

GLOBOCAN 2020 annexes

J. Ferlay¹, M. Colombet¹, I. Soerjomataram¹, D.M. Parkin^{2,3}, M. Piñeros¹, A. Znaor¹, F. Bray¹.

¹ Cancer Surveillance Branch, International Agency for Research on Cancer, 150 cours Albert Thomas, 69372 Lyon Cedex 08, France.

² School of Cancer & Pharmaceutical Sciences, King's College London, UK

³ CTSU, Nuffield Department of Population Health, University of Oxford, UK.

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Annex A. Cancer incidence and mortality data: sources and methods by country

Estimates of cancer incidence by country

- For 45 countries with at least six and up to ten years of recent national cancer incidence data available, corresponding rates for 2020 were predicted using short-term prediction models (*method 1*) [1]. Cancer- and sex-specific prediction models were fitted only when at least 50 cancer-specific cases for all ages were recorded per year. For the cancer and sex combinations where these criteria were not satisfied, the rates for 2020 were derived from the annual average rates recorded in the most recent period of at least three years and with at least 20 cases (all ages) recorded (*method 2a* or *2b*).
- For 54 countries where no historical national cancer incidence data existed, or where national mortality data were not available, the most recent cancer incidence rates (as specified above) from one cancer registry (*method 2a*, 32 countries) or from multiple registries (*method 2b*, 22 countries) within the country were used as proxy for 2020.
- When registries were subnational and where national mortality data were available, national incidence was estimated from national mortality using statistical models, with the fitted mortality to incidence (M:I) ratios derived from recorded data from one or more cancer registries within the country (*method 3a*, 14 countries) or derived from recorded data from neighbouring countries, with M:I ratios between countries scaled according to levels of Human Development Index (HDI) (*method 3b*, 37 countries). These comprised one model for Africa; one for Caribbean; two for Asia; two for Europe and one for Oceania (see Annex C).
- When neither national or subnational registries, nor national mortality data were available, and the within-country source information was considered to lack the necessary level of accuracy, a set of age- and sex-specific national incidence rates for all cancers combined were obtained averaging overall rates from neighbouring countries. These rates were then partitioned to obtain the national incidence for specific sites using available cancer-specific relative frequency data (*method 4*, 5 countries).
- When neither national or subnational registries, nor national mortality data were available, and the within-country source information was either unavailable or compatible, average incidence rates from neighbouring countries in the same region were used to derive national incidence within the country (*method 9*, 30 countries).

Estimates of cancer mortality by country

To maximize comparability across countries, deaths coded to ill-defined categories (ICD-10, chapter XVIII) were redistributed pro rata across cancers (malignant neoplasms ICD-10 'C' category) and all other causes excluding injuries, by year and sex. The corrected "cancer deaths" 'C' category was then partitioned into cancer-specific categories using proportions from the uncorrected data. Vital registration is also known to be incomplete during the period under study for some countries and the source data were therefore corrected using the estimated completeness as reported by the WHO when necessary. Depending on the coverage, completeness and degree of detail of the mortality data available [2], four methods were utilised:

- For 80 countries where national mortality data were available historically and a sufficient number of recorded cancer deaths were available, mortality rates were, as for incidence,

projected to 2020 using the short-term prediction models and applied to the 2018 national population estimate (*method 1*)

- When recent mortality data were available from national or subnational sources, the most recent mortality rates from one source within the country (*method 2a*, 20 countries) or from multiple sources (*method 2b*, 1 country) within the country, were used as proxy for 2020.
- For 81 countries where recent mortality data were not available, national mortality was estimated from national incidence using statistical models, with the fitted incidence to mortality (I:M) ratios derived from recorded data from cancer registries, with I:M ratios between countries scaled according to levels of HDI (*method 3*). These comprised two models for Africa; three for Asia and one for Oceania (see Annex C).
- When recent mortality data were not available from national sources, and I:M ratios could not be derived using the previous method, the country-specific rates represent simply those of neighbouring countries in the same region (*method 9*, 3 countries).

The source of information (incidence and mortality) used to estimate the burden of cancer in each country is given in the file GLOBOCAN2020_Annex_A.xlsx file available at <https://gco.iarc.fr>

The authors would also like to recognize and acknowledge the work of the following population-based cancer registries who agreed to make their results available:

Africa

Algeria- Tumour Registry of Algiers, Annaba Cancer Registry, Cancer Registry of the Wilaya of Batna, Sétif Cancer Registry, Cancer Registry of Sidi-Bel-Abbès, Tizi-Ouzou Cancer Registry, Tlemcen Cancer Registry; **Benin**- Cotonou Cancer Registry; **Botswana**- Botswana National Cancer Registry; **Burkina Faso**- Registre des cancers de Ouagadougou; **Cameroon**- Yaounde Cancer Registry; **Congo**- Registre des cancers de Brazzaville; **Cote d'Ivoire**- Registre des Cancers d'Abidjan; **Egypt**- Aswan Cancer Registry, Damietta Cancer Registry, Minia Cancer Registry; **Eswatini** - Eswatini National Cancer Registry; **Ethiopia**- Addis Ababa City Cancer Registry; **The Gambia**- The Gambia National Cancer Registry; **Gabon**- Registre du cancer du Gabon; **Ghana**- Kumasi Cancer Registry; **Guinea**- Registre de Cancer de Guinée; **Kenya**- Eldoret Cancer Registry, Nairobi Cancer Registry; **Malawi**- Malawi National Cancer Registry; **Mali**- Registre de Cancer du Mali; **Mauritius**- Mauritius National Cancer Registry; **Morocco**- Casablanca Cancer Registry, Rabat Cancer Registry; **Mozambique**- Registro de Cancro de Beira, Maputo City Cancer Registry; **Namibia**- Namibian National Cancer Registry; **Niger**- Registre des Cancers du Niger; **Nigeria**- Abuja Cancer Registry, Calabar Cancer Registry, Ekiti Cancer Registry, Ibadan Cancer Registry; **Réunion (France)**- Registre des cancers de la Réunion; **Rwanda**- Rwanda Cancer Registry; **Sierra Leone**- Sierra Leone National Cancer Registry; **South Africa**- National Cancer Registry of South Africa, Eastern Cape Cancer Registry; **Sudan**- Khartoum Cancer Registry; **Tanzania**- Dodoma Cancer Registry, Kilimanjaro Cancer Registry, Mbeya Cancer Registry, Mwanza Cancer Registry; **Tunisia**- Cancer Registry of North Tunisia, Cancer Registry of Central Region; **Uganda**- Gulu Cancer Registry, Kampala Cancer Registry; **Zambia**- National Cancer Registry of Zambia; **Zimbabwe**- Bulawayo Cancer Registry, Zimbabwe National Cancer Registry.

South America and Caribbean

Argentina- Bahía Blanca Cancer Registry, Chaco Cancer Registry, Córdoba Cancer Registry, Entre Ríos Cancer Registry, Provincial Registry of Tumors of Mendoza, Neuquén Cancer Registry, Santa Fe

Cancer Registry, Cancer Registry of the Province of Tierra del Fuego; **Brazil**- Cancer Registry of Aracaju, Barretos Cancer Registry, Cancer Registry of Curitiba, Espirito Santo Cancer Registry, Florianopolis Cancer Registry, Cancer Registry of Goiânia, Jau Cancer Registry, Cancer Registry of João Pessoa, Pocos de Caldas Cancer Registry, Recife Cancer Registry, Roraima Cancer Registry, Cancer Registry of São Paulo City; **Chile**- Cancer Registry - Region of Antofagasta, Arica Cancer Registry, Cancer Registry - Province of Bío Bío, Concepción Cancer Registry, Region de Los Ríos (Valdivia) Cancer Registry; **Colombia**- Cancer Registry of the Metropolitan Area of Bucaramanga, Cali Cancer Registry, Cancer Registry of Manizales, Cancer Registry of Pasto; **Costa Rica**- Costa Rica National Tumour Registry; **Cuba**- Cuba National Cancer Registry; **Ecuador**- Cuenca Cancer Registry, Guayaquil Cancer Registry, Loja Cancer Registry, Manabí Cancer Registry, National Tumour Registry (Quito); **France**- Registre des cancers de Guyane Française; **Guadeloupe (France)**- Registre des cancers de la Guadeloupe; **Honduras**- National Cancer Registry of Honduras (Francisco Morazán); **Jamaica**- Jamaica Cancer Registry (Kingston and St. Andrew); **Martinique (France)**- Registre des cancers de la Martinique; **Peru**- Cancer Registry of Arequipa, Metropolitan Lima Cancer Registry; **Puerto Rico**- Puerto Rico Central Cancer Registry; **Uruguay**- Uruguay National Cancer Registry.

Northern America

Canada- Alberta Cancer Registry, Northwest Territories Cancer Registry, New Brunswick Cancer Registry, Nova Scotia Cancer Registry, Prince Edward Island Cancer Registry, Newfoundland and Labrador Cancer Registry, Nunavut Cancer Registry, Ontario Cancer Registry, British Columbia Cancer Registry, Manitoba Cancer Registry, Saskatchewan Cancer Registry, Yukon Cancer Registry; **USA**- Alabama Statewide Cancer Registry, Alaska Cancer Registry, Arizona Cancer Registry, Arkansas Central Cancer Registry, California Cancer Registry, Colorado Central Cancer Registry, Connecticut Tumour Registry, Delaware Cancer Registry, Florida Cancer Data System, Georgia Comprehensive Cancer Registry, Hawaii Tumour Registry, Cancer Data Registry of Idaho, Illinois State Cancer Registry, Indiana State Cancer Registry, State Health Registry of Iowa, Kentucky Cancer Registry, Louisiana Tumour Registry, Maine Cancer Registry, Massachusetts Cancer Registry, Michigan Cancer Surveillance Program, Mississippi Cancer Registry, Missouri Cancer Registry and Research Center, Montana Central Tumour Registry, Nebraska Cancer Registry, New Hampshire State Cancer Registry, New Jersey State Cancer Registry, New Mexico Tumour Registry, New York State Cancer Registry, North Carolina Central Cancer Registry, North Dakota Statewide Cancer Registry, Ohio Cancer Incidence Surveillance System, Oklahoma Central Cancer Registry, Oregon State Cancer Registry, Pennsylvania Cancer Registry, Rhode Island Cancer Registry, South Carolina Central Cancer Registry, South Dakota Cancer Registry, Tennessee Cancer Registry, Texas Cancer Registry, Utah Cancer Registry, Vermont Cancer Registry, Virginia Cancer Registry, Washington State Cancer Registry, West Virginia Cancer Registry, Wisconsin Cancer Reporting System, Wyoming Cancer Surveillance Program.

Asia

Bahrain- Bahrain National Cancer Registry; **Brunei**- Brunei National Cancer Registry; **China**- Anshan Cancer Registry, Baoding Cancer Registry, Beijing Cancer Registry, Benxi Cancer Registry, Changle Cancer Registry, Cili Cancer Registry, Cixi Cancer Registry, Cixian County Cancer Registry, Dafeng Cancer Registry, Dancheng Cancer Registry, Daoli District-Harbin Cancer Registry, Dazhu Cancer Registry, Dehui Cancer Registry, Donghai Cancer Registry, Fei Cheng Cancer Registry, Ganyu Cancer Registry, Ganzhou District-Zhangye Cancer Registry, Gonggan Cancer Registry, Guangzhou Cancer

Registry, Guanyun Cancer Registry, Guilin Cancer Registry, Haimen Cancer Registry, Haining City Cancer Registry, Hangzhou Cancer Registry, Hefei Cancer Registry, Hengdong Cancer Registry, Hepu Cancer Registry, Hong Kong Cancer Registry, Huaian District-Huaian Cancer Registry, Huaiyin District-Huaian Cancer Registry, Huixian Cancer Registry, Jiangmen Cancer Registry, Jianhu Cancer Registry, Jianping Cancer Registry, Jiashan County Cancer Registry, Jiaxing Cancer Registry, Jingtai Cancer Registry, Jingxian Cancer Registry, Jinhua Cancer Registry, Jiyuan Cancer Registry, Junan Cancer Registry, Liangzhou District-Wuwei City Cancer Registry, Lianshui Cancer Registry, Lianyungang Cancer Registry, Linqu County Cancer Registry, Lintan Cancer Registry, Linzhou Cancer Registry, Liuzhou Cancer Registry, Luoshan Cancer Registry, Luoyang Cancer Registry, Lushan Cancer Registry, Maanshan Cancer Registry, Macao Cancer Registry, Macheng Cancer Registry, Nan Gang District-Harbin Cancer Registry, Neixiang Cancer Registry, Pengzhou Cancer Registry, Qidong Cancer Registry, Qingyang District-Chengdu Cancer Registry, Shanghai Cancer Registry, Shangyu Cancer Registry, Shenqiu Cancer Registry, Shenyang Cancer Registry, Sheyang County Cancer Registry, Shifeng District-Zhuzhou Cancer Registry, Shexian Cancer Registry, Sihui Cancer Registry, Tengzhou Cancer Registry, Tianjin Cancer Registry, Tianjin Rural Areas Cancer Registry, Tongling Cancer Registry, Wenshang Cancer Registry, Wuan Cancer Registry, Wufeng Cancer Registry, Wuhan Cancer Registry, Wuxi Cancer Registry, Xianju Cancer Registry, Xining Cancer Registry, Xinyuan Cancer Registry, Xiping Cancer Registry, Yang Cheng Cancer Registry, Yangquan Cancer Registry, Yanji Cancer Registry, Yanshi Cancer Registry, Yanting Cancer Registry, Yingdong District-Fuyang Cancer Registry, Yueyanglou Cancer Registry, Zhaoyuan Cancer Registry, Zhongshan Cancer Registry, Zhuanghe Cancer Registry, Zoucheng Cancer Registry; **India**- Ahmedabad Cancer Registry, Aurangabad Cancer Registry, Bangalore Cancer Registry, Barshi Cancer Registry, Bhopal Cancer Registry, Cachar Cancer Registry, Chennai Cancer Registry, Delhi Cancer Registry, Dibrugarh Cancer Registry, Dindigul Cancer Registry, Kamrup Cancer Registry, Kollam Cancer Registry, Karwar Cancer Registry, Imphal/Manipur Cancer Registry, Mansa District Population Based Cancer Registry, Meghalaya Cancer Registry, Mizoram Cancer Registry, Mumbai Cancer Registry, Nagpur Cancer Registry, Nagaland Cancer Registry, Poona Cancer Registry, Ratnagiri Cancer Registry, Sangrur District Population Based Cancer Registry, Sikkim Cancer Registry, Trivandrum Cancer Registry, Tripura Cancer Registry; **Iran**- Iranian National Population-based Cancer Registry; **Israel**- Israel National Cancer Registry; **Japan**- Aichi Cancer Registry, Fukui Cancer Registry, Hiroshima Cancer Registry, Miyagi Cancer Registry, Nagasaki Cancer Registry, Niigata Cancer Registry, Osaka Cancer Registry, Tochigi Cancer Registry, Yamagata Cancer Registry; **Jordan**- Jordan National Cancer Registry; **Kazakhstan**- Kazakhstan National Cancer Registry; **Republic of Korea**- Korea Central Cancer Registry, Busan Cancer Registry, Daegu Cancer Registry, Daejeon Cancer Registry, Gwanju Cancer Registry, Incheon Cancer Registry, Jeju Cancer Registry, Seoul Cancer Registry, Ulsan Cancer Registry; **Kuwait**- Kuwait National Cancer Registry; **Lebanon**- Lebanon National Cancer Registry; **Malaysia**- Malaysian National Cancer Registry, Penang Cancer Registry; **Nepal**- Kathmandu Valley Cancer Registry, Siraha, Saptari, Dhanusha, Mohattari (SSDM) Cancer Registry, Rukum Cancer Registry; **Oman**- Oman National Cancer Registry; **Pakistan**- Punjab Cancer Registry; **Philippines**- Cebu Cancer Registry, Manila Cancer Registry, Rizal Cancer Registry; **Qatar**- Qatar National Cancer Registry; **Saudia Arabia**- Saudia Arabia National Cancer Registry, Riyadh Cancer Registry; **Thailand**- Bangkok Cancer Registry, Chiang Mai Cancer Registry, Chonburi Cancer Registry, Khon Kaen Cancer Registry, Lampang Cancer Registry, Lopburi Cancer Registry, Songkhla Cancer Registry, Surat Thani Cancer Registry; **Turkey**- Ankara Cancer Registry, Antalya Cancer Registry, Bursa Cancer Registry, Edirne Cancer Registry, Erzurum Cancer Registry, Eskisehir Cancer Registry, Izmir Cancer Registry,

Samsun Cancer Registry, Trabzon Cancer Registry; **Vietnam**- Hanoi City cancer registry, Ho Chi Minh City Cancer Registry.

Europe

Austria- Austrian Cancer Registry; **Belarus**- Belarussian National Cancer Registry; **Belgium**- Belgian Cancer Registry; **Bosnia and Herzegovina**- Republika of Srpska Cancer Registry; **Bulgaria**- Bulgarian National Cancer Registry; **Croatia**- Croatian National Cancer Registry; **Cyprus**- Cyprus Cancer Registry; **Czechia**- Czech National Cancer Registry; **Denmark**- Danish Cancer Registry; **Estonia**- Estonian Cancer Registry; **France**- Bas-Rhin Cancer Registry, Calvados Cancer Registries, Doubs Cancer Registry, Gironde Cancer Registry, Haut-Rhin Cancer Registry, Herault Cancer Registry, Iserre Tumour Registry, Lille-Metropole Cancer Registry, Limousin Cancer Registry, Loire-Atlantique Cancer Registry, Manche Cancer Registry, Somme Cancer Registry, Tarn Cancer Registry, Territoire de Belfort Cancer Registry; **Germany**- Cancer Registry Bavaria, Bremen Cancer Registry, Hamburg Cancer Registry, Lower Saxony Cancer Registry, Epidemiological Cancer Registry North Rhine-Westphalia, Cancer Registry of Rhineland-Palatinate, Saarland Cancer Registry, Schleswig-Holstein Cancer Registry; **Iceland**- Icelandic Cancer Registry; **Ireland**- National Cancer Registry Ireland; **Italy**- Aosta Valley Cancer Registry, Barletta Cancer Registry, Basilicata Cancer Registry, Bergamo Cancer Registry, Province of Biella Cancer Registry, Cancer Registry of Caserta, Integrated Cancer Registry of Catania-Messina-Siracusa-Enna, Cancer Registry of Como province, Cremona Cancer Registry, Ferrara Province Cancer Registry, Friuli-Venezia Giulia Cancer Registry, Latina Province Cancer Registry, Lecco Cancer Registry, Cancer Registry of South Lombardy, Mantova Cancer Registry, Milano Tumour Registry, Tumour Registry of Modena, Monza Cancer Registry, Naples Cancer Registry, Nuoro Cancer Registry, Palermo Province Cancer Registry, Parma Cancer Registry, Piacenza Cancer Registry, Ragusa Cancer Registry, Reggio Emilia Province Tumour Registry, Romagna Tumour Registry, Sassari Province Tumour Registry, Sondrio Province Tumour Registry, South Tyrol Cancer Registry, Cancer Registry of the Province of Syracuse, Taranto Cancer Registry, Trento Cancer Registry, Piedmont Tumour Registry, Tuscany Region Tumour Registry, Umbrian Tumour Registry, Varese Tumour Registry, Veneto Tumour Registry; **Latvia**- Latvian Cancer Registry; **Lithuania**- Lithuanian Cancer Registry; **Malta**- Malta National Cancer Registry; **Montenegro**- Registry of Malignant Neoplasms of Montenegro ; **Netherlands**- Netherlands Cancer Registry; **Norway**- Cancer Registry of Norway; **Poland**- Cracow City and District Cancer Registry, Greater Poland Cancer Registry, Kielce Regional Cancer Registry, Lower Silesian Cancer Registry, Lublin Cancer Registry, Podkarpackie Cancer Registry; **Portugal**- Azores Cancer Registry, Central Region Cancer Registry, North Region Cancer Registry, South Region Cancer Registry; **Romania**- Cluj Regional Cancer Registry, Timisoara Regional Cancer Registry; **Russian Federation**- Arkhangelsk Cancer Registry, Chelyabinsk Cancer Registry, Karelia Cancer Registry, Saint Petersburg Cancer Registry, Samara Cancer Registry; **Serbia**- Central Serbia Cancer Registry; **Slovakia**- Slovakia National Cancer Registry; **Slovenia**- Cancer Registry of the Republic of Slovenia; **Spain**- Albacete Cancer Registry, Asturias Cancer Registry, Basque Country Cancer Registry, Canary Islands Cancer Registry, Castellón Cancer Registry, Ciudad Real Cancer Registry, Cuenca Cancer Registry, Girona Cancer Registry, Granada Cancer Registry, La Rioja Cancer Registry, Mallorca Cancer Registry, Murcia Cancer Registry, Navarra Cancer Registry, Tarragona Cancer Registry; **Switzerland**- Basel Cancer Registry, Fribourg Tumour Registry, Geneva Cancer Registry, Graubünden and Glarus Cancer Registry, Neuchatel Cancer Registry, St. Gallen-Appenzell Cancer Registry, Ticino Cancer Registry, Valais Cancer Registry, Vaud Cancer Registry, Zurich Cancer Registry; **United Kingdom**- National Cancer Registration Service (NCRS), Northern Ireland Cancer

Registry, Scottish Cancer Registry, Welsh Cancer Intelligence and Surveillance Unit; **Ukraine**- National Cancer Registry of Ukraine.

Oceania

Australia- Australian Capital Territory Cancer Registry, New South Wales Central Cancer Registry, Northern Territory Cancer Registry, Queensland Cancer Registry, South Australian Cancer Registry, Tasmanian Cancer Registry, Victorian Cancer Registry, Western Australian Cancer Registry; **New Caledonia (France)**- Registre du cancer de Nouvelle-Calédonie; **New Zealand**- New Zealand Cancer Registry; **USA**- Pacific Regional Central Cancer Registry (NPCR).

[1] Dyba T, Hakulinen T. Comparison of different approaches to incidence prediction based on simple interpolation techniques. *Stat Med* 2000; 19 (13):1741–52.

[2] World health statistics 2018: monitoring health for the SDGs, sustainable development goals. Geneva: World Health Organization; 2018.

Annex B. List of cancer sites included in GLOBOCAN 2020 and criteria for including and allocating certain malignancies.

The 38 categories of cancer estimated in GLOBOCAN 2020 include malignant neoplasms only, except for bladder cancer which may include some carcinomas in situ or tumours of uncertain or unknown behaviour (ICD-10 categories D09.0 and D41.4 respectively) in incidence (but not in mortality) depending on the definition of malignancy in each cancer registry. The categories “Kaposi sarcoma”, “non-Hodgkin lymphoma” and “All cancers” include some disease entities that have been coded in mortality (but not incidence) statistics to the ICD-10 category B21 (HIV disease resulting in neoplasms). The category “Non-melanoma skin cancer (C44)” (NMSC) excludes basal cell carcinomas (BCC) in incidence, while mortality includes deaths from all types of NMSCs.

1. Lip, oral cavity (C00-06)
2. Salivary glands (C07-08)
3. Oropharynx (C09-10)
4. Nasopharynx (C11)
5. Hypopharynx (C12-13)
6. Oesophagus (C15)
7. Stomach (C16)
8. Colon (C18)
9. Rectum (C19-20)
10. Anus (C21)
11. Liver (including intrahepatic bile ducts C22)
12. Gallbladder (C23)
13. Pancreas (C25)
14. Larynx (C32)
15. Lung (including trachea, C33-34)
16. Melanoma of skin (C43)
17. Non-melanoma skin cancer (C44)
18. Mesothelioma (C45)
19. Kaposi sarcoma (C46)
20. Female breast (C50)
21. Vulva (C51)
22. Vagina (C52)
23. Cervix uteri (C53)
24. Corpus uteri (C54)
25. Ovary (C56)
26. Penis (C60)
27. Prostate (C61)
28. Testis (C62)
29. Kidney (including renal pelvis C64-65)
30. Bladder (C67)
31. Brain, central nervous system (C70-72)
32. Thyroid (C73)
33. Hodgkin lymphoma (C81)
34. Non-Hodgkin lymphoma (C82-86, C96)
35. Multiple myeloma (and immunoproliferative diseases C88+C90)
36. Leukaemia (C91-95)
37. Other specified cancers (C17, C24, C30-31, C37-38, C40-41, C47-49, C57-58, C63, C66, C68-69, C74-75)
38. Unspecified sites (C76-80, C97)
39. All cancers (C00-97)

Ill-defined codes

Wherever national or subnational data were available for the following ICD-10 unspecified cancer groupings they were redistributed to specific categories by year, sex and age: C14.0 (pharynx, unspecified), C14.8 (overlapping lesion of lip, oral cavity and pharynx), C26.0 (intestinal tract, part unspecified), C26.8-9 (ill-defined sites within the digestive system), C39 (other and ill-defined sites in the respiratory system), C55 (uterus, unspecified), C57.8-9 (female genital organ, unspecified), C63.8-9 (male genital organ, unspecified), C68.8-9 (urinary organs, unspecified) and C75.8-9 (endocrine glands, unspecified); the three-digit C14 (other and ill-defined sites in the lip, oral cavity and pharynx) and C26 (other and ill-defined digestive organs) were redistributed when the 4th digit categories were not available.

Given the large variations in the accuracy of death certificates related to cancer of the uterus, with many deaths recorded as “uterus cancer, not otherwise specified” (ICD-10 C55), these proportions were relocated to specified sites. By default, the number of cancer deaths coded as “uterus unspecified” was reallocated to either cervix (C53) or corpus (C54) uterine cancer according to age-specific proportions in the same population when the all age proportion of uterine cancer deaths coded to the unspecified category was considered to be low (<25% of the total). For the other countries for which country-specific incidence and survival data were available, mortality for cervix uteri (C53) and corpus uteri (C54) cancers was estimated from incidence and 5-year relative survival probabilities. The total number of cancer deaths from uterine cancers (ICD-10 C53-55) estimated in 2020 were then partitioned into cervix and corpus uteri cancers using the proportions obtained from the survival analysis, and then further stratified by age using age-specific death counts of the two sites (C53 and C54) extracted from the WHO mortality database.

No attempt was made to reallocate the ‘unspecified cancers’ group (ICD-10 categories C76-80+C97) into some specific categories: should a simple reallocation by site, sex and age be performed, it could amplify the over representation of some cancer sites such as screen-detectable cancers in incidence or cancers with possible inclusion of metastatic cancers along with primary neoplasms in mortality.

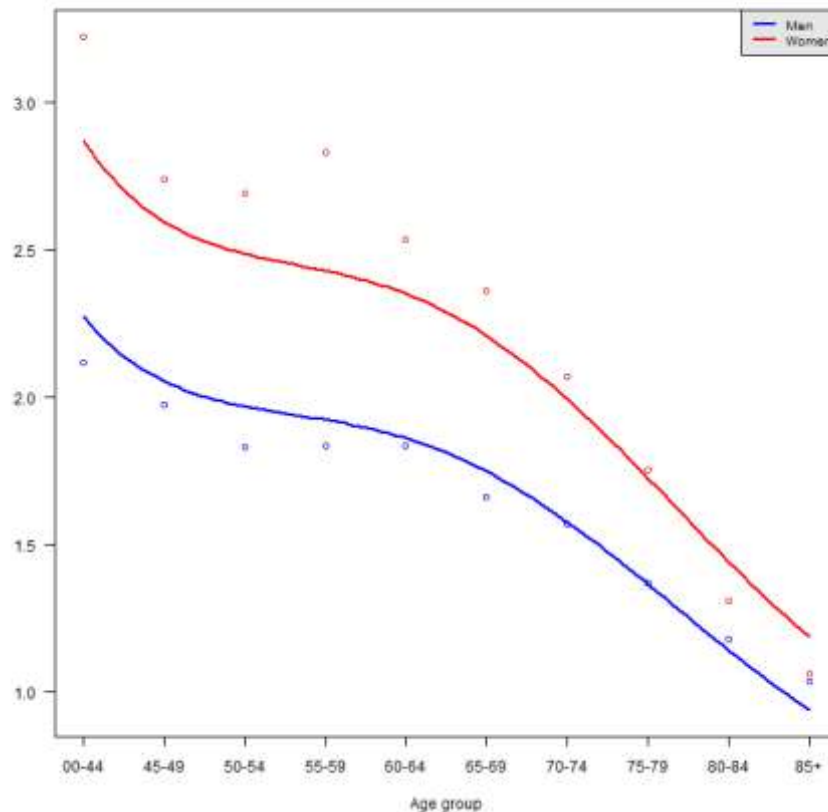
	Redistribution of ill-defined codes (ICD-10 4 digit)									
	C14.0	C14.8	C26.0	C26.8-9	C39	C55	C57.8-9	C63.8-9	C68.8-9	C75.8-9
C00-06		X								
C07-08		X								
C09-10	x	X								
C11	x	X								
C12-13	x	X								
C15				x						
C16				x						
C18			x	x						
C19-20			x	x						
C21			x	x						
C22				x						
C23				x						
C25				x						
C32					x					
C33-34					x					
C43										
C44										
C45										
C46										
C50										
C51							x			

C52							x			
C53							x	x		
C54							x	x		
C56								x		
C60									x	
C61									x	
C62									x	
C64-65										x
C67										x
C70-72										
C73										x
C81										
C82-86, C96										
C88+C90										
C91-95										
Other		C14.2	C17	C24, C26.1	C30-31, C37-38		C57.0-7	C63.0-7	C66; C68.0-1	C74; C75.0-5

	Redistribution of ill-defined codes (ICD-10 3 digit)			
	C14	C26	C39	C55
C00-06	x			
C07-08	x			
C09-10	x			
C11	x			
C12-13	x			
C15		x		
C16		x		
C18		x		
C19-20		x		
C21		x		
C22		x		
C23		x		
C25		x		
C32			x	
C33-34			x	
C43				
C44				
C45				
C46				
C50				
C51				
C52				
C53				x
C54				x
C56				
C60				
C61				
C62				
C64-65				
C67				
C70-72				
C73				
C81				
C82-86, C96				
C88+C90				
C91-95				
Other		C17, C24	C30-31, C37-38	

Annex C. Modelling of incidence and mortality

Whenever possible, country-specific mortality to incidence ratios (incidence method 3a) were used (Argentina, Bosnia Herzegovina, Brazil, Chile, Colombia, Ecuador, France (metropolitan), Italy, Japan, Peru, Poland, Portugal, Spain and Switzerland).



Example of modelling of mortality to incidence ratios: Japanese cancer registries, lung cancer, by sex.

When this was not possible, regional models were established, based upon the incidence and mortality data from population-based cancer registries which supplied data to *Cancer Incidence in Five Continents* Vol. XI:

Mortality to incidence (incidence method 3b)

1. Sub-Saharan Africa: USA, Black population
2. Caribbean: Costa Rica, France: Martinique and Guadeloupe and Puerto Rico
3. Central America: Costa Rica, Brazil (8 registries), Ecuador (5 registries) and Peru (2 registries)
4. South America: Brazil (18 registries), Colombia (4 registries), Ecuador (5 registries) and Peru (2 registries)
5. South Central Asia: Kazakhstan
6. Western Asia: Israel and Kazakhstan
7. Eastern Europe: Bulgaria, Romania (2 registries) and Serbia
8. Southern Europe: Croatia, Cyprus, Italy (33 registries), Malta, Slovenia and Spain (14 registries)
9. Oceania: New Zealand and New Caledonia

Incidence to mortality (mortality method 3)

1. Northern Africa: France (15 registries), Italy (33 registries) and Israel.
2. Sub-Saharan Africa: USA, Black population (except breast, cervical and childhood cancers, see below)
3. South-Eastern Asia: China (90 registries), Japan (9 registries) and Korea
4. South Central Asia: Kazakhstan
5. Western Asia: Israel and Kazakhstan
6. Oceania: New Zealand and New Caledonia

For each sex and cancer site combination, the mortality to incidence and incidence to mortality ratios by age groups were scaled using the ratio of the HDI (Human Development Report 2019, <http://hdr.undp.org/>) of the country to the mean HDI of the countries in the model.

$$I_{\text{National}} = M_{\text{National}} * (I_{\text{Regional}}/M_{\text{Regional}}) * (HDI_{\text{National}}/HDI_{\text{Regional}}) \quad (\text{incidence method 3b})$$

$$M_{\text{National}} = I_{\text{National}} * (M_{\text{Regional}}/I_{\text{Regional}}) * (HDI_{\text{Regional}}/HDI_{\text{National}}) \quad (\text{mortality method 3})$$

When the resulting ratios by age were lower than 1 (incidence method 3b) or greater than 1 (mortality method 3) these were set to 1. The ratios were then fitted using Poisson regression models as in incidence method 3a.

For countries in Sub-Saharan Africa, and for breast, cervical and childhood (age range 0-14) cancers, mortality was estimated from incidence estimates and modelled survival as described in GLOBOCAN 2012 [1]

- For breast and cervical cancers we used the 5-year relative survival available in [2, 3].
- For childhood cancers we used 5-year relative survival from England for the period 2011-2015 [4], scaled using the ratio of the HDI of the country to the HDI of the UK in 2013.

[1] Ferlay J, Soerjomataram I, Dikshit R, Eser S, Mathers C, Rebelo M, Parkin DM, Forman D, Bray F. Cancer incidence and mortality worldwide: Sources, methods and major patterns in GLOBOCAN 2012. *Int J Cancer*. 2015 Mar 1;136(5):E359-86. doi: 10.1002/ijc.29210. Epub 2014 Oct 9. PMID: 25220842

[2] Joko-Fru WY, Miranda-Filho A, Soerjomataram I, et al. Breast cancer survival in sub-Saharan Africa by age, stage at diagnosis and human development index: A population-based registry study. *Int J Cancer*. 2020;146(5):1208-1218. doi:10.1002/ijc.32406

[3] Sengayi-Muchengeti M, Joko-Fru WY, Miranda-Filho A, et al. Cervical cancer survival in sub-Saharan Africa by age, stage at diagnosis and Human Development Index (HDI): A population-based registry study. *Int J Cancer*. 2020;147(11):3037-3048. doi: 10.1002/ijc.33120. Epub 2020 Jun 19. PMID: 32449157.

[4] Childhood Cancer Statistics, England Annual report 2018 – Appendix B Cancer survival tabulation. <http://www.ncin.org.uk/publications/> (accessed 26-05-2020)

Annex D. Computation of the standard error by method of estimation

Uncertainty intervals (95% UI) of the estimated sex- and site-specific number of new cancer cases and cancer deaths for all ages have been computed using the standard error se of the crude incidence or mortality rate used in the estimation. The se have been calculated on the log scale and the UI back on the arithmetic scale using the following formulae:

$$UI_{lower} = \exp(\log(CR2020_{pcs}) - 1.96 * se) * P2020_{ps} / 100,000$$

$$UI_{upper} = \exp(\log(CR2020_{pcs}) + 1.96 * se) * P2020_{ps} / 100,000$$

Where $CR2020_{pcs}$ is the estimated crude incidence/mortality rate per 100,000 in 2020 for country p , cancer c and sex s ; $P2020_{ps}$ is the population of country p and sex s in 2020, and se the standard error. The standard error se should be corrected for three major causes of bias:

1. *Coverage*
2. *The lag time*
3. *The quality*

For sake of simplicity, the three biases have been considered to have the same importance, and a correction based on three categorical variables having the same range of values from 0 (high) to 10 (low) has been introduced:

$$SE = se * 100/(100-c) * 100/(100-t) * 100/(100-q)$$

Where SE is the combined standard error, se is the standard error of the crude incidence or mortality rate used in the estimation calculated on a log scale; the categorical variables c describes the coverage of the dataset; t the time lag expressed in year and q describes the quality of the dataset. For each country, these three categorical variables can be sex- and cancer-specific, depending upon the amount and the quality of available data.

- **For method 1:** for prediction of incidence and mortality rates, se is given by the model. The coverage (c) and the lag time (t) = 0 (no penalty) because the variance is composed of the variance of the model and of the variance of the projected crude rate. Quality (q) is based on the quality of the dataset (see below).
- **For methods 2:** most recent rates are used as proxy (incidence and mortality), $se = 1/\sqrt{n}$ where n is the number of cases or deaths (all ages) used to compute the crude rate. Because the crude rate is based on the at least three most recent years (see manuscript), n can be very large (e.g. for the Chinese registries, for example) yielding extremely narrow uncertainty intervals, we used the annual number of cases when it was greater than 20 (per year). The coverage (c), the lag time (t) and the quality (q) are defined below.
- **For incidence method 3a** (modelling of M:I ratios using country-specific incidence and mortality data): se is the standard error of the crude incidence rate of the pooled incidence data included in the model. The coverage (c), the lag time (t) and the quality (q) are defined below (similar to method 2).
- **For incidence method 3b and mortality method 3** (modelling of M:I/I:M ratios using incidence and mortality data from neighbouring countries): the standard error for incidence (i) and mortality (m) (se_i and se_m respectively) is defined as the standard error of the estimated crude

mortality rate (se (CR2020_m), incidence method 3b), or of the crude incidence rate (se (CR2020_i), mortality method 3). The lag time (t) is defined below and the coverage (c) and the quality (q) = 10 (no data, maximum penalty).

- **For incidence method 4** ('All sites' incidence rates from neighbouring registries partitioned using frequency data): se is computed using the annual number of cases in the frequency dataset, the lag time (t) is defined below, the coverage (c) = 10 (no incidence rates) and quality (q) = 8 (poor quality).
- **For method 9** (average of rates from neighbouring countries, incidence and mortality): se is defined as the largest standard error of the crude incidence/mortality rate in the neighbouring countries, the lag time (t) as the population weighted average of neighbouring countries lag times, the coverage (c) and the quality (q) = 10 (no data, maximum penalty).

All sites (by country and sex)

$se = 1/\sqrt{n}$ with n total annual number of cancer cases or cancer deaths by sex.

$t = \max$ lag time within the 38 specific cancers

$q = c =$ highest values for quality and coverage within the 38 specific cancers

Area/World by sex and site (including "All sites")

$se = 1/\sqrt{n}$ with $n =$ population weighted average of the annual number of cases or deaths by sex and cancer in the countries/areas.

$t =$ population weighted average of the lag times by sex and cancer in the countries/areas.

$q =$ population weighted average of quality by sex and cancer in the countries/areas.

$c =$ population weighted average of coverage by sex and cancer in the countries/areas.

Both sexes combined

$$se = \sqrt{se_m^2 + se_f^2}$$

$$t = (t_m + t_f)/2$$

$$q = (q_m + q_f)/2$$

$$c = (c_m + c_f)/2$$

Where m is for males and f is for females.

Definition of the categorical variables:

Coverage: c is defined as followed:

$c=0$ if coverage = 100% or if the standard error is obtained from prediction (method 1) because coverage is already taken into consideration in the computation of the variance of the projected crude rate.

$c=10$ coverage = 0% (no data)

$c=9$ coverage < 1%

$c=8$ coverage < 5%

$c=7$ coverage < 10%

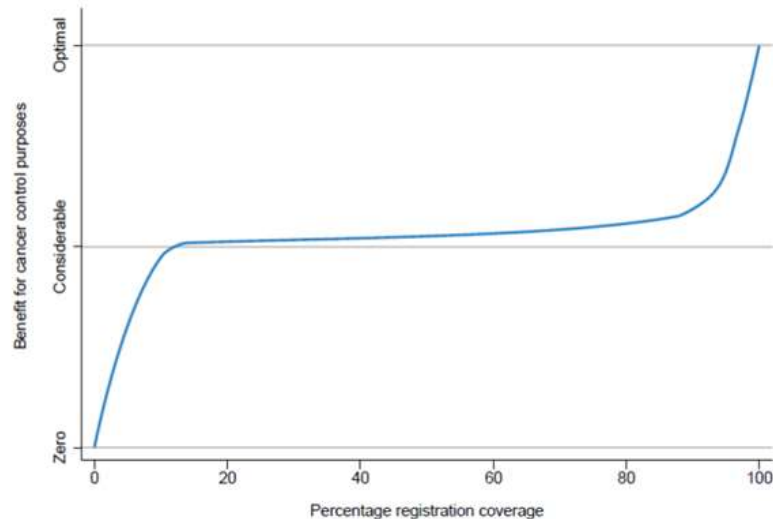
$c=1$ if coverage > 95%

$c=2$ coverage > 90%

$c=3$ coverage > 80%

c=4 coverage > 60%
 c=5 coverage > 50%
 c=6 otherwise (between 10% and 50%).

Benefits of increasing population coverage by cancer registration.



Source: Planning and Developing Population-Based Cancer Registration in Low- and Middle-Income Settings. IARC Technical Report 43. <https://publications.iarc.fr/Book-And-Report-Series/Iarc-Technical-Publications>

Lag time: t is the difference (in year) between the mid-period of the most recent incidence or mortality rates used to compute the sex and site-specific estimates, and the target year (2020). t = 0 when method 1 is used because the lag time is already taken into consideration in the computation of the variance of the projected crude rate.

Quality (incidence): q is based on results from the *Cancer Incidence in Five Continents* Vol. XI (CI5) editorial process.

q=0 if the national or all sub-national registries are included in CI5 without an asterisk.

q=1 if the national or all sub-national registries are included in the last volume of CI5 with an asterisk.

q=2 to 7 are based on the review of the datasets by IARC staff (including Visiting Scientist) during the editorial processes of CI5 and Cancer in Sub Saharan Africa projects (see also Chapter 5 of CI5 Vol. XI available at <https://ci5.iarc.fr/CI5-XI/Default.aspx>).

q=8 if frequency data were used

q=10 if there were no data.

Quality (mortality): q is based on the percentage of garbage codes (GC), as defined in the World health statistics 2017 (monitoring health for the SDGs, Sustainable Development Goals. Geneva: World Health Organization; 2017).

q=10 no data

q=0 if GC = 0%

q=1 if GC < 5%

q=2 if GC < 10%

q=3 if GC < 15%

q=4 if GC < 20%

q=5 if GC < 25%

q=6 if GC < 30%

q=7 if GC < 35%

q=8 if GC < 40%

q=9 if GC >= 40%

Annex E. Methods of estimation and penalties used to estimate the corrected standard error

GLOBOCAN2020_Annex_E.xlsx is available at <https://gco.iarc.fr>