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With a global mandate to collect, analyse, and disseminate cancer data to inform cancer control action, the Section of Cancer Surveillance (CSU) seeks new ways to interact, innovate, and expand across its interlinked core areas of activity. The founding principles of CSU remain: to ensure that locally recorded high-quality cancer data are of benefit to governments in informing priorities for national cancer control, and to serve as a reference to the global cancer community in the provision of national cancer surveillance indicators, developed through our collaborative research programme.

The Global Initiative for Cancer Registry Development (GICR, http://gicr.iarc.fr) has made consolidated efforts during this biennium to put into practice a train-the-trainer approach to building local cancer registry capacity within each defined IARC/GICR Regional Hub. CSU's estimates of cancer incidence and mortality on the Global Cancer Observatory website (http://gco.iarc.fr) were updated to 2018, and a new module compiling local estimates of cancer survival was added to the website. The high-impact research of the Section, evaluating the potential contribution of specific interventions, lifestyle, and environmental risk factors to the current and future burden of cancer, is of direct relevance to global cancer control. In accordance with a globally increasing awareness and prioritization of childhood cancer, CSU has further developed its childhood cancer research programme, together with international collaborators.

Cancer registry support and collaboration

Support to cancer registries worldwide remains a priority for CSU, and the GICR serves to strengthen capacity in low- and middle-income countries (LMICs). Six

IARC Regional Hubs provide resources to nearby countries in the Caribbean; Latin America; Northern Africa, Central and Western Asia; the Pacific Islands; South, East and South-Eastern Asia; and Sub-Saharan Africa. The overall aim of the GICR is to accelerate improvements in the coverage, quality, and use of population-based cancer registries.

A key activity of the GICR during the biennium has been in knowledge translation. This has been enhanced through the launch of GICR*Net*, a train-the-trainer model whereby standardized teaching materials for cancer registries are developed jointly by IARC and local experts. To date, four networks have been formed to cover specific topic areas: CanReg5, coding and staging, data quality, and data analyses. A total of 61 designated IARC GICR Regional Trainers assist as faculty in courses, develop educational resources, and work with colleagues to provide tailored support. For example, in the area of data quality, Mr Francis Okongo organized a course in the United Republic of Tanzania (December 2018, 20 participants), and Dr Lamia Kara translated teaching materials into French and organized a 1-day course in Algeria (June 2019, 30 participants). Similar activities have taken place in the other IARC Regional Hubs, leading to an increase in the number of training courses. Work to develop self-learning e-modules is also under way, together with a GICR Mentorship Programme.

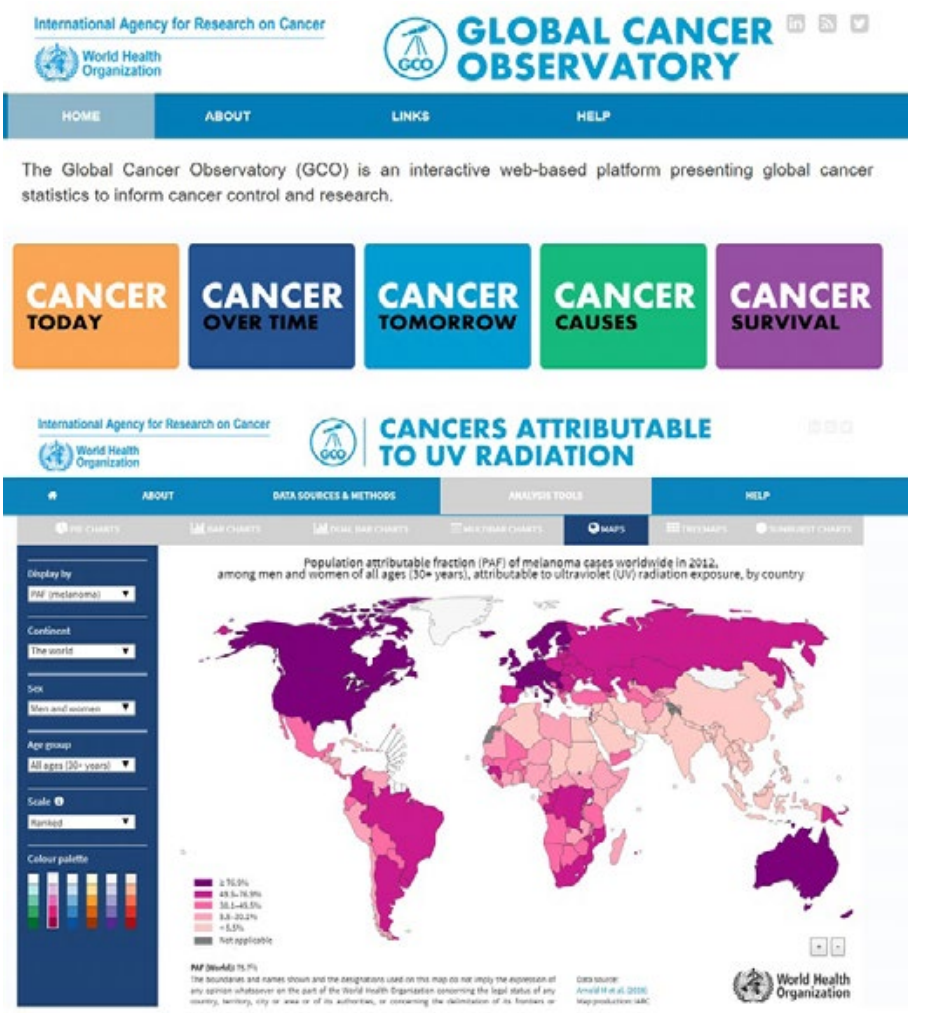
Expanding regional partnerships have led to seven new IARC GICR Collaborating Centres: one in Africa (Morocco), five in Asia (China, Islamic Republic of Iran, Japan, Republic of Korea, and Thailand), and one in the Caribbean (Martinique). Complementing those in Latin America, these Collaborating Centres work to fulfil the functions of the IARC Regional Hubs in the areas of training, support, research, and networks. The first regional IARC GICR Summer School was held in July 2019 through this model, funded and hosted by the National Cancer Center of the Republic of Korea as a founding Collaborating Centre in the region. CSU has contributed to several multiauthor papers discussing the challenges of and solutions to cancer control in specific regions and subpopulations, such as small island nations (Sarfati et al., 2019a), particularly in the Caribbean (Spence et al., 2019a, b) and the Pacific Islands (Sarfati et al., 2019b), and the actions required to measure cancer accurately and appropriately in Indigenous populations (Sarfati et al., 2018).

CSU's support to registries also includes linkages with the International Association of Cancer Registries (IACR, http://www.iacr.com.fr). In addition to the annual IACR scientific conference, which was held in Arequipa, Peru, in 2018 and in Vancouver, Canada, in 2019, there are continuing efforts to further enhance registry standards. For example, an IACR Working Group compiled a list of the required additions, changes, and revisions to the International Classification of Diseases for Oncology (ICD-O) from version 3.1 to version 3.2, recommending that these be implemented by registries from 2020. Similarly, to improve the availability and comparability of cancer staging, CSU developed the simplified staging system Essential TNM (Piñeros et al., 2019).

Global cancer indicators

With a focus on data visualization and interactivity, the Global Cancer Observatory aims to make available a broad set of relevant indicators developed through the Section's flagship projects and studies across five subsites (Figure 1). Cancer Today includes GLOBOCAN estimates of national incidence, mortality, and prevalence in 185 countries for 2018, derived using data from registries worldwide. As well an increased granularity of data – estimates are available for 36 separate cancer entities – corresponding

Figure 1. Screenshots of (upper) homepage of the Global Cancer Observatory and (lower) Cancer Causes, showing the population attributable fraction of melanoma cases worldwide attributable to exposure to ultraviolet radiation (http://gco.iarc.fr). © IARC.



uncertainty intervals have been developed to provide a semi-qualitative assessment of the validity of estimates based on an assessment of the quality, representativeness, and timeliness of the source information nationally. Studies reviewing the data sources and methods (Ferlay et al., 2019) and the international variations in the cancer magnitude and profiles across 20 world regions (Bray et al., 2018) were published during the biennium. Cancer Tomorrow uses these current estimates alongside demographic projections to 2040 to predict the future burden worldwide; realistic scenario-based longer-term projections are also under development. Cancer Causes provides estimates of population attributable fractions (PAFs) to quantify the potential of prevention; the cancer burdens attributable to obesity, infections, and exposure to ultraviolet radiation are currently available, and PAFs as a result of tobacco use and alcohol consumption are under development. Cancer Survival is the most recent addition, reflecting a major emphasis on developing comparable survival estimates across different income settings. Finally, Cancer Over Time is now under development; funds from the Danish Cancer Society to redevelop NORDCAN (Cancer statistics for the Nordic countries), in collaboration with the Association of Nordic Cancer Registries (http://ancr.nu), are supporting regional templates for detailed analyses of cancer incidence and mortality trends nationally.

Descriptive epidemiology of cancer

The Section's activities revolve around several major lines of research that use the databases held at CSU, including in-depth assessments of the international variations of specific cancer types, quantification of the major risk factors contributing to the current cancer burden, and an assessment of the long-term benefits of preventive interventions.

International geographical and temporal studies have been undertaken for cancers of the colorectum (Araghi et al., 2018, 2019a, b), lung (Miranda-Filho et al., 2019a), endometrium (Lortet-Tieulent et al., 2018), ovary, prostate, and testis (Gurney et al., 2019), and for haematological cancers (Miranda-Filho et al., 2018, 2019b). Time-trend studies increasingly incorporate future trends-based predictions to advocate for preventive actions for longer-term public health gains; for example, the studies on colorectal cancer highlight the increasing burden in recent generations (Figure 2) and the need to monitor and target interventions among young adults (Araghi et al., 2019a). Related to this, there is continuing work applying frailty models to estimate the proportion of individuals who are susceptible to age-related subtypes of testicular germ cell cancer, Hodgkin lymphoma, and nasopharyngeal carcinoma. CSU has also published several papers that have sought to highlight the increasing burden of cancer among older adults (Pilleron et al., 2019a, b, c).

The Section is increasingly engaged in a quantification of the potential impact of cancer prevention. CSU completed a comprehensive assessment of the established causes of cancer in France in 2018 (Arnold et al., 2018a, b; Cao et al., 2018; Kulhánová et al., 2018; Marant Micallef et al., 2018, 2019a; Menvielle et al., 2018; Shield et al., 2018a, b, c, d; Soerjomataram et al., 2018; Marant-

Figure 2. Trends in age-standardized or age-truncated incidence rates of (a) colon cancer and (b) rectal cancer in seven high-income countries. Reprinted from Araghi et al. (2019a), Copyright 2019, with permission from Elsevier.

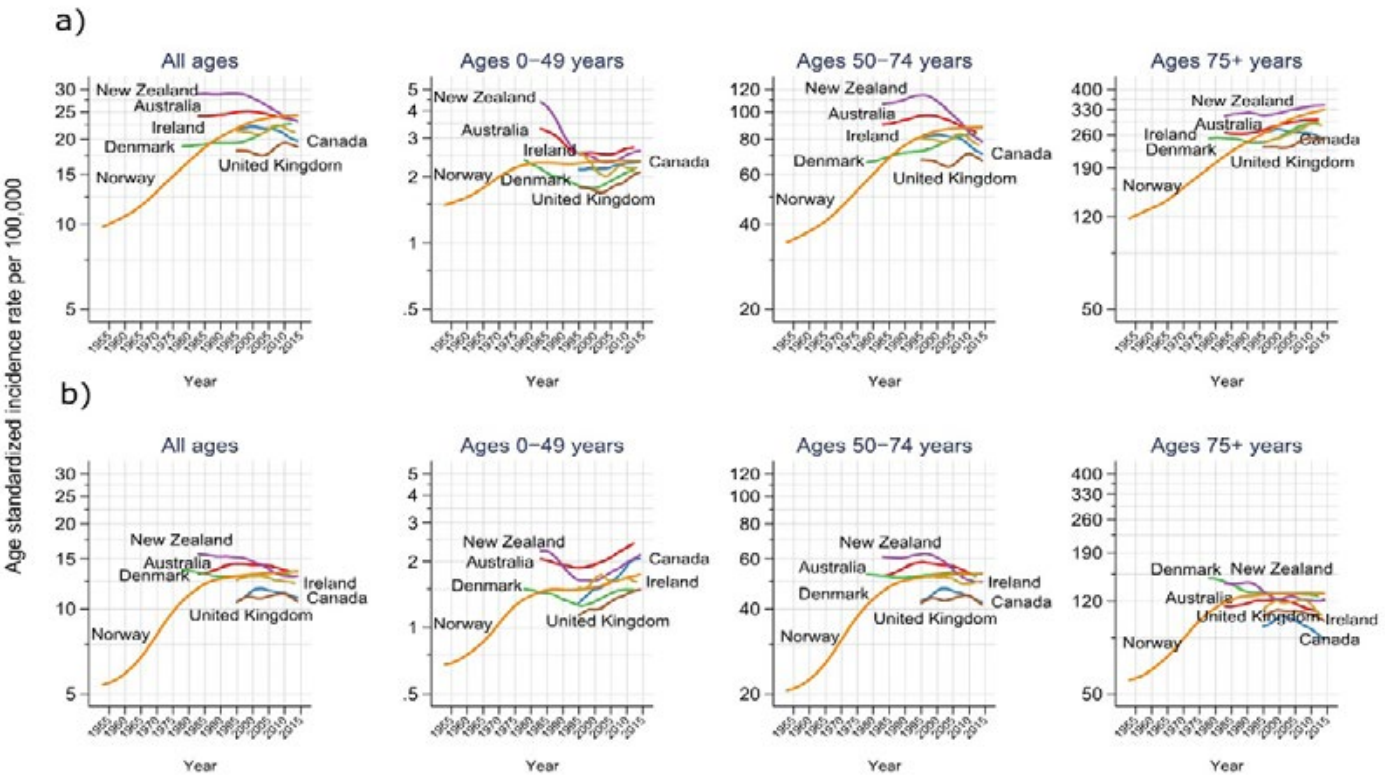
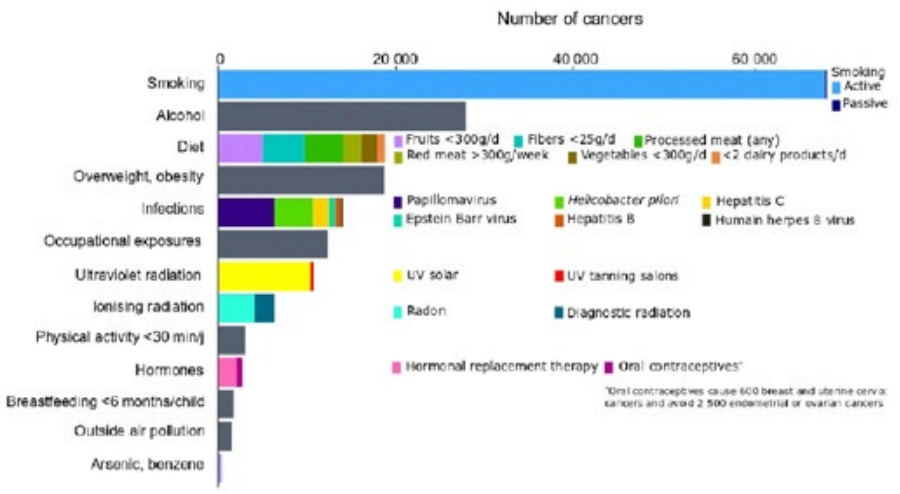


Figure 3. Number and proportion of cancer cases attributable to lifestyle and environmental factors in France in 2015, both sexes. Reprinted from Soerjomataram et al. (2018), Copyright 2018, with permission from Elsevier.



Micallef et al., 2019b; Touillaud et al., 2019), showing that 1 in 4 cancers are avoidable (Figure 3). Working across the relevant French authorities, the report (http://gco.iarc.fr/resources/paf-france_fr.php) serves as a basis for national prevention campaigns. CSU has also focused on specific risk factors globally, reporting on the burden related to exposure to ultraviolet radiation (Arnold et al., 2018c) and compiling the PAF estimates in Cancer Causes as part of the Global Cancer Observatory (Figure 1). A collaboration with colleagues from Cancer Council New South Wales, Australia, provided estimates of the cervical cancer burden until 2100 based on a scale-up of screening and human papillomavirus (HPV) vaccination programmes, driven by the ambitious Global Initiative for Cervical Cancer Elimination, led by the World Health Organization (WHO) (Simms et al., 2019); CSU also highlighted the importance of local population-based cancer registry data in achieving this goal (Baussano and Bray, 2019). Work is also continuing to estimate the impact of the implementation of effective tobacco control measures on the prevalence of tobacco use in Europe, based on measures of national adherence to the WHO Framework Convention on Tobacco Control.

A major component during this biennium has been the development of comparable population-based cancer survival estimates to assist planners in assessing the effectiveness of cancer services in different settings. Three international projects are under way: SURVMARK-2 (Cancer Survival in High-Income Countries), SURVCAN-3 (Cancer Survival in Countries in Transition), and SURVPOOL (A Consortium on Risk Factors and Cancer Survival). The first overview paper from SURVMARK-2 compared the survival of patients diagnosed with one of seven cancer types during 1995–2014 in seven countries (Figure 4), reporting marked progress in cancer control for several sites, while highlighting the extent to which international disparities persist (Arnold et al., 2019a). A recently published study that was part of SURVPOOL assessed the impact of lifestyle factors and demonstrated that duration and intensity of overweight were highly associated with poorer survival in women with breast and colorectal cancer (Arnold et al., 2019b). Further in-depth studies assessing the role of age, histology, and stage, among other factors, are in progress.

Childhood cancer

The Section's activities are fully aligned with the WHO Global Initiative for Childhood Cancer (GICC, https://www.who.int/cancer/childhood-cancer/en)

Figure 4. Age-standardized 5-year net survival by cancer site, country, and period of diagnosis, 1995–2014. Age-standardized net survival is for patients aged 15–99 years at diagnosis. The beginning of the arrow represents estimates for 1995–1999, and arrow heads from left to right refer to estimates for 2000–2004, 2005–2009, and 2010–2014. Australia includes New South Wales (1995–2012), Victoria, and Western Australia; Canada includes Alberta, British Columbia, Manitoba, New Brunswick, Nova Scotia, Ontario, Prince Edward Island, and Saskatchewan; Ireland (1995–2013); the United Kingdom includes its four constituent countries: England, Scotland, Wales, and Northern Ireland; all other countries with national data (1995–2014). Reproduced from Arnold et al. (2019a). © 2019 World Health Organization; licensee Elsevier.

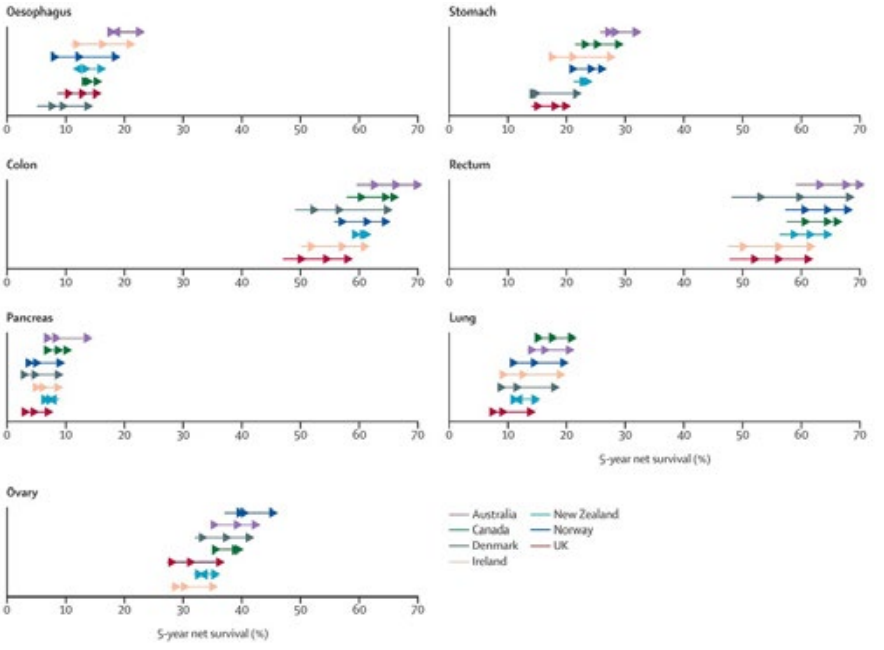
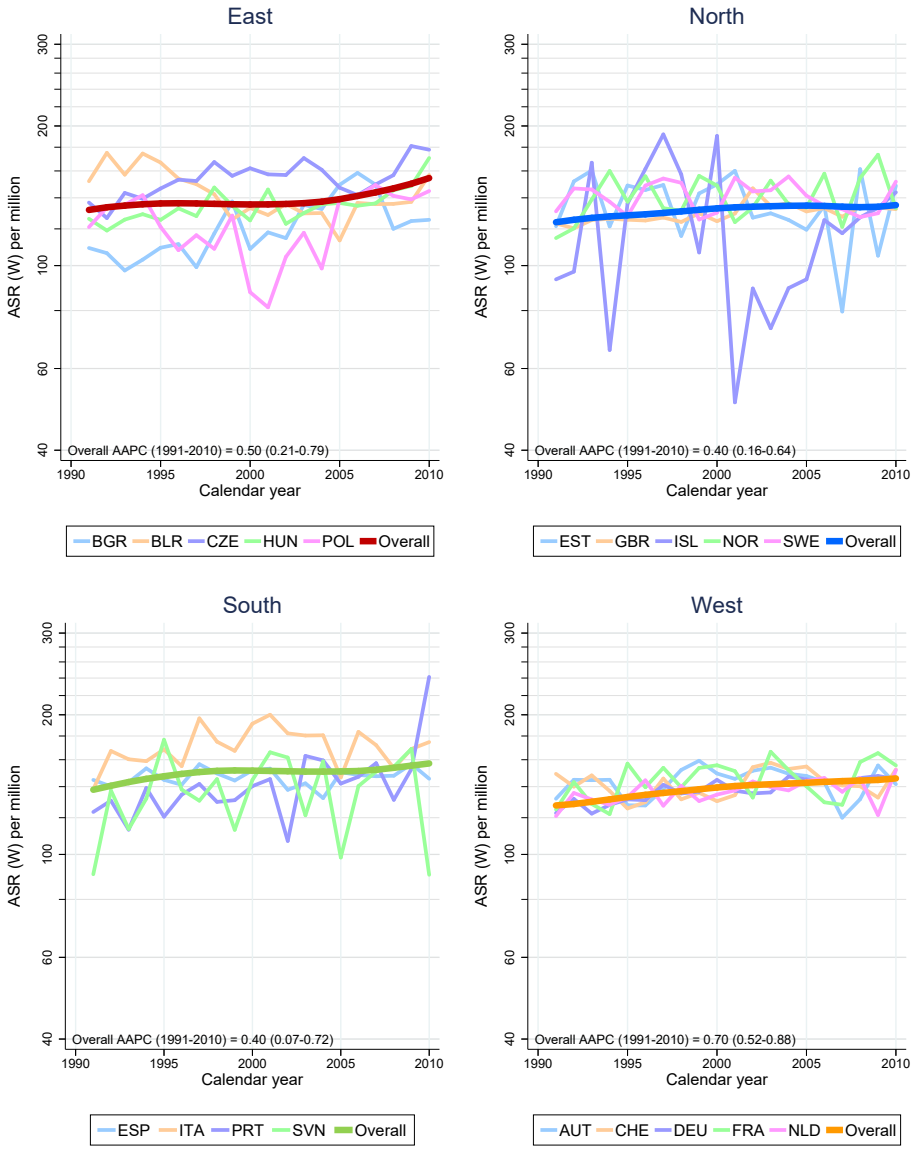


Figure 5. Trends in cancer incidence in children aged 0–14 years in Europe, 1991–2010. Thin lines are observed annual age-standardized (World) incidence rates (ASR) in countries; thick lines are the modelled incidence trends in each region of Europe. AAPC, average annual percentage change, with 95% confidence interval. Reprinted from Steliarova-Foucher et al. (2018), Copyright 2018, with permission from Elsevier.



and the unprecedented efforts to raise awareness of the impact of childhood cancer worldwide; specifically, there is an overwhelming need to reduce the marked disparities in childhood cancer survival observed between low- and high-income settings. Although cancer is relatively rare before the age of 20 years, recent research by CSU has shown that incidence rates of childhood cancer have been rising in the European Region (Steliarova-Foucher et al., 2018) (Figure 5). This highlights the need to continuously monitor the disease in every setting, particularly in LMICs, where underdiagnosis is an important determinant of poor survival (Steliarova-Foucher, 2019). The lack of population-based data in many LMICs impedes childhood cancer planning and treatment (Bhakta et al., 2019). Therefore, CSU, as a key partner of the GICC, is expanding the GICR programme to support the development of national childhood cancer registration in El Salvador, Ghana, Myanmar, Peru, the Philippines, Serbia, and Uzbekistan. A dedicated workshop with more than 100 participants from 50 countries was held at IARC in October 2019 and contributed multidisciplinary expertise to the development of a roadmap to improve the availability and quality of childhood cancer data globally.