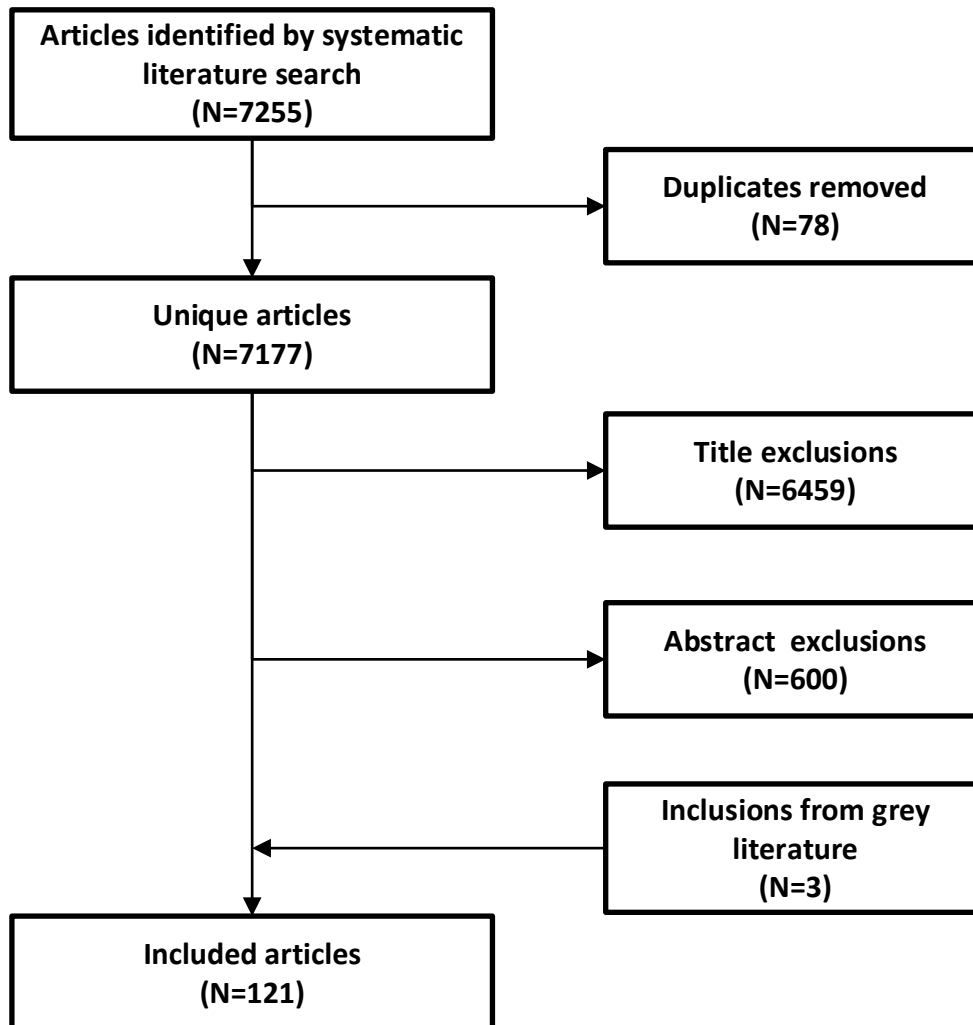
Access to stroke units

In total, there was information on stroke units in 62 countries. There was no information to determine access in 28 of the 62 countries (i.e. no information on the proportion of patients treated in stroke units). For countries where this information was available, the access to stroke units ranged from 1% to 90%.

For 21 of the 30 European countries with information on access to stroke units, this information was obtained from reports published on the Stroke Alliance For Europe website (<http://strokeeurope.eu/>). For 17 of these 22 European countries, there was information about access to stroke units from other literature identified in the search as well. Information on access to stroke units in Belarus, Bosnia and Herzegovina, Georgia, Moldova, Romania, Russia, Slovakia, Slovenia and Turkey were not available in the Stroke Alliance For Europe resources. Estimates of access were provided in other published sources.^{86, 87}

There were 25 countries outside of Europe that were identified as having a stroke unit from North and South America, Asia, Africa and Australasia, but only five of these countries had information on access to stroke units: Argentina, Australia, Canada, New Zealand and Thailand (Supplementary Table 11).

There was information found that some low income countries have stroke units (Table 1). These were Central African Republic, Ghana, India, Mauritania, Nigeria and Ukraine. The majority of information on stroke units were middle-income countries.



Supplementary Figure 1. Summary of literature search and included articles.

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