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FULL PAPER

Medical conditions associated with the use of CT in children and young adults, Great Britain, 1995–2008

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Objective: To describe the medical conditions associated with the use of CT in children or young adults with no previous cancer diagnosis.

Methods: Radiologist reports for scans performed in 1995–2008 in non-cancer patients less than 22 years of age were collected from the radiology information system in 44 hospitals of Great Britain. By semantic search, an automated procedure identified 185 medical conditions within the radiologist reports. Manual validation of a subsample by a paediatric radiologist showed a satisfactory performance of the automatic coding procedure.

Results: Medical information was extracted for 37,807 scans; 19.5% scans were performed in children less than 5 years old; 52.0% scans were performed in 2000 or after. Trauma, diseases of the nervous (mainly hydrocephalus) or the circulatory system were each mentioned in 25–30% of scans. Hydrocephalus was

mentioned in 19% of all scans, 59% of scans repeated ≥ 5 times in a year, and was the most frequent condition in children less than 5 years of age. Congenital diseases/malformations, disorders of the musculoskeletal system/connective tissues and infectious or respiratory diseases were each mentioned in 5–10% of scans. Suspicion or diagnosis of benign or malignant tumour was identified in 5% of scans.

Conclusion: This study describes the medical conditions that likely underlie the use of CT in children in Great Britain. It shows that patients with hydrocephalus may receive high cumulative radiation exposures from CT in early life, i.e. at ages when they are most sensitive to radiation.

Advances in knowledge: The majority of scans were unrelated to cancer suspicion. Repeated scans over time were mainly associated with the management of hydrocephalus.

INTRODUCTION

The benefits of CT, in the diagnosis and follow-up of numerous conditions, are undeniable. The justification for CT scanning must be balanced against the potential harmful effects of radiation exposures, particularly in children, who appear to be at a greater risk of radiation-related cancer than adults.^{1,2} Increased cancer risks in relation to CT exposures at young ages have been reported in several populations. The UK CT cohort study showed a significant dose–response relationship between radiation doses from scans received before the age of 22 years and the risk of cerebral tumours and leukaemia/myelodysplastic syndromes.³ After a first scan before the age of 10 years, 1 excess case of leukaemia and 1 excess case of cerebral tumour per 10,000 head scans were estimated to occur in the subsequent 10 years. Other cohort studies have found comparable results.^{4–7}

The interpretation of these results nevertheless requires an understanding of whether the excess risks of later malignancies observed after CT scans were due to the radiation exposure or to the underlying medical condition.^{8,9} It is indeed possible that the increased incidence rates observed after receipt of CT scans were, at least in part, attributable to the indication for CT use, whether it was the first symptoms of a tumour, a follow-up for cancer predisposition or a non-cancer disease associated with an elevated risk of developing cancer. To date, however, very few surveys have described the common medical conditions in paediatric CT, and those which justify the use of repeated scans in children.^{10–13} Most have used billing claims, following non-standardized billing rules which applied in the participating hospitals at that time,^{10–12} and none, to our

knowledge, have described the particular medical conditions associated with repeated CT scans in childhood.

In epidemiological studies, the large sample size needed to detect small potential excess risks after CT exposures made it unfeasible to retrospectively collect the scanning indications for all the cohort members. Moreover, to the best of our knowledge, no radiology department during the past period archived the radiology request forms (or kept an archive for a prolonged period), which would have contained the information regarding the reasons for CT use. Instead, some departments or radiologists routinely included some or all of the indications or underlying medical conditions in the text of their report (it is this information which forms the basis of this study). In all the previously reported epidemiological studies, the analyses were conducted after excluding cancers occurring within the first 1–10 years after exposures to reduce the possibility that scans were performed to investigate early symptoms of a tumour diagnosed later.^{3–7} *Ad hoc* analyses^{7,14,15} showed little to no evidence of an overestimation of radiation-related risks owing to the presence of cancer-predisposing conditions, such as Down syndrome, neurofibromatosis or ataxia telangiectasia, or immune deficiencies known to be associated with an elevated risk of haematopoietic tumours.^{16,17}

To complement these findings, we aim here to describe medical conditions associated with the use of CT in children or young adults with no previous diagnosis of cancer, among members of the previously reported UK CT cohort.³ We report medical conditions, *i.e.* suspected diseases, past medical history or CT findings mentioned by the radiologists at the time of scan in their electronic reports archived in the radiology information system (RIS) of secondary- and tertiary-level hospitals. Of particular interest are the conditions of patients who received multiple scans and hence the highest radiation doses.

METHODS AND MATERIALS

Data collection

Electronically stored radiologist reports for CT scans performed in 1995–2008 were collected for members of the UK CT cohort from available local RIS databases at hospitals of 44 National Health Service (NHS) trusts.³ Half of the hospitals were devoted to tertiary-level care (children's, specialized and/or university hospitals) and the others to secondary-level care (district general or acute hospitals). Scans were performed in patients younger than 22 years old with no diagnosis of cancer prior to the examination or within the next 2 years. A history of a malignant disease or benign brain tumour was retrieved through the NHS Central Register,³ or from the radiologist comments for some cases of malignant diseases unreported in the cancer registry.¹⁴ Since the previously published risk analyses,^{3–14} additional information on CT exposures and scan reports was collected for the period 2003–2008 in half of the participating hospitals and the follow-up (diagnosis of cancer, vital status) was extended up to 31 December 2010. Available information for scans performed before 1995 was sparse and not included in this report.

Semantic search

Radiologist reports contained heterogeneous information about the indication for the scan (symptoms or clinical signs, suspected disease, medical follow-up after an intervention), the patient past medical history (personal or familial), description of imaging appearances on the scan and/or the radiologist interpretation for the examination (excluded, possible, likeliest diagnosis). As these reports were written as non-structured free text, we performed a semantic search to retrieve medical conditions mentioned by the radiologists. First, we searched for frequent substantives or expressions in all records using Tropes V8.4 software.¹⁸ These terms were then classified into 185 medical conditions (diseases, symptoms/signs, medical contexts or procedures) grouped into the main chapters of the 10th edition of the International Classification of Diseases (ICD-10) (Table A1). An algorithm was then defined to retrieve from the text fields specific character strings related to the 185 medical conditions of interest and their possible synonyms and misspellings (using SAS® v. 9.3; SAS Institute Inc., Cary, NC). Systematic manual verification enabled correcting possible coding errors (*e.g.* character strings “particular” read as “articular”).

Validation of medical coding

The performance of the coding algorithm was assessed by a paediatric radiologist (KMCH) in a randomly selected sample of 400 reports. This validation procedure identified missing conditions (mainly trauma, infection, sinusitis and congenital malformations) for <2% of examinations. No case of cancer was missed in the validation sample, but one was a false positive; this was the only false-positive case identified. KMCH also reviewed all available radiology reports for a sample of 50 children who received 5 or more scans within a year, all of whom had hydrocephalus. Lastly, all reports of benign tumours (of other sites than brain, which were excluded from the analyses³) or malignancies were reviewed to identify those related to previously diagnosed or treated diseases, suspected diseases at the time of scan, family history or scan findings (*i.e.* diagnoses excluded or reported as possible or likeliest by the radiologist).

Description of medical conditions

Frequencies of medical conditions were described as ICD-10 chapters and subgroups, by age at scan (<1, 1–4, 5–9, 10–14 and 15–21 years), scanned body part (head, neck, chest, abdomen, pelvis, spine, limbs/hips), year at scan (1995–1999, 2000–2008) and hospital type (secondary- or tertiary-level health). We also described medical conditions according to the number of scans (regardless of the availability of radiologist comments, the scanned body region and the date and place of the examinations; data obtained by linkage with the UK CT cohort data set) received by the patients within a given calendar year, or during a specific age period (<5, 5–14 and 15–21 years). The last analyses were restricted to children with at least one scan report and a complete follow-up during a given age period.

RESULTS

Description of the sample

In a total of 62,797 scan reports collected, clinical information was retrieved in 37,807 scans (*i.e.* 60.2% of the initial sample) of

28,878 patients. The remaining 24,990 records had no clinical information within the body of the report or only mentioned the absence of any abnormality or lesion. The availability of clinical information was higher in most recent years (65.8% in 2000 or after *vs* 55.1% in 1995–1999) and in tertiary-level hospitals (63.8 *vs* 51.3% in secondary-level hospitals). Clinical information availability was also higher for non-head scans (75.2 *vs* 55.1% in head scans) and for scans in patients less than 1 year of age (65.1 *vs* 59.8% in patients aged more than 1 year), which both accounted for an increasing proportion of all procedures over time. Among the 37,807 scans with accompanying clinical information, 75.5% scans were performed in tertiary hospitals; 52.0% scans were performed in 2000 or after. Patients were aged less than 1 year (9.0%), 1–9 years (23.8%), 10–14 years (18.2%) or 15 years or more (49.0%). The body parts scanned were the head (68.3%), neck (1.9%), chest (9.8%), abdomen (9.1%), pelvis (4.1%), limbs or hips (5.5%), spine (4.2%) or unknown (1.4%).

Main medical conditions identified

Reported medical conditions were mainly diseases of the nervous system, trauma and diseases of the circulatory system, each mentioned in 25–30% scans (Table 1). Congenital diseases/malformations, disorders of the musculoskeletal system/connective tissues and infectious or respiratory diseases each accounted for 5–10% of scans. Benign or malignant tumours were mentioned in 5% of scans; more than half of them being diagnoses ruled out on the basis of the imaging appearances (Table A8).

Subtypes of medical conditions

Hydrocephalus (suspected disease, diagnosis or follow-up) represented the largest proportion of diseases of the nervous system, accounting for 19% of all scans (Table A2). Cerebral haemorrhage was the main disease of the circulatory system, accounting also for 19% of all scans. Congenital diseases or malformations were mostly unspecified abnormalities (47% of

Table 1. Distribution (%) of medical conditions retrieved in the radiologist reports of CT scans coded as 10th edition of the International Classification of Diseases (ICD-10) chapters, in secondary- and tertiary-level hospitals

ICD-10 Chapter	Overall	Secondary-level hospital	Tertiary-level hospital
	N = 37,807	N = 11,674	N = 26,133
I Infectious and parasitic diseases	5.0	5.1	4.9
II Neoplasms	4.8	4.4	5.0
III Diseases of the blood and blood-forming organs, disorders of the immune system	0.4	0.2	0.4
IV Endocrine, nutritional and metabolic diseases	0.5	0.5	0.5
V Mental and behavioural disorders	0.4	0.9	0.2
VI Diseases of the nervous system	26.9	19.3	29.3
VIII Diseases of the eye and adnexa	1.4	2.9	0.9
VIII Diseases of the ear and mastoid process	3.9	5.8	3.3
IX Diseases of the circulatory system	25.2	27.9	24.3
X Diseases of the respiratory system	11.0	9.2	11.6
XI Diseases of the digestive system	1.4	0.9	1.6
XIII Diseases of the musculoskeletal system and connective tissue	8.8	10.9	8.1
XIV Diseases of the genitourinary system	1.0	0.5	1.2
XVI Certain conditions originating in the perinatal period	0.5	0.9	0.3
XVII Congenital malformations, deformations and chromosomal abnormalities	8.9	9.2	8.8
XVIII Symptoms, signs and abnormal clinical and laboratory findings	28.0	29.7	27.4
XIX Injury, poisoning and certain other consequences of external causes ^a	27.6	31.0	26.5
Surgery ^b	7.4	3.8	8.6
Medical procedures or devices ^b	3.2	1.4	3.8

^aVirtually only trauma; poisoning/intoxication accounted for 0.02% of all scans.

^bThese categories are not defined as such in the ICD-10. NB: Secondary-level hospitals: district general or acute hospitals; tertiary-level hospitals: children's, specialized or university hospitals. Sums exceed 100% because each scan could be related to several medical conditions.

reports for congenital diseases/malformations), craniostenosis (22%), microcephaly (10%), arteriovenous malformation (7%), phacomatoses (4%) and spina bifida (4%) (Table A9). Disorders of the musculoskeletal system or connective tissues were also mostly unspecified (Table A2). Meningitis, whether it was a suspected, diagnosed or excluded diagnosis, was the most frequent infectious disease mentioned (23% of cases of infectious disease). Bronchiectasis (36% of cases of respiratory disease), atelectasis (18%) and sinusitis (17%) were the most frequent respiratory diseases. Non-specific symptoms or signs were also frequently reported: cyst/nodule in non-cancer reports (9% of all scans), haematoma (8%), lymphadenopathy (5%), headache (4%), pain (2%), ascites (1%) and nausea/vomiting (1%).

Frequencies by hospital type

Overall, medical conditions were reported in similar frequencies in secondary- and tertiary-level hospitals (Table 1; Table A2). A notable difference, however, was for suspicion, diagnosis or follow-up of hydrocephalus, which was reported in 24% of scans in tertiary-level hospitals *vs* 7% of scans in secondary-level hospitals. Conversely, secondary-level hospitals reported two to four times higher frequencies of other diseases of the nervous system (apart hydrocephalus) as well as of mental/behavioural disorders and diseases of the eye or the ear than tertiary-level hospitals, but these conditions remain rare.

Frequencies by patient age

The frequency of reported medical conditions also varied with patient age (Figure 1; Table A3). The percentage of diseases of the nervous system decreased with age (from 37% before 1 year to 22% at ages 15–21 years), as did diseases of the circulatory system, congenital diseases or malformations, and infectious diseases. Conversely, the proportion of suspicion or history of trauma increased from 18% at age less than 1 year to 31% at

ages 15–21 years, as did the proportion of disorders of the musculoskeletal system/connective tissues and respiratory diseases. The proportion of scans for suspected cancer was constant across age groups.

Frequencies by scanned body part

Types of medical conditions varied according to the scanned body part following expected patterns (Table 2; Table A4). Head scans were mainly associated with hydrocephalus, cerebral haemorrhage and trauma, whereas chest scans were mainly associated with diseases of the respiratory or the circulatory system. Trauma was mentioned in 50–65% of scans of the spine or limbs and 20–30% of head, neck or abdomen scans, but only in 7% of chest scans. Suspected or diagnosed benign tumours or malignancies accounted for 10–15% of body scans, but only 3% of head scans.

Conditions associated with multiple scans

Among children scanned only once over a year, trauma was the most commonly reported condition (Figure 2). Repeated scans were, however, strongly associated with the treatment or follow-up of hydrocephalus, which was mentioned in 30% of examinations in children scanned 2–4 times in a year and 59% of scans in children scanned five or more times in a year. Hydrocephalus was mentioned (at least once) in 66% of children scanned five or more times within a year (Table A5). This condition was even more frequent in youngest children, as it was reported in 80% of children scanned five or more times before age 5 years *vs* 68 and 49% of children scanned five or more times, respectively, at ages 5–14 years and 15–21 years (Figure 3). The frequency of cerebral infarction or haemorrhagia, and brain congenital malformations (in particular craniostenosis) was also higher in children who received multiple scans over time (Table A6). Among 50 children (randomly selected among 319 children) who received five or more scans over a year, of which

Figure 1. Distribution of the main medical conditions retrieved in radiologist reports of CT scans by age groups.

Table 2. Frequencies of most frequent ($\geq 5\%$ of scans) medical conditions retrieved in the radiologist reports, by subtypes, when appropriate, and scanned body part

Scanned body part	%	Scanned body part	%
Head ($n = 25817$)		Abdomen ($n = 3435$)	
Hydrocephalus/VP shunt	27.9	Trauma	24.7
Cerebral haemorrhage	26.9	Lymphadenopathy	21.9
Trauma	26.6	Diseases of the respiratory system	19.8
Congenital diseases/malformations	9.5	Cyst, nodule (if no cancer reported)	18.2
Haematoma	9.3	Haematoma	15.6
Ischaemia stroke, cerebral infarction	8.1	Ascites	13.4
Cyst, nodule (if no cancer reported)	6.0	Diseases of the circulatory system	10.2
Diseases of the ear and mastoid process	5.5	Diseases of the digestive system (except pancreatitis)	9.4
Headache	5.0	Neoplasms	9.3
Infectious and parasitic diseases	4.7	Diseases of the musculoskeletal system	8.5
Cerebral oedema	4.7	Splenomegaly	7.3
		Pain	7.6
		Haemorrhage, infarction (except cerebral)	6.2
Chest ($n = 3715$)		Organ transplant	6.2
Bronchiectasis	39.2	Infectious and parasitic diseases	5.8
Diseases of the respiratory system (except bronchiectasis, atelectasis)	27.2	Renal calculi	5.3
Lymphadenopathy	25.7	Pancreatitis	4.7
Cyst, nodule (if no cancer reported)	20.5		
Atelectasis	13.8		
Diseases of the circulatory system	13.5	Pelvis^a ($n = 1530$)	
Neoplasms	8.1	Trauma	32.2
Congenital diseases/malformations	7.9	Lymphadenopathy	21.5
Infectious and parasitic diseases	7.3	Diseases of the musculoskeletal system	20.5
Trauma	6.7	Diseases of the respiratory system	17.3
		Cyst, nodule (if no cancer reported)	14.6
Neck ($n = 698$)		Haematoma	14.3
Lymphadenopathy	37.1	Diseases of the digestive system	9.5
Trauma	29.5	Neoplasms	9.3
Cyst, nodule (if no cancer)	21.1	Ascites	9.2
Diseases of the circulatory system	16.9	Diseases of the circulatory system	7.4
Neoplasms	14.8	Infectious and parasitic diseases	7.3
Diseases of the musculoskeletal system/connective tissue	14.6	Pain	6.9
Diseases of the respiratory system	11.3	Diseases of the genitourinary system	5.3
Haematoma	8.2	Haemorrhagia, infarction (except cerebral infarction)	4.7
Infectious and parasitic diseases	8.0		
Spine ($n = 1591$)		Limbs and Hips ($n = 2073$)	
Trauma	65.6	Trauma	53.4
Diseases of the musculoskeletal system/connective tissue (except spondylolisthesis)	26.3	Diseases of the musculoskeletal system	50.1

(Continued)

Table 2. (Continued)

Scanned body part	%	Scanned body part	%
Diseases of the nervous system	9.4	Congenital diseases/malformations	11.8
Congenital diseases/malformations	9.4	Neoplasms	11.7
Spondylolisthesis	5.7	Diseases of the circulatory system	11.0
Haematoma	5.4	Cyst, nodule (if no cancer reported)	5.9
Diseases of the circulatory system	5.1		

VP, ventriculoperitoneal.

^aThe pelvic region was scanned in the course of a whole-body, chest-abdomen-pelvis or abdomen-pelvis scan in 58.1% of cases.

hydrocephalus was mentioned at least once, we were able to identify the possible underlying condition for 37 (74.0%) children. Of these, hydrocephalus was considered to be congenital in 17 (45.9%) children, subsequent to trauma in 10 (27.0%) children, related to an infectious disease in 6 (16.2%) children and related to a tumour in 4 (10.8%) children.

DISCUSSION

To the best of our knowledge, this is the first study conducted in the UK, and one of the few surveys worldwide, to describe the medical conditions associated with the use of CT in children and young adults. Medical conditions identified from the radiologist comments in RIS reports provided indirect information on the disorders, diseases or symptoms that likely influenced the performance of those scans. We found that diseases of the nervous system (mainly hydrocephalus) or the circulatory system (mainly cerebral haemorrhage) and trauma were by far the most frequent conditions reported in patients with no previous malignant disease. Many of the cerebral haemorrhage cases were also associated with trauma. In this non-cancer referral population, the majority of scans were, however, unrelated to cancer suspicion or surveillance. Suspicion or diagnosis of a benign or malignant tumour was reported in only 5% of scans and for more than half of them,

the possibility of an underlying tumour was excluded by the radiologists on the basis of the imaging appearances. By design, the remaining possible diagnoses were also subsequently excluded, or confirmed later than 2 years after the CT scan.¹⁴ Suspected or diagnosed congenital diseases/malformations were mentioned in <10% of scans, of which only a small proportion was possibly related to an increased risk of cancer.¹⁴

Many studies have assessed the conformity of clinical practice to guidelines for traumatic brain injury or other conditions,^{19–23} but very few have provided a broad overview of medical conditions which are associated with the use of CT in paediatrics,^{10,11,13} and none, to our knowledge, was conducted in the UK. Tompane et al¹⁰ described billing records associated with 14,000 CT scans of children and adolescents by US practitioners between 2001 and 2009. The study reported frequencies of claims for trauma (21% of scans) and congenital diseases/malformations (11%) that were very similar to the present study (28 and 9% of scans, respectively). Compared with the present study, gastrointestinal (GI) symptoms were much more frequent (>20% of scans in children aged of 5 years or more), but, conversely, the frequency of neurologic symptoms was low (4% of scans). However, the authors did

Figure 2. Distribution of the main medical conditions retrieved in radiologist comments of CT reports stratified by the total number of scans received by the patients within the year.

Figure 3. Frequencies of children who had a scan report for hydrocephalus according to the number of scans they received and the age period during which they were exposed.

not define which conditions they considered to be GI or neurologic symptoms. The higher frequency of GI symptoms possibly reflects the lower threshold for scanning suspected appendicitis with CT in North America in contrast to European practice, where ultrasound evaluation is preferred.

Chodick et al¹¹ reported ICD-9 billing records for 22,000 scans performed in children and adolescents under 18 years of age in Israel in 1999–2003. In this study, the frequency of claims for respiratory diseases (22% of scans) was high compared with the present study (11%) and the one reported by Tompane et al (7%). Conversely, the proportions of scans associated with trauma (10%), congenital diseases (3%) and diseases of the nervous (14%) or the circulatory system (1%) were lower than that in the present study. Patterns by patient age were nevertheless very similar to our findings, *i.e.* a decrease in the frequency of diseases of the nervous system and congenital anomalies, but an increase of the frequency of diseases of the musculoskeletal system/connective tissues, with age. In France, claims for trauma were found for 17% of 16,000 children under 10 years of age scanned in university hospitals in 2000–2011 (*vs* 18–25% of children here in the same age group).¹² In Japan, trauma was reported in 16% of RIS reports of children under the age 15 years at university hospitals in 2008–2010 ($N = 4000$); in Germany, it was reported in 34% children ($N = 900$).¹³

The differences between studies might reflect variability in clinical practices between countries, but also differences in the sources of information. With the use of billing records in the previous studies,^{10–12} it is possible that cases of hydrocephalus (which represented the majority of diseases of the nervous system here) were not recorded as such but rather as their underlying diseases (trauma, infection, congenital disease). Also, the presence of lesions excluded by the radiologists based

on the imaging features may not have been recorded as claims for visit or hospitalization. The exclusion of patients diagnosed with cancer is also a major difference with the previous studies, making the comparison of frequencies of neoplasms irrelevant. Using radiology reports in patients without cancer as it was here, Krille et al⁷ found a similar frequency for cancer suspicion (3%) in children less than 15 years of age in German hospitals.

Compared with the previous reports, the present study has several advantages, of which a longer time period and a larger sample size. Most importantly, it made the use of radiologist reports, which enabled to report frequencies of certain conditions (*e.g.* hydrocephalus) and conditions related to repeated scans over time, which have never been described in previous reports but are of major relevance in clinical practice. The survey, which was conducted in public-funded NHS hospitals where virtually all paediatric CT scans are performed, would not have been biased by referral to the private sector. Finally, considering the size of the sample size and the complexity of lexical search in radiologist reports, the present survey provides a unique source of information.

As in the previous, above-mentioned, studies, the present survey does not, however, provide direct information on the indication for scans, *i.e.* diseases or presenting complaints that justified the use of CT, and should not be interpreted as such. These data do not either give any information on either the appropriateness of CT use or its conformity with guidelines. For the interpretation of the present results, one limitation was the heterogeneity of the clinical information reported by the radiologists, which described the reason for scan, the patient past medical history, the imaging features and/or their interpretation by the radiologist. Non-standardization of the reports probably led to uncertainty in the frequencies of potential underlying diseases in terms of absolute rates. The increasing completeness of the radiology

reports over time also made the description of trends by time periods inappropriate, while the indications for CT evolve faster and faster as the resolution of CT scanning improves and CT and other imaging techniques become available. Nonetheless, analyses restricted to the most recent period (2000–2008) showed absolute and relative frequencies by age very similar to the analyses reported for the whole period (Table A7).

Of particular interest is the description of conditions associated with repeated scans over time and thus higher radiation exposures. These results inform on which patients might be at highest risks of radiation-related harmful effects. In particular, we found that the vast majority of repeated scans were associated with hydrocephalus and presumed ventriculoperitoneal shunt malfunction, which were reported in 60% of scans repeated five or more times within a year (Figure 2). This result suggests that children and adolescents treated and followed for hydrocephalus might receive high cumulative radiation exposures from CT and thus represent a population particularly at risk of potential radiation-induced effects. This would be all the more worrying, given that the majority of these children were exposed at very young ages (80% of children scanned five or more times before age 5 years had a report for hydrocephalus) (Figure 3), *i.e.* when they are the most sensitive to radiation.¹

That some children with hydrocephalus may undergo repeated CT scanning is well known to neurosurgeons and neuro-radiologists. A malfunctioning shunt resulting in a medical emergency often happens in young children with an initial treatment of hydrocephalus and, in these patients, a fast CT examination is much easier and safer to organize, often “out of hours”, than an MRI scan. Non-emergency and emergency departments might now opt to perform a low-dose CT examination or an abbreviated MRI scan for hydrocephalus evaluation to reduce the known radiation hazard from repeated CT scans,^{24,25} since studies have demonstrated that MRI is as efficient as CT in detecting shunt malfunctioning.^{26,27} However, the long time to complete the examination, high costs and unavailability of equipment or dedicated staff can limit the use of MRI, in particular in emergency cases. To date, only one study, to our

knowledge, has assessed the magnitude of radiation exposure in this specific population.²⁸ The study included all children ($N = 1300$) who underwent an initial ventricular shunt placement before the age of 18 years in 2003 in 1 of the 31 involved US children’s hospitals. Of these children, 73% children were aged less than 1 year at the initial shunt placement, 30% children received three and more scans in the 10 subsequent years and 15% of the exposed ones received a cumulative effective dose ≥ 20 mSv. The authors also reported a large variability of the frequency of CT use among the hospitals. Further assessment of current practices in other settings and radiation exposures of this at-risk population would thus be worthwhile, as will be the continuing assessment of the performance of different modalities to detect and monitor shunt malfunction and other neurovascular diseases.

In conclusion, this study described medical conditions that appear more frequently associated with the use of CT in paediatrics, providing insights for both clinical practice and epidemiological studies assessing the potential subsequent cancer risks. It showed that in patients with no previous history of cancer, the majority of scans were unrelated to cancer suspicion, especially in patients who received repeated scans over time. In patients with multiple exposures in a short time period, hydrocephalus was by far the most frequently reported disorder. These results warrant further investigation to evaluate the magnitude of radiation exposures in these young patients and the efficiency of CT use, in relation to clinical outcomes, compared with other strategies of diagnosis and follow-up.

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APPENDIX A

Table A1. List of 185 diseases, symptoms or medical procedures searched for in radiologist reports of CT scans to describe medical conditions associated with the use of CT

ICD-10 chapter	Medical conditions
I Infectious and parasitic diseases	Infectious disease (unspecified)
	Meningitis
	Tuberculosis
	Meningococcus
	Toxoplasmosis
	Encephalitis
II Neoplasms	Cancer (malignant or unspecified behaviour)
	Benign tumour
III Diseases of the blood and blood-forming organs, disorders involving the immune mechanism	Sarcoidosis
	Neutropenia
	Coagulopathy
	Immune deficiency (unspecified, acquired or inherited)
	Splenic infarct
IV Endocrine, nutritional and metabolic diseases	Hormonal disorder (unspecified)
	Homocystinuria
	Ornithine transcarbamylase
	Cystic fibrosis
	Androgenic disorder
	Disorder of the thyroid gland
	Disorder of growth hormones
V Mental and behavioural disorders	Behavioural/mental/psychiatric disorder (unspecified)
	Developmental defect
	Psychosis
	Autism
	Mental retardation
	Landau–Kleffner syndrome
	Attention deficit
	Disorder of speech
VI Diseases of the nervous system	Neurological disorder (unspecified)
	Dejerine–Sottas syndrome
	Encephalopathy
	Hemiplegia
	Guillain–Barre syndrome
	Tolosa–Hunt syndrome
	Hydrocephalus/VP shunt malfunctioning
	Epilepsy/seizures
	Intracranial hypertension
	Cerebral oedema

(Continued)

Table A1. (Continued)

ICD-10 chapter	Medical conditions
	Cerebral palsy
	Seventh nerve palsy (Bell's palsy)
VIII Diseases of the eye and adnexa	Disorder of the eye (unspecified)
	Orbital cellulitis
	Vision blur
	Vision defect (decreased acuity, visual disturbance, visual loss)
	Photophobia, photopsia
	Myopia
	Macrophthalmia
	Diplopia
	Optic canal stenosis
	Third, fourth and sixth nerve palsy
VIII Diseases of the ear and mastoid process	Disorder of the ear (unspecified)
	Otitis
	Neuritis
	Hearing disorder
IX Diseases of the circulatory system	Disease of the circulatory system (unspecified)
	Cardiomegaly
	Ischaemia stroke, cerebral infraction
	Budd–Chiari syndrome
	Cardiac transplant
	Heart failure
	Cardiomyopathy
	Aneurysm
	Embolism, thrombosis
	Hypertension
	Heart infarct
	Phlebitis, thrombophlebitis
	Haemorrhagic telangiectasia
	Subdural haemorrhagia
	Subarachnoid haemorrhagia
	Ventricular haemorrhagia
	Cerebral haemorrhagia (unspecified elsewhere)
X Diseases of the respiratory system	Respiratory disease (unspecified)
	Bronchiectasis
	Pneumonia
	Bronchiolitis
	Pneumonitis
	Atelectasis

(Continued)

Table A1. (Continued)

ICD-10 chapter	Medical conditions
	Sinusitis
	Asthma
XI Diseases of the digestive system	Digestive disease (unspecified)
	Crohn disease
	Appendicitis
	Peritonitis
	Rectal prolapse
	Cirrhosis, liver disease
	Pancreatitis
	Hepatitis
	Colitis
	Constipation
XIII Diseases of the musculoskeletal system and connective tissue	Disorder of the musculoskeletal system or connective tissue
	Osteomyelitis
	Scoliosis
	Spondylolisthesis
	Myositis
	Osteochondritis
	Disorder of bone density
	Sacroilitis
	Granulomatosis
	Fibrous dysplasia
	Osteoporosis
	Arthrosis
	Spondylitis
	Spinal stenosis
XIV Diseases of the genitourinary system	Nephritis
	Pyelonephritis
	Renal calculus
	Renal failure
	Portal venous hypertension
	Renal infarct
	Portal thrombophlebitis
	Ovarian cyst
XVI Certain conditions originating in the perinatal period	Conditions originating in the perinatal period (unspecified)
	Birth asphyxia
	Traumatism at birth, perinatal traumatism
	Hypoxia at birth
	Perinatal infarct
	Perinatal ischaemia
	Hydrocephalus of the newborn

(Continued)

Table A1. (Continued)

ICD-10 chapter	Medical conditions
XVII Congenital malformations, deformations and chromosomal abnormalities	Congenital malformations, deformations and chromosomal abnormalities (unspecified)
	Phakomatosis
	Marfan's syndrome
	Crouzon's syndrome
	Dandy-Walker's syndrome
	Schizencephaly
	Down's syndrome
	Klippel-Feil's syndrome
	Sprengel's syndrome
	Joubert's syndrome
	Zunich-Kaye's syndrome
	Spina bifida
	Arteriovenous malformation
	Biliary atresia
	Scaphocephaly
	Microcephaly
	Choanal atresia
	Craniostenosis
XVIII Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified	Convulsion, spam
	Pain
	Clumsiness
	Weight loss
	Dizziness
	Paraesthesia
	Headache
	Vomiting, nausea
	Fever
	Neck stiffness
	Meningism
	Drowsiness
	Scalp tenderness
	Macrocephaly
	Ascite
	Haematuria
	Empty sella syndrome
	Splenomegaly
	Hepatomegaly
	Enlarged pancreas
	Jaundice
	Diarrhoea

(Continued)

Table A1. (Continued)

ICD-10 chapter	Medical conditions
	Coma
	Hallucination
	Fatigue, lethargy
	Tachycardy
	Twitching
	Irritability
	Cough
	Pregnancy
	Cyst, nodule (if no cancer)
	Lymphadenopathy
	Haemorrhagia, infarction (excluding ischaemic stroke/cerebral infraction)
	Haematoma (unspecified; not classified elsewhere)
XIX Injury, poisoning and certain other consequences of external causes	Trauma, injury
	Poisoning, intoxication
00 Medical procedures or devices	Implant
	Pacemaker
	Transplant
	Embolization
	Catheter or drain (other than VP shunt)
00 Surgery	Surgery (not specified elsewhere)
	Tracheostomy
	Craniotomy
	Hysterectomy
	Appendectomy
	Neurosurgery
	Nephrectomy
	Mastoidectomy

VP, ventriculoperitoneal. Unlike the ICD-10 classification, fractures are not individualized as such here but combined with “trauma” or “birth trauma”. VP shunt is not individualized as a subgroup of medical procedures but included in the “Hydrocephalus” category.

Table A2. Distribution (%) of medical conditions retrieved in the radiologist reports of CT scans, by hospital type ($n = 37,807$ scans)

ICD-10 chapter	Overall	Hospital type	
		Secondary-level hospital	Tertiary-level hospital
I Infectious and parasitic diseases	5.0	5.1	4.9
Meningitis	1.1	1.2	1.1
Tuberculosis	0.2	0.2	0.2
Toxoplasmosis	0.1	<0.1	0.1
Encephalitis	0.5	0.8	0.4
II Neoplasms	4.8	4.4	5.0
Cancer (malignant or unspecified behaviour)	3.0	3.0	3.0
Benign tumour	1.8	1.4	1.9
III Diseases of the blood and blood-forming organs, disorders involving the immune mechanism	0.4	0.2	0.4
Sarcoidosis	0.1	0.2	0.1
Coagulopathy	0.1	<0.1	0.1
Immune deficiency (unspecified, acquired or inherited)	0.1	<0.1	0.1
IV Endocrine, nutritional and metabolic diseases	0.5	0.5	0.5
Cystic fibrosis	0.4	0.3	0.5
V Mental and behavioural disorders	0.4	0.9	0.2
Developmental defect	0.1	0.2	0.1
Psychosis	0.1	0.1	<0.1
VI Diseases of the nervous system	26.9	19.3	29.3
Encephalopathy	0.1	0.2	0.1
Hemiplegia	0.1	0.2	<0.1
Hydrocephalus	19.4	6.6	23.6
Epilepsy	1.4	3.0	0.9
Intracranial hypertension	1.7	2.7	1.4
Cerebral oedema	3.2	3.9	3.0
Cerebral palsy	0.1	0.2	0.1
Seventh nerve palsy (Bell's palsy)	0.2	0.4	0.1
VIII Diseases of the eye and adnexa	1.4	2.9	0.9
Orbital cellulitis	0.4	0.7	0.3
Vision blur	0.1	0.3	<0.1
Vision defect (unspecified, decreased acuity, visual disturbance, visual loss)	0.1	0.2	0.1
Photophobia, photopsia	0.3	0.7	0.1
Diplopia	0.2	0.4	0.1
Third, fourth and sixth nerve palsy	0.1	0.2	<0.1
VIII Diseases of the ear and mastoid process	3.9	5.8	3.3
Otitis	0.1	0.4	0.1
Hearing disorder	0.2	0.3	0.2

(Continued)

Table A2. (Continued)

ICD-10 chapter	Overall	Hospital type	
		Secondary-level hospital	Tertiary-level hospital
IX Diseases of the circulatory system	25.2	27.9	24.3
Cardiomegaly	0.1	0.1	0.1
Ischaemia stroke, cerebral infraction	5.7	6.7	5.3
Aneurysm	0.7	0.4	0.7
Embolism, thrombosis	1.1	0.8	1.2
Hypertension	0.1	<0.1	0.1
Cerebral haemorrhagia	18.5	22.2	17.3
X Diseases of the respiratory system	11.0	9.2	11.6
Pneumonia	0.3	0.2	0.3
Bronchiolitis	0.3	0.1	0.4
Pneumonitis	0.1	<0.1	0.1
Atelectasis	1.9	0.6	2.4
Sinusitis	1.8	3.5	1.3
Asthma	0.8	0.6	0.9
Bronchiectasis	4.0	2.6	4.4
XI Diseases of the digestive system	1.4	0.9	1.6
Crohn disease	0.4	0.2	0.4
Appendicitis	0.3	0.2	0.4
Peritonitis	0.1	<0.1	0.1
Cirrhosis, liver disease	0.2	<0.1	0.2
Pancreatitis	0.5	0.4	0.5
Colitis	0.1	0.1	0.1
Constipation	0.1	0.1	<0.1
XIII Diseases of the musculoskeletal system and connective tissue	8.8	10.9	8.1
Osteomyelitis	0.3	0.3	0.2
Scoliosis	0.4	0.2	0.5
Spondylolisthesis	0.2	0.2	0.3
Myositis	0.1	<0.1	0.1
Osteochondritis	0.6	0.6	0.7
Fibrous dysplasia	0.2	0.1	0.2
Arthrosis	0.2	0.2	0.3
Spinal stenosis	0.2	0.2	0.1
XIV Diseases of the genitourinary system	1.0	0.5	1.2
Pyelonephritis	0.1	<0.1	0.1
Renal calculus	0.6	0.4	0.7
Renal failure	0.1	<0.1	0.1
Portal venous hypertension	0.2	<0.1	0.3
Ovarian cyst	0.2	0.1	0.2

(Continued)

Table A2. (Continued)

ICD-10 chapter	Overall	Hospital type	
		Secondary-level hospital	Tertiary-level hospital
XVI Certain conditions originating in the perinatal period	0.5	0.9	0.3
Traumatism at birth, perinatal traumatism	0.1	0.2	0.1
Hydrocephalus of the newborn	0.1	<0.1	0.1
XVII Congenital malformations, deformations and chromosomal abnormalities	8.9	9.2	8.8
Phakomatosis	0.4	0.5	0.3
Dandy–Walker’s syndrome	0.3	0.4	0.3
Schizencephaly	0.1	0.1	0.1
Down’s syndrome	0.1	0.1	0.1
Spina bifida	0.4	0.2	0.4
Arteriovenous malformation	0.7	0.6	0.7
Scaphocephaly	0.1	0.1	0.1
Microcephaly	0.9	1.2	0.7
Choanal atresia	0.1	0.1	0.1
Craniostenosis	2.0	2.5	1.8
XVIII Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified	28.0	29.7	27.4
Convulsion, spam	0.2	0.4	0.1
Pain	1.6	2.8	1.2
Weight loss	0.1	0.1	0.1
Dizziness	0.3	0.9	0.2
Headache	3.5	8.0	2.1
Vomiting, nausea	1.3	2.6	0.9
Fever	0.7	1.0	0.7
Neck stiffness	0.2	0.7	0.1
Meningism	0.1	0.2	0.1
Drowsiness	0.2	0.5	0.2
Macrocephaly	0.1	0.2	0.1
Ascite	1.5	0.6	1.8
Haematuria	0.1	0.2	0.1
Splenomegaly	0.9	0.2	1.1
Hepatomegaly	0.2	0.1	0.2
Enlarged pancreas	0.1	0.1	<0.1
Diarrhoea	<0.1	0.1	<0.1
Fatigue	0.1	<0.1	0.1
Twitching	0.1	0.2	0.1
Cough	0.1	0.2	<0.1
Pregnancy	0.2	0.3	0.2
Cyst, nodule (if no cancer)	8.5	6.1	9.3

(Continued)

Table A2. (Continued)

ICD-10 chapter	Overall	Hospital type	
		Secondary-level hospital	Tertiary-level hospital
Lymphadenopathy	5.2	3.1	5.9
Haemorrhagia, infarction (excluding ischaemic stroke/cerebral infraction)	1.1	0.8	1.1
Haematoma (unspecified; not classified elsewhere)	8.4	8.0	8.6
XIX Injury, poisoning and certain other consequences of external causes	27.6	31.0	26.5
Trauma	27.6	31.0	26.5
Surgery	7.4	3.8	8.6
Tracheostomy	0.1	0.1	0.1
Craniotomy	2.2	0.3	2.8
Appendectomy	0.1	0.1	0.1
Neurosurgery	0.5	1.1	0.3
Nephrectomy	0.1	<0.1	0.1
Mastoidectomy	0.3	0.4	0.3
Medical procedures and devices	3.2	1.4	3.8
Implant	0.2	0.1	0.2
Transplant	1.0	0.2	1.3
Embolization	0.1	<0.1	0.1
Catheter or drain (other than VP shunt, cerebral catheter or drain)	2.0	1.1	2.3

Only medical conditions retrieved in $\geq 1\%$ of reports overall are detailed here.

Table A3. Distribution (%) of medical conditions retrieved in the radiologist reports of CT scans, by age groups ($n = 37,807$ scans)

ICD-10 chapter	Overall	Age (in years)				
		<1	1–4	5–9	10–14	15–21
I Infectious and parasitic diseases	5.0	7.9	5.9	4.1	4.2	4.7
Meningitis	1.1	2.4	1.4	0.6	0.5	1.2
Tuberculosis	0.2	<0.1	0.1	0.1	0.1	0.3
Toxoplasmosis	0.1	0.2	0.1	<0.1	0.1	<0.1
Encephalitis	0.5	1.4	1.1	0.5	0.3	0.3
II Neoplasms	4.8	5.3	3.8	4.2	5.0	5.1
Cancer (malignant or unspecified behaviour)	3.0	2.0	2.6	2.9	2.9	3.4
Benign tumour	1.8	3.3	1.2	1.3	2.1	1.7
III Diseases of the blood and blood-forming organs, disorders involving the immune mechanism	0.4	0.1	0.2	0.3	0.2	0.5
Sarcoidosis	0.1	<0.1	<0.1	0.1	0.1	0.2
Coagulopathy	0.1	0.1	<0.1	0.1	<0.1	0.1

(Continued)

Table A3. (Continued)

ICD-10 chapter	Overall	Age (in years)				
		<1	1–4	5–9	10–14	15–21
Immune deficiency (unspecified, acquired or inherited)	0.1	<0.1	0.1	0.1	0.1	0.1
IV Endocrine, nutritional and metabolic diseases	0.5	<0.1	0.1	0.2	0.6	0.7
Cystic fibrosis	0.4	<0.1	<0.1	0.2	0.5	0.7
V Mental and behavioural disorders	0.4	0.5	0.6	0.6	0.3	0.3
Developmental defect	0.1	0.5	0.4	0.1	<0.1	<0.1
Psychosis	0.1	<0.1	<0.1	<0.1	<0.1	0.1
VI Diseases of the nervous system	26.9	36.7	36.3	32.0	25.1	22.3
Encephalopathy	0.1	0.6	0.1	0.1	<0.1	<0.1
Hemiplegia	0.1	0.1	0.3	0.1	0.1	<0.1
Hydrocephalus	19.4	28.7	29.1	24.4	17.9	14.8
Epilepsy	1.4	1.9	1.5	1.4	1.0	1.4
Intracranial hypertension	1.7	1.9	2.0	2.0	1.6	1.6
Cerebral oedema	3.2	4.1	3.2	3.7	3.2	3.0
Cerebral palsy	0.1	<0.1	0.1	0.1	0.1	0.1
Seventh nerve palsy (Bell's palsy)	0.2	<0.1	0.1	0.3	0.3	0.2
VIII Diseases of the eye and adnexa	1.4	0.4	1.5	1.6	1.8	1.4
orbital cellulitis	0.4	0.1	0.9	0.7	0.6	0.1
Vision blur	0.1	<0.1	<0.1	0.1	0.2	0.1
Vision defect (unspecified, decreased acuity, visual disturbance, visual loss)	0.1	<0.1	<0.1	0.1	0.2	0.1
Photophobia, photopsia	0.3	<0.1	<0.1	<0.1	0.2	0.5
Diplopia	0.2	<0.1	0.1	0.2	0.2	0.2
Third, fourth and sixth nerve palsy	0.1	<0.1	0.2	0.1	0.1	0.1
VIII Diseases of the ear and mastoid process	3.9	1.4	4.3	6.4	5.8	2.9
Otitis	0.1	<0.1	0.2	0.2	0.4	0.1
Hearing disorder	0.2	0.1	0.1	0.3	0.2	0.2
IX Diseases of the circulatory system	25.2	35.1	21.2	19.8	20.6	27.4
Cardiomegaly	0.1	0.1	0.1	0.1	0.2	0.1
Ischaemia stroke, cerebral infraction	5.7	11.8	5.3	3.3	3.6	6.1
Aneurysm	0.7	0.1	0.3	0.6	0.7	0.8
Embolism, thrombosis	1.1	2.0	0.8	0.8	0.8	1.2
Hypertension	0.1	<0.1	<0.1	0.1	<0.1	0.1
Cerebral haemorrhagia	18.5	24.4	15.2	14.4	14.8	20.7
X Diseases of the respiratory system	11.0	4.7	11.4	14.6	12.3	10.6
Pneumonia	0.3	0.2	0.5	0.3	0.1	0.3
Bronchiolitis	0.3	0.5	0.5	0.4	0.3	0.2
Pneumonitis	0.1	0.1	<0.1	<0.1	0.1	0.1
Atelectasis	1.9	1.9	3.7	2.6	1.8	1.4
Sinusitis	1.8	<0.1	0.7	1.8	2.7	2.1

(Continued)

Table A3. (Continued)

ICD-10 chapter	Overall	Age (in years)				
		<1	1–4	5–9	10–14	15–21
Asthma	0.8	0.8	1.1	1.3	1.4	0.5
Bronchiectasis	4.0	0.6	5.6	8.5	5.2	2.5
XI Diseases of the digestive system	1.4	<0.1	0.4	0.6	1.1	2.3
Crohn disease	0.4	<0.1	<0.1	<0.1	0.2	0.7
Appendicitis	0.3	<0.1	0.1	0.3	0.4	0.4
Peritonitis	0.1	<0.1	<0.1	0.1	<0.1	0.1
Cirrhosis, liver disease	0.2	<0.1	0.1	0.1	0.2	0.2
Pancreatitis	0.5	<0.1	0.1	0.2	0.3	0.8
Colitis	0.1	<0.1	<0.1	<0.1	<0.1	0.2
Constipation	0.1	<0.1	0.1	0.1	<0.1	0.1
XIII Diseases of the musculoskeletal system and connective tissue	8.8	2.4	3.8	5.8	10.9	11.1
Osteomyelitis	0.3	0.1	0.2	0.4	0.4	0.2
Scoliosis	0.4	0.1	0.1	0.3	0.6	0.5
Spondylolisthesis	0.2	<0.1	<0.1	0.2	0.3	0.3
Myositis	0.1	<0.1	<0.1	<0.1	0.1	0.1
Osteochondritis	0.6	0.8	1.1	0.5	0.8	0.5
Fibrous dysplasia	0.2	<0.1	0.2	0.2	0.3	0.2
Arthrosis	0.2	<0.1	<0.1	0.1	0.4	0.3
Spinal stenosis	0.2	<0.1	<0.1	<0.1	0.1	0.3
XIV Diseases of the genitourinary system	1.0	0.1	0.4	0.5	0.5	1.7
Pyelonephritis	0.1	<0.1	0.1	<0.1	<0.1	0.1
Renal calculus	0.6	<0.1	0.2	0.2	0.2	1.0
Renal failure	0.1	<0.1	<0.1	<0.1	<0.1	0.1
Portal venous hypertension	0.2	0.1	0.2	0.2	0.1	0.2
Ovarian cyst	0.2	<0.1	<0.1	<0.1	0.1	0.3
XVI Certain conditions originating in the perinatal period	0.5	2.5	0.4	0.3	0.1	0.3
Traumatism at birth, perinatal traumatism	0.1	0.5	0.1	0.1	<0.1	<0.1
Hydrocephalus of the newborn	0.1	0.4	0.1	<0.1	<0.1	<0.1
XVII Congenital malformations, deformations and chromosomal abnormalities	8.9	17.4	10.3	7.7	8.9	7.3
Phakomatosis	0.4	0.8	0.3	0.5	0.4	0.3
Dandy–Walker's syndrome	0.3	0.8	0.6	0.3	0.2	0.2
Schizencephaly	0.1	0.1	0.1	0.1	0.1	<0.1
Down's syndrome	0.1	0.1	0.1	0.1	0.1	0.1
Spina bifida	0.4	0.3	0.3	0.4	0.4	0.4
Arteriovenous malformation	0.7	0.5	0.4	0.5	0.7	0.8
Scaphocephaly	0.1	0.6	0.2	0.2	0.1	<0.1
Microcephaly	0.9	3.2	1.8	0.5	0.3	0.5

(Continued)

Table A3. (Continued)

ICD-10 chapter	Overall	Age (in years)				
		<1	1–4	5–9	10–14	15–21
Choanal atresia	0.1	0.7	0.1	<0.1	<0.1	<0.1
Craniostenosis	2.0	5.0	2.6	1.5	1.9	1.5
XVIII Symptoms, signs and abnormal clinical and laboratory findings, not classified elsewhere	28.0	23.0	26.0	25.1	27.7	30.2
Convulsion, spam	0.2	0.5	0.3	0.1	0.1	0.2
Pain	1.6	<0.1	0.3	0.9	1.7	2.3
Weight loss	0.1	<0.1	<0.1	<0.1	<0.1	0.2
Dizziness	0.3	<0.1	<0.1	0.3	0.5	0.4
Headache	3.5	<0.1	0.6	3.3	5.0	4.3
Vomiting, nausea	1.3	0.4	1.4	1.4	1.7	1.3
Fever	0.7	0.7	1.0	0.7	0.5	0.8
Neck stiffness	0.2	0.1	0.1	<0.1	0.1	0.4
Meningism	0.1	<0.1	0.1	<0.1	<0.1	0.1
Drowsiness	0.2	0.3	0.4	0.2	0.2	0.2
Macrocephaly	0.1	0.5	0.2	<0.1	<0.1	<0.1
Ascite	1.5	0.5	0.8	1.3	1.3	1.9
Haematuria	0.1	<0.1	<0.1	0.1	0.1	0.2
Splenomegaly	0.9	0.3	0.7	1.0	0.8	1.0
Hepatomegaly	0.2	0.1	0.2	0.1	0.2	0.2
Enlarged pancreas	0.1	<0.1	<0.1	0.1	<0.1	0.1
Diarrhoea	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Fatigue	0.1	0.1	<0.1	<0.1	<0.1	0.1
Twitching	0.1	0.1	0.2	0.1	0.1	0.1
Cough	0.1	0.1	0.1	0.1	0.1	<0.1
Pregnancy	0.2	<0.1	0.2	0.3	0.4	0.2
Cyst, nodule (if no cancer)	8.5	9.6	11.3	7.4	7.9	8.3
Lymphadenopathy	5.2	1.0	5.3	5.0	4.7	6.2
Haemorrhagia, infarction (excluding ischaemic stroke/cerebral infraction)	1.1	0.5	0.5	0.7	0.9	1.4
Haematoma (unspecified; not classified elsewhere)	8.4	9.6	6.8	7.7	7.9	9.0
XIX Injury, poisoning and certain other consequences of external causes	27.6	18.0	20.2	25.0	29.0	31.1
Trauma	27.6	18.0	20.1	25.0	28.9	31.1
Surgery	7.4	5.4	6.5	7.0	7.5	8.1
Tracheostomy	0.1	0.1	<0.1	0.1	0.1	0.2
Craniotomy	2.2	1.7	2.7	2.6	2.3	2.1
Appendectomy	0.1	<0.1	0.1	0.1	0.2	0.2
Neurosurgery	0.5	1.1	0.5	0.3	0.4	0.4
Nephrectomy	0.1	<0.1	<0.1	<0.1	0.1	0.1
Mastoidectomy	0.3	<0.1	0.1	0.4	0.5	0.3

(Continued)

Table A3. (Continued)

ICD-10 chapter	Overall	Age (in years)				
		<1	1–4	5–9	10–14	15–21
Medical procedures and devices	3.2	0.9	2.5	2.7	2.9	4.0
Implant	0.2	<0.1	0.2	0.3	0.2	0.2
Transplant	1.0	0.2	1.6	0.9	0.9	1.1
Embolization	0.1	0.1	0.1	<0.1	<0.1	0.2
Catheter or drain (other than VP shunt, cerebral catheter or drain)	2.0	0.6	0.8	1.4	1.8	2.7

Only medical conditions retrieved in $\geq 1\%$ of reports overall are detailed here.

Table A4. Distribution (%) of medical conditions retrieved in the radiologist reports of CT scans, by scanned body part ($n = 37,807$ scans)

ICD-10 chapter	Overall	Head	Neck	Chest	Abdomen	Spine	Pelvis	Limbs/hips	Unknown
I Infectious and parasitic diseases	5.0	4.7	8.0	7.3	5.8	0.9	7.3	3.2	7.7
Meningitis	1.1	1.7	<0.1	<0.1	<0.1	<0.1	0.1	<0.1	0.4
Tuberculosis	0.2	0.1	1.0	0.8	0.4	0.1	0.3	0.1	0.4
Toxoplasmosis	0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Encephalitis	0.5	0.7	<0.1	<0.1	<0.1	<0.1	0.1	<0.1	0.4
II Neoplasms	4.8	3.3	14.8	8.1	9.3	3.0	9.3	11.7	9.0
Cancer (malignant or unspecified behaviour)	3.0	2.2	10.7	5.1	7.4	0.9	7.1	5.5	3.2
Benign tumour	1.8	1.1	4.0	3.0	1.9	2.0	2.2	6.2	5.8
III Diseases of the blood and blood-forming organs, disorders involving the immune mechanism	0.4	0.1	1.0	2.0	0.8	0.1	0.8	0.2	0.9
Sarcoidosis	0.1	<0.1	0.4	1.1	0.2	<0.1	0.2	0.1	0.4
Coagulopathy	0.1	0.1	<0.1	0.1	0.1	0.1	0.2	<0.1	0.2
Immune deficiency (unspecified, acquired or inherited)	0.1	<0.1	0.4	0.6	0.1	<0.1	0.1	<0.1	0.4
IV Endocrine, nutritional and metabolic diseases	0.5	0.1	0.3	3.7	0.6	<0.1	0.7	0.1	0.6
Cystic fibrosis	0.4	<0.1	0.1	3.7	0.6	<0.1	0.6	<0.1	0.2
V Mental and behavioural disorders	0.4	0.6	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.2
Developmental defect	0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Psychosis	0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
VI Diseases of the nervous system	26.9	38.0	3.3	1.2	2.7	9.4	2.2	0.3	9.5
Encephalopathy	0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Hemiplegia	0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

(Continued)

Table A4. (Continued)

ICD-10 chapter	Overall	Head	Neck	Chest	Abdomen	Spine	Pelvis	Limbs/ hips	Unknown
Hydrocephalus	19.4	27.9	1.0	0.9	2.1	0.5	0.9	<0.1	6.5
Epilepsy	1.4	2.0	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.2
Intracranial hypertension	1.7	2.5	0.1	0.1	0.1	0.1	<0.1	<0.1	1.3
Cerebral oedema	3.2	4.7	0.6	0.2	0.1	0.9	0.2	<0.1	0.4
Cerebral palsy	0.1	0.1	0.1	<0.1	0.1	<0.1	0.2	<0.1	<0.1
Seventh nerve palsy (Bell's palsy)	0.2	0.3	0.3	<0.1	<0.1	0.1	<0.1	<0.1	<0.1
VIII Diseases of the eye and adnexa	1.4	2.0	0.4	0.1	0.1	0.1	0.2	0.1	2.2
Orbital cellulitis	0.4	0.5	0.4	<0.1	<0.1	<0.1	0.1	<0.1	0.9
Vision blur	0.1	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Vision defect (unspecified, decreased acuity, visual disturbance, visual loss)	0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.2
Photophobia, photopsia	0.3	0.4	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.4
Diplopia	0.2	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.4
Third, fourth and sixth nerve palsy	0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
VIII Diseases of the ear and mastoid process	3.9	5.5	2.6	0.1	0.2	0.8	0.3	<0.1	3.4
Otitis	0.1	0.2	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.6
Hearing disorder	0.2	0.3	0.1	<0.1	0.1	0.1	0.1	<0.1	0.7
IX Diseases of the circulatory system	25.2	32.1	16.9	13.5	10.2	5.1	7.4	11.0	8.6
Cardiomegaly	0.1	<0.1	0.3	0.8	0.3	0.1	0.5	0.1	0.2
Ischaemia stroke, cerebral infraction	5.7	8.1	0.6	0.2	1.4	0.2	0.6	0.2	0.2
Aneurysm	0.7	0.5	1.3	0.9	1.7	0.2	0.3	0.5	1.9
Embolism, thrombosis	1.1	1.2	1.1	1.5	1.9	0.1	1.0	0.1	0.6
Hypertension	0.1	<0.1	<0.1	0.5	0.1	<0.1	<0.1	<0.1	<0.1
Cerebral haemorrhagia	18.5	26.9	2.4	0.6	0.8	2.8	0.9	0.1	0.7
X Diseases of the respiratory system	11.0	3.8	11.3	65.6	19.8	1.6	17.3	2.7	10.8
Pneumonia	0.3	<0.1	0.4	2.0	0.3	<0.1	0.3	0.1	0.9
Bronchiolitis	0.3	<0.1	<0.1	3.1	<0.1	<0.1	<0.1	<0.1	0.2
Pneumonitis	0.1	<0.1	<0.1	0.5	0.1	<0.1	0.1	<0.1	0.2
Atelectasis	1.9	0.1	1.7	13.8	5.2	0.5	4.4	0.3	1.3
Sinusitis	1.8	2.6	0.7	0.1	<0.1	0.1	0.1	<0.1	1.9
Asthma	0.8	0.7	1.0	2.7	0.6	0.1	0.8	0.2	0.6
Bronchiectasis	4.0	<0.1	0.3	39.2	0.4	0.1	0.4	0.1	3.0

(Continued)

Table A4. (Continued)

ICD-10 chapter	Overall	Head	Neck	Chest	Abdomen	Spine	Pelvis	Limbs/ hips	Unknown
XI Diseases of the digestive system	1.4	<0.1	0.3	0.5	13.9	<0.1	9.5	0.1	0.7
Crohn disease	0.4	<0.1	<0.1	0.1	3.2	<0.1	4.1	<0.1	<0.1
Appendicitis	0.3	<0.1	0.1	0.1	3.1	<0.1	2.6	<0.1	<0.1
Peritonitis	0.1	<0.1	<0.1	<0.1	0.7	<0.1	0.9	<0.1	0.2
Cirrhosis, liver disease	0.2	<0.1	<0.1	0.2	1.4	<0.1	0.1	<0.1	<0.1
Pancreatitis	0.5	<0.1	<0.1	0.1	4.7	<0.1	1.7	<0.1	0.4
Colitis	0.1	<0.1	<0.1	0.1	1.0	<0.1	1.0	<0.1	<0.1
Constipation	0.1	<0.1	<0.1	<0.1	0.6	<0.1	0.3	<0.1	0.2
XIII Diseases of the musculoskeletal system and connective tissue	8.8	3.6	14.6	4.2	8.5	31.4	20.5	50.1	23.4
Osteomyelitis	0.3	0.1	0.1	0.2	0.1	0.1	0.3	2.0	0.2
Scoliosis	0.4	0.1	1.0	0.9	0.5	3.9	0.7	0.3	0.7
Spondylolisthesis	0.2	<0.1	<0.1	<0.1	<0.1	5.7	0.1	<0.1	0.2
Myositis	0.1	<0.1	0.3	0.1	0.1	<0.1	0.3	0.6	0.2
Osteochondritis	0.6	0.7	0.1	0.1	<0.1	0.3	0.1	2.3	0.9
Fibrous dysplasia	0.2	0.2	<0.1	0.1	<0.1	<0.1	0.1	0.4	0.7
Arthrosis	0.2	<0.1	<0.1	<0.1	<0.1	1.5	0.4	2.4	0.7
Spinal stenosis	0.2	<0.1	<0.1	<0.1	<0.1	3.5	<0.1	<0.1	<0.1
XIV Diseases of the genitourinary system	1.0	0.1	1.0	0.5	9.3	<0.1	5.3	0.1	0.9
Pyelonephritis	0.1	<0.1	<0.1	0.1	0.7	<0.1	0.5	<0.1	<0.1
Renal calculus	0.6	<0.1	0.7	0.2	5.3	<0.1	3.1	0.1	0.4
Renal failure	0.1	<0.1	<0.1	0.1	0.3	<0.1	0.1	<0.1	0.2
Portal venous hypertension	0.2	<0.1	0.1	0.2	2.0	<0.1	0.2	<0.1	<0.1
Ovarian cyst	0.2	<0.1	0.1	<0.1	1.3	<0.1	1.5	<0.1	0.4
XVI Certain conditions originating in the perinatal period	0.5	0.5	0.1	0.3	0.1	<0.1	1.4	<0.1	0.2
Traumatism at birth, perinatal traumatism	0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.2
Hydrocephalus of the newborn	0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
XVII Congenital malformations, deformations and chromosomal abnormalities	8.9	9.5	4.0	7.9	2.5	9.4	4.3	11.8	18.3
Phakomatosis	0.4	0.5	<0.1	0.1	0.3	<0.1	0.1	0.1	0.2
Dandy-Walker's syndrome	0.3	0.4	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Schizencephaly	0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Down's syndrome	0.1	0.1	<0.1	<0.1	<0.1	0.1	0.1	<0.1	0.2

(Continued)

Table A4. (Continued)

ICD-10 chapter	Overall	Head	Neck	Chest	Abdomen	Spine	Pelvis	Limbs/ hips	Unknown
Spina bifida	0.4	0.3	0.1	0.1	0.3	2.4	0.4	0.1	0.6
Arteriovenous malformation	0.7	0.8	<0.1	0.9	0.1	<0.1	<0.1	<0.1	0.6
Scaphocephaly	0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	1.7
Microcephaly	0.9	1.2	<0.1	<0.1	0.1	0.1	0.1	<0.1	0.4
Choanal atresia	0.1	0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.4
Craniostenosis	2.0	2.8	0.9	0.2	<0.1	<0.1	<0.1	<0.1	2.4
XVIII Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified	28.0	22.3	62.6	45.5	67.5	11.6	57.9	13.9	26.9
Convulsion, spam	0.2	0.3	0.1	<0.1	0.1	0.4	0.2	<0.1	<0.1
Pain	1.6	0.5	2.0	1.2	7.6	2.2	6.9	3.2	5.0
Weight loss	0.1	<0.1	0.6	0.3	0.7	<0.1	0.5	0.1	0.2
Dizziness	0.3	0.5	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.6
Headache	3.5	5.0	0.3	<0.1	<0.1	0.1	<0.1	<0.1	4.1
Vomiting, nausea	1.3	1.6	0.4	0.2	1.7	0.1	1.5	<0.1	1.7
Fever	0.7	0.6	2.4	0.7	2.3	0.1	2.5	0.3	1.1
Neck stiffness	0.2	0.3	<0.1	<0.1	<0.1	0.1	0.1	0.2	0.7
Meningism	0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Drowsiness	0.2	0.3	<0.1	<0.1	<0.1	0.1	<0.1	<0.1	0.4
Macrocephaly	0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Ascite	1.5	0.1	3.2	1.4	13.4	0.4	9.2	0.7	0.9
Haematuria	0.1	<0.1	<0.1	<0.1	1.0	<0.1	1.0	<0.1	0.4
Splenomegaly	0.9	0.1	2.4	1.6	7.3	<0.1	2.7	0.4	0.7
Hepatomegaly	0.2	<0.1	0.4	0.4	1.4	<0.1	0.6	0.1	<0.1
Enlarged pancreas	0.1	<0.1	0.1	0.1	0.5	<0.1	0.2	<0.1	<0.1
Diarrhoea	<0.1	<0.1	0.1	0.1	0.2	<0.1	0.1	<0.1	0.4
Fatigue	0.1	<0.1	<0.1	<0.1	0.4	<0.1	0.4	<0.1	<0.1
Twitching	0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.4
Cough	0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.2
Pregnancy	0.2	<0.1	0.3	1.8	<0.1	<0.1	<0.1	<0.1	0.7
Cyst, nodule (if no cancer)	8.5	6.0	21.1	20.5	18.2	1.6	14.6	5.9	8.0
Lymphadenopathy	5.2	0.5	37.1	25.7	21.9	0.1	21.5	3.9	5.0
Haemorrhagia, infarction (excluding ischaemic stroke/ cerebral infraction)	1.1	0.1	3.7	2.4	6.2	2.8	4.7	0.8	2.1
Haematoma (unspecified; not classified elsewhere)	8.4	9.3	8.2	3.4	15.6	5.4	14.3	1.8	3.4

(Continued)

Table A4. (Continued)

ICD-10 chapter	Overall	Head	Neck	Chest	Abdomen	Spine	Pelvis	Limbs/ hips	Unknown
XIX Injury, poisoning and certain other consequences of external causes	27.6	26.6	29.5	6.7	24.7	65.6	32.2	53.4	23.9
Trauma	27.6	26.6	29.5	6.7	24.7	65.6	32.2	53.4	23.9
Surgery	7.4	8.1	8.6	3.9	9.7	3.1	11.6	3.5	8.2
Tracheostomy	0.1	<0.1	3.0	0.5	<0.1	<0.1	0.1	<0.1	0.2
Craniotomy	2.2	3.2	<0.1	0.1	<0.1	0.1	<0.1	<0.1	1.3
Appendectomy	0.1	<0.1	<0.1	<0.1	1.4	<0.1	1.2	<0.1	<0.1
Neurosurgery	0.5	0.7	0.4	<0.1	<0.1	0.3	0.1	<0.1	0.2
Nephrectomy	0.1	<0.1	<0.1	<0.1	0.6	<0.1	0.4	<0.1	0.2
Mastoidectomy	0.3	0.4	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.2
Medical procedures and devices	3.2	0.6	7.7	8.0	17.3	3.4	14.6	2.1	11.8
Implant	0.2	0.2	0.3	<0.1	0.1	<0.1	0.1	0.1	0.2
Transplant	1.0	0.2	1.4	1.7	6.2	2.7	2.5	0.6	2.2
Embolization	0.1	0.1	0.1	0.2	0.4	<0.1	<0.1	<0.1	<0.1
Catheter or drain (other than VP shunt, cerebral catheter or drain)	2.0	0.2	5.7	6.2	11.4	0.6	12.7	1.4	9.2

Only medical conditions retrieved in $\geq 1\%$ of reports overall are detailed here.

Table A5. Distribution of medical conditions retrieved in the radiologist reports of CT scans, according the total number of scans received by the patient within the calendar year. Frequencies are expressed as % of scans with an informative report ($n = 37,807$ scans) and as % of children for whom RIS reports were available and informative ($n = 28,878$ individuals)

ICD-10 chapter	Overall	1	2–4	5 and +	Overall	1	2–4	5 and +
	% of scans				% of children			
I Infectious and parasitic diseases	5.0	4.4	6.4	7.0	6.0	4.7	10.8	25.0
Meningitis	1.1	1.2	1.0	0.7	1.4	1.3	1.8	3.2
Tuberculosis	0.2	0.2	0.3	<0.1	0.2	0.2	0.5	0.2
Toxoplasmosis	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.2	<0.1
Encephalitis	0.5	0.5	0.5	0.4	0.6	0.5	0.9	1.5
II Neoplasms	4.8	5.4	3.7	1.7	5.9	5.7	6.0	6.4
Cancer (malignant or unspecified behaviour)	3.0	3.3	2.4	1.5	3.8	3.6	4.1	5.9
Benign tumour	1.8	2.1	1.3	0.2	2.1	2.2	1.9	0.5
III Diseases of the blood and blood-forming organs, disorders involving the immune mechanism	0.4	0.3	0.5	0.3	0.5	0.3	1.0	1.2
Sarcoidosis	0.1	0.2	0.1	<0.1	0.2	0.2	0.2	0.2
Coagulopathy	0.1	0.1	0.2	<0.1	0.1	0.1	0.3	<0.1

(Continued)

Table A5. (Continued)

ICD-10 chapter	Overall	1	2–4	5 and +	Overall	1	2–4	5 and +
	% of scans				% of children			
Immune deficiency (unspecified, acquired or inherited)	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.5
IV Endocrine, nutritional and metabolic diseases	0.5	0.5	0.5	<0.1	0.5	0.5	0.6	0.2
Cystic fibrosis	0.4	0.5	0.5	<0.1	0.4	0.4	0.6	<0.1
V Mental and behavioural disorders	0.4	0.5	0.1	<0.1	0.5	0.5	0.2	<0.1
Developmental defect	0.1	0.1	<0.1	<0.1	0.1	0.1	<0.1	<0.1
Psychosis	0.1	0.1	<0.1	<0.1	0.1	0.1	<0.1	<0.1
VI Diseases of the nervous system	26.9	20.8	37.3	66.9	22.5	20.1	39.6	76.2
Encephalopathy	0.1	0.1	0.1	<0.1	0.1	0.1	0.2	0.2
Hemiplegia	0.1	0.1	0.1	<0.1	0.1	0.1	0.1	<0.1
Hydrocephalus	19.4	13.3	30.3	58.6	13.9	12.1	29.6	65.9
Epilepsy	1.4	1.7	0.5	0.3	1.8	1.9	0.8	1.5
Intracranial hypertension	1.7	1.7	1.8	1.3	2.2	1.9	3.2	5.6
Cerebral oedema	3.2	2.2	5.2	8.9	3.7	2.4	8.6	21.6
Cerebral palsy	0.1	0.1	0.1	<0.1	0.1	0.1	0.1	0.2
Seventh nerve palsy (Bell's palsy)	0.2	0.2	0.1	<0.1	0.3	0.2	0.3	0.2
VIII Diseases of the eye and adnexa	1.4	1.6	1.1	0.2	1.8	1.7	1.8	1.2
Orbital cellulitis	0.4	0.4	0.4	0.1	0.5	0.4	0.6	0.5
Vision blur	0.1	0.1	<0.1	<0.1	0.1	0.1	0.1	<0.1
Vision defect (unspecified, decreased acuity, visual disturbance, visual loss)	0.1	0.1	0.1	<0.1	0.1	0.1	0.1	0.2
Photophobia, photopsia	0.3	0.3	0.2	<0.1	0.3	0.3	0.3	0.2
Diplopia	0.2	0.2	0.1	<0.1	0.2	0.2	0.2	<0.1
Third, fourth and sixth nerve palsy	0.1	0.1	<0.1	<0.1	0.1	0.1	<0.1	0.2
VIII Diseases of the ear and mastoid process	3.9	4.6	2.1	1.1	4.8	4.9	3.5	4.4
Otitis	0.1	0.2	<0.1	<0.1	0.2	0.2	<0.1	<0.1
Hearing disorder	0.2	0.2	0.2	0.1	0.3	0.2	0.4	0.5
IX Diseases of the circulatory system	25.2	25.7	24.8	19.7	29.4	27.2	35.6	49.3
Cardiomegaly	0.1	0.1	0.1	<0.1	0.1	0.1	0.3	<0.1
Ischaemia stroke, cerebral infraction	5.7	5.8	5.4	4.4	6.8	6.2	8.3	13.5
Aneurysm	0.7	0.5	1.1	0.6	0.7	0.5	1.6	2.5
Embolism, thrombosis	1.1	1.0	1.6	1.4	1.4	1.0	2.7	5.1
Hypertension	0.1	0.1	0.1	<0.1	0.1	0.1	0.1	<0.1
Cerebral haemorrhagia	18.5	19.3	16.9	13.7	22.2	20.7	25.7	37.0
X Diseases of the respiratory system	11.0	11.6	10.2	5.6	11.9	11.2	14.6	15.0
Pneumonia	0.3	0.3	0.3	0.3	0.3	0.3	0.5	0.7
Bronchiolitis	0.3	0.4	0.2	<0.1	0.4	0.4	0.3	<0.1
Pneumonitis	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.5
Atelectasis	1.9	1.9	2.3	0.7	2.3	2.0	3.8	2.7

(Continued)

Table A5. (Continued)

ICD-10 chapter	Overall	1	2–4	5 and +	Overall	1	2–4	5 and +
	% of scans				% of children			
Sinusitis	1.8	2.1	1.1	0.7	2.3	2.3	1.8	2.5
Asthma	0.8	1.0	0.5	<0.1	1.0	1.0	0.7	0.2
Bronchiectasis	4.0	4.9	1.6	0.2	4.1	4.4	2.4	1.0
XI Diseases of the digestive system	1.4	1.4	1.7	1.0	1.6	1.4	2.6	3.2
Crohn disease	0.4	0.4	0.3	<0.1	0.4	0.4	0.5	<0.1
Appendicitis	0.3	0.4	0.2	0.1	0.4	0.4	0.4	0.7
Peritonitis	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2
Cirrhosis, liver disease	0.2	0.1	0.2	<0.1	0.2	0.1	0.3	0.2
Pancreatitis	0.5	0.3	0.8	0.6	0.5	0.3	1.1	1.7
Colitis	0.1	0.1	0.2	<0.1	0.1	0.1	0.3	0.2
Constipation	0.1	0.1	<0.1	<0.1	0.1	0.1	<0.1	<0.1
XIII Diseases of the musculoskeletal system and connective tissue	8.8	10.1	6.1	1.8	10.8	10.7	9.9	7.1
Osteomyelitis	0.3	0.3	0.3	0.1	0.3	0.3	0.5	0.5
Scoliosis	0.4	0.4	0.3	<0.1	0.5	0.5	0.5	<0.1
Spondylolisthesis	0.2	0.3	0.1	<0.1	0.3	0.3	0.2	<0.1
Myositis	0.1	0.1	0.1	<0.1	0.1	0.1	0.1	<0.1
Osteochondritis	0.6	0.7	0.6	0.4	0.8	0.7	1.1	2.0
Fibrous dysplasia	0.2	0.2	0.1	<0.1	0.2	0.2	0.2	<0.1
Arthrosis	0.2	0.3	<0.1	<0.1	0.3	0.3	0.1	<0.1
Spinal stenosis	0.2	0.2	<0.1	<0.1	0.2	0.2	<0.1	<0.1
XIV Diseases of the genitourinary system	1.0	1.1	0.9	0.4	1.3	1.2	1.6	1.5
Pyelonephritis	0.1	0.1	<0.1	<0.1	0.1	0.1	<0.1	0.2
Renal calculus	0.6	0.7	0.4	<0.1	0.7	0.7	0.7	0.2
Renal failure	0.1	<0.1	0.1	0.1	0.1	<0.1	0.1	0.5
Portal venous hypertension	0.2	0.2	0.3	0.1	0.2	0.2	0.6	0.7
Ovarian cyst	0.2	0.2	0.1	<0.1	0.2	0.2	0.2	<0.1
XVI Certain conditions originating in the perinatal period	0.5	0.6	0.2	<0.1	0.6	0.6	0.4	<0.1
Traumatism at birth, perinatal traumatism	0.1	0.1	<0.1	<0.1	0.1	0.1	<0.1	<0.1
Hydrocephalus of the newborn	0.1	0.1	0.1	<0.1	0.1	0.1	0.1	<0.1
XVII Congenital malformations, deformations and chromosomal abnormalities	8.9	9.6	7.3	6.3	10.5	1<0.1	11.9	20.8
Phakomatosis	0.4	0.5	0.2	<0.1	0.5	0.5	0.3	<0.1
Dandy–Walker’s syndrome	0.3	0.2	0.4	0.7	0.3	0.2	0.6	2.2
Schizencephaly	0.1	0.1	<0.1	<0.1	0.1	0.1	<0.1	0.2
Down’s syndrome	0.1	0.1	<0.1	<0.1	0.1	0.1	<0.1	0.2
Spina bifida	0.4	0.3	0.5	0.5	0.4	0.3	0.7	2.0
Arteriovenous malformation	0.7	0.6	0.8	1.0	0.7	0.6	1.1	2.2
Scaphocephaly	0.1	0.1	0.2	0.1	0.2	0.1	0.3	0.5

(Continued)

Table A5. (Continued)

ICD-10 chapter	Overall	1	2–4	5 and +	Overall	1	2–4	5 and +
	% of scans				% of children			
Microcephaly	0.9	0.9	0.7	0.5	1.1	1.0	1.2	1.5
Choanal atresia	0.1	0.1	0.1	<0.1	0.1	0.1	0.1	<0.1
Craniosynostosis	2.0	2.0	2.0	1.7	2.5	2.2	3.5	7.8
XVIII Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified	28.0	27.1	32.3	22.7	30.6	27.9	42.6	51.2
Convulsion, spasms	0.2	0.3	0.1	<0.1	0.3	0.3	0.1	0.2
Pain	1.6	1.9	0.7	0.3	2.0	2.0	1.4	1.2
Weight loss	0.1	0.1	0.1	<0.1	0.1	0.1	0.1	<0.1
Dizziness	0.3	0.4	0.1	<0.1	0.5	0.5	0.2	0.2
Headache	3.5	4.2	1.7	1.5	4.4	4.5	2.7	3.9
Vomiting, nausea	1.3	1.4	1.1	1.4	1.6	1.4	1.7	4.4
Fever	0.7	0.7	0.8	0.8	0.9	0.8	1.4	3.7
Neck stiffness	0.2	0.2	0.2	<0.1	0.3	0.3	0.4	<0.1
Meningism	0.1	0.1	<0.1	<0.1	0.1	0.1	<0.1	<0.1
Drowsiness	0.2	0.2	0.3	0.2	0.3	0.2	0.6	1.2
Macrocephaly	0.1	0.1	<0.1	0.1	0.1	0.1	<0.1	0.7
Ascites	1.5	1.1	2.6	2.5	1.6	1.1	4.1	6.4
Haematuria	0.1	0.1	0.1	<0.1	0.2	0.2	0.1	<0.1
Splenomegaly	0.9	0.7	1.4	0.7	0.9	0.7	2.2	2.5
Hepatomegaly	0.2	0.2	0.3	0.1	0.2	0.2	0.5	0.7
Enlarged pancreas	0.1	<0.1	0.1	<0.1	0.1	<0.1	0.2	<0.1
Diarrhoea	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Fatigue	0.1	0.1	<0.1	<0.1	0.1	0.1	0.1	<0.1
Twitching	0.1	0.1	0.1	0.2	0.1	0.1	0.2	1.0
Cough	0.1	0.1	<0.1	<0.1	0.1	0.1	<0.1	0.2
Pregnancy	0.2	0.3	0.1	<0.1	0.3	0.3	0.1	<0.1
Cyst, nodule (if no cancer)	8.5	8.3	9.4	8.6	9.0	8.3	12.7	20.1
Lymphadenopathy	5.2	5.3	5.5	2.1	5.9	5.5	7.9	5.4
Haemorrhagia, infarction (excluding ischaemic stroke/cerebral infarction)	1.1	0.9	1.8	0.9	1.3	0.9	3.0	3.7
Haematoma (unspecified; not classified elsewhere)	8.4	6.8	14.1	7.6	9.6	7.3	20.5	20.3
XIX Injury, poisoning and certain other consequences of external causes	27.6	28.3	28.5	14.1	31.6	3<0.1	35.6	24.5
Trauma	27.6	28.3	28.5	14.1	31.6	3<0.1	35.6	24.5
Surgery	7.4	5.3	12.6	16.2	7.5	5.4	18.0	42.9
Tracheostomy	0.1	0.1	0.1	<0.1	0.1	0.1	0.3	0.2
Craniotomy	2.2	1.0	4.9	7.3	2.2	1.0	7.5	22.8
Appendectomy	0.1	0.2	0.1	<0.1	0.2	0.2	0.1	<0.1
Neurosurgery	0.5	0.4	0.6	0.8	0.6	0.4	1.1	2.5

(Continued)

Table A5. (Continued)

ICD-10 chapter	Overall	1	2–4	5 and +	Overall	1	2–4	5 and +
	% of scans				% of children			
Nephrectomy	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.5
Mastoidectomy	0.3	0.4	0.2	0.1	0.4	0.4	0.2	0.5
Medical procedures and devices	3.2	2.3	5.6	4.6	3.1	2.4	7.5	10.3
Implant	0.2	0.2	0.1	<0.1	0.2	0.2	0.1	0.2
Transplant	1.0	0.7	2.0	1.6	0.9	0.7	2.2	2.7
Embolization	0.1	0.1	0.1	0.3	0.1	0.1	0.2	1.2
Catheter or drain (other than VP shunt, cerebral catheter or drain)	2.0	1.4	3.8	2.8	2.1	1.4	5.4	7.1

Only medical conditions retrieved in $\geq 1\%$ of reports overall are detailed here.

Table A6. Distribution of medical conditions retrieved in the radiologist comments of CT reports, according the total number of scans received by the patient during a given age period. Frequencies are expressed as % of children for whom RIS reports were available and informative. The last analyses are restricted to children with at least one scan report and a complete follow-up during a given age period.

ICD-10 chapter	Scanned at ages <5 years				Scanned at ages 5–14 years				Scanned at ages 15–21 years			
	Overall	Once	2–4 times	≥5 times	Overall	Once	2–4 times	≥5 times	Overall	Once	2–4 times	≥5 times
	N = 2840	N = 2058	N = 629	N = 153	N = 9155	N = 6920	N = 1898	N = 337	N = 14,859	N = 11,190	N = 3203	N = 466
I Infectious and parasitic diseases	7.5	6.8	7.8	15.0	5.0	3.7	7.3	19.0	5.5	4.1	8.5	19.3
Meningitis	1.7	1.7	1.7	2.0	0.7	0.7	0.6	1.5	1.5	1.4	1.5	2.4
Tuberculosis	0.1	0.1	0.2	<0.1	0.1	0.1	0.3	<0.1	0.4	0.2	0.7	1.1
Toxoplasmosis	0.2	0.1	0.3	1.3	<0.1	<0.1	0.1	0.3	<0.1	<0.1	0.1	0.2
Encephalitis	1.3	1.3	1.3	2.0	0.5	0.4	0.7	0.9	0.3	0.3	0.6	<0.1
II Neoplasms	5.3	5.0	6.7	4.6	5.6	5.6	5.9	5.0	5.9	5.4	7.2	10.9
Cancer (malignant or unspecified behaviour)	3.2	2.5	4.9	4.6	3.7	3.7	3.4	3.9	4.0	3.5	4.9	9.4
Benign tumour	2.1	2.4	1.7	<0.1	2.0	1.9	2.5	1.2	2.0	1.9	2.4	1.5
III Diseases of the blood and blood-forming organs, disorders involving the immune mechanism	0.2	0.1	0.5	<0.1	0.3	0.2	1.0	0.6	0.6	0.4	1.1	2.1
Sarcoidosis	<0.1	<0.1	0.2	<0.1	0.1	0.1	0.2	<0.1	0.3	0.2	0.5	0.4
Coagulopathy	<0.1	<0.1	<0.1	<0.1	0.1	<0.1	0.2	0.6	0.1	0.1	0.2	0.2
Immune deficiency (unspecified, acquired or inherited)	0.1	<0.1	0.3	<0.1	0.1	<0.1	0.5	<0.1	0.1	0.1	0.3	0.6
IV Endocrine, nutritional and metabolic diseases	0.1	0.1	<0.1	<0.1	0.5	0.3	1.3	<0.1	0.7	0.4	1.7	2.4
Cystic fibrosis	<0.1	<0.1	<0.1	<0.1	0.4	0.2	1.2	<0.1	0.6	0.3	1.6	2.1
V Mental and behavioural disorders	0.7	1.0	<0.1	0.7	0.6	0.7	0.2	0.9	0.3	0.3	0.4	<0.1
Developmental defect	0.5	0.6	<0.1	0.7	0.1	0.1	0.1	0.3	<0.1	<0.1	<0.1	<0.1
Psychosis	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.2	0.2	0.1	<0.1
VI Diseases of the nervous system	30.3	21.9	45.3	81.7	22.0	16.5	33.0	74.5	20.9	17.4	27.8	57.7
Encephalopathy	0.2	0.2	0.5	<0.1	0.1	<0.1	0.3	<0.1	<0.1	<0.1	0.1	0.4
Hemiplegia	0.4	0.5	<0.1	<0.1	0.1	0.1	0.1	0.6	<0.1	<0.1	0.1	<0.1
Hydrocephalus	21.6	12.4	37.4	79.7	13.9	8.0	25.6	67.7	12.5	9.5	17.9	48.9
Epilepsy	1.8	2.3	0.5	0.7	1.5	1.8	0.6	0.6	1.7	1.8	1.3	2.4

(Continued)

Table A6. (Continued)

ICD-10 chapter	Scanned at ages <5 years				Scanned at ages 5–14 years				Scanned at ages 15–21 years			
	Overall	Once	2–4 times	≥5 times	Overall	Once	2–4 times	≥5 times	Overall	Once	2–4 times	≥5 times
Intracranial hypertension	<i>N</i> = 2840	<i>N</i> = 2058	<i>N</i> = 629	<i>N</i> = 153	<i>N</i> = 9155	<i>N</i> = 6920	<i>N</i> = 1898	<i>N</i> = 337	<i>N</i> = 14,859	<i>N</i> = 11,190	<i>N</i> = 3203	<i>N</i> = 466
Cerebral oedema	2.8	2.2	4.1	5.2	2.2	1.7	3.2	5.3	2.0	1.8	2.1	4.7
Cerebral palsy	3.8	3.4	4.8	6.5	3.7	2.7	5.3	14.8	3.3	2.0	6.4	11.8
Seventh nerve palsy (Bell's palsy)	0.1	0.1	0.2	<0.1	0.1	0.1	0.1	1.2	0.1	0.1	0.1	1.1
VIII Diseases of the eye and adnexa	0.1	0.1	<0.1	<0.1	0.4	0.4	0.5	0.3	0.2	0.2	0.3	<0.1
Orbital cellulitis	1.6	1.9	0.8	0.7	2.2	2.2	2.2	1.5	1.7	1.6	1.7	1.9
Vision blur	0.9	1.1	0.3	<0.1	0.8	0.8	1.1	0.6	0.2	0.1	0.2	0.6
Vision defect (unspecified, decreased acuity, visual disturbance, visual loss)	<0.1	<0.1	<0.1	<0.1	0.2	0.2	0.1	0.3	0.2	0.2	0.2	<0.1
Photophobia, photopsia	<0.1	<0.1	<0.1	<0.1	0.2	0.2	0.2	<0.1	0.1	0.1	0.1	0.4
Diplopia	<0.1	<0.1	<0.1	<0.1	0.1	0.1	0.2	0.3	0.6	0.6	0.7	0.2
Third, fourth and sixth nerve palsy	<0.1	<0.1	<0.1	<0.1	0.3	0.3	0.2	<0.1	0.2	0.2	0.2	0.6
VIII Diseases of the ear and mastoid process	0.2	0.2	<0.1	<0.1	0.1	0.1	<0.1	<0.1	0.1	0.1	0.1	0.2
Otitis	4.7	5.2	4.1	0.7	7.5	8.3	5.1	4.2	3.4	3.4	3.4	3.4
Hearing disorder	0.2	0.3	<0.1	<0.1	0.4	0.4	0.2	<0.1	0.1	0.1	0.1	<0.1
IX Diseases of the circulatory system	0.1	0.1	0.2	<0.1	0.3	0.3	0.4	0.6	0.2	0.2	0.3	0.4
Cardiomegaly	28.1	26.9	31.3	32.0	23.7	22.0	27.1	38.0	30.4	28.5	34.9	45.7
Ischaemia stroke, cerebral infarction	0.1	0.1	<0.1	<0.1	0.2	0.1	0.5	0.3	0.1	<0.1	0.2	0.9
Aneurysm	9.2	8.1	12.7	10.5	4.0	3.5	4.7	12.2	7.0	6.6	7.6	12.7
Embolism, thrombosis	0.3	0.1	0.6	0.7	0.7	0.4	1.4	2.1	0.9	0.5	1.8	3.0
Hypertension	1.1	0.8	1.9	0.7	1.0	0.7	1.5	3.9	1.4	1.0	2.4	4.3
Cerebral haemorrhagia	<0.1	<0.1	<0.1	<0.1	0.1	0.1	0.1	<0.1	0.1	<0.1	0.2	0.4
X Diseases of the respiratory system	19.7	19.0	21.3	23.5	17.4	16.8	18.2	26.1	23.5	22.6	25.7	31.3
Pneumonia	10.7	11.2	10.7	3.3	14.2	12.6	20.4	12.8	11.2	9.1	16.8	24.9
Bronchiolitis	0.3	0.2	0.6	0.7	0.2	0.2	0.6	<0.1	0.3	0.2	0.6	1.1
	0.4	0.5	0.3	<0.1	0.4	0.2	1.0	0.9	0.3	0.2	0.6	1.1

(Continued)

Table A6. (Continued)

ICD-10 chapter	Scanned at ages <5 years				Scanned at ages 5–14 years				Scanned at ages 15–21 years			
	Overall	Once	2–4 times	≥5 times	Overall	Once	2–4 times	≥5 times	Overall	Once	2–4 times	≥5 times
Pneumonitis	N = 2840 <0.1	N = 2058 <0.1	N = 629 <0.1	N = 153 <0.1	N = 9155 0.1	N = 6920 <0.1	N = 1898 0.3	N = 337 <0.1	N = 14,859 0.1	N = 11,190 <0.1	N = 3203 0.2	N = 466 0.4
Atelectasis	3.3	3.4	3.8	0.7	2.5	1.8	4.8	3.0	1.6	1.0	3.4	5.2
Sinusitis	0.8	1.0	0.3	<0.1	2.9	2.9	2.7	3.0	2.5	2.5	2.3	3.2
Asthma	1.2	1.4	1.0	<0.1	1.5	1.6	1.5	0.6	0.6	0.7	0.5	<0.1
Bronchiectasis	4.8	5.0	5.2	0.7	6.7	5.6	11.2	4.2	2.7	2.3	4.2	3.9
XI Diseases of the digestive system	0.4	0.2	1.0	<0.1	1.1	1.1	1.2	1.8	2.4	1.7	4.2	7.3
Crohn disease	<0.1	<0.1	<0.1	<0.1	0.1	0.2	<0.1	<0.1	0.7	0.5	1.4	1.1
Appendicitis	0.1	0.1	<0.1	<0.1	0.4	0.5	0.4	0.3	0.5	0.4	0.6	0.6
Peritonitis	<0.1	<0.1	0.2	<0.1	0.1	0.1	0.1	0.3	0.1	<0.1	0.2	1.3
Cirrhosis, liver disease	0.2	0.1	0.5	<0.1	0.2	0.2	0.2	0.3	0.2	0.1	0.4	0.9
Pancreatitis	0.1	<0.1	0.2	<0.1	0.3	0.2	0.6	0.6	0.7	0.4	1.3	3.4
Colitis	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.3	0.1	0.6	1.3
Constipation	<0.1	<0.1	<0.1	<0.1	0.1	0.1	<0.1	<0.1	0.1	0.1	0.2	<0.1
XIII Diseases of the musculoskeletal system and connective tissue	4.5	5.0	3.8	1.3	10.7	10.7	11.1	7.7	13.1	13.1	13.3	12.9
Osteomyelitis	0.4	0.4	0.2	0.7	0.5	0.4	0.7	0.3	0.3	0.2	0.6	0.9
Scoliosis	0.1	<0.1	0.2	<0.1	0.6	0.5	0.8	<0.1	0.5	0.5	0.6	0.6
Spondylolisthesis	<0.1	<0.1	<0.1	<0.1	0.3	0.2	0.5	0.3	0.4	0.4	0.5	<0.1
Myositis	<0.1	<0.1	<0.1	<0.1	0.1	0.1	0.1	<0.1	0.1	0.1	0.2	<0.1
Osteochondritis	1.2	1.2	1.3	<0.1	0.8	0.7	1.1	2.7	0.6	0.5	0.9	2.6
Fibrous dysplasia	0.1	0.2	<0.1	<0.1	0.3	0.2	0.4	0.9	0.2	0.2	0.3	<0.1
Arthrosis	<0.1	<0.1	<0.1	<0.1	0.3	0.2	0.4	0.6	0.4	0.5	0.3	<0.1
Spinal stenosis	<0.1	<0.1	<0.1	<0.1	0.1	0.1	<0.1	<0.1	0.3	0.4	0.2	<0.1
XIV Diseases of the genitourinary system	0.3	0.3	0.2	<0.1	0.6	0.5	0.8	1.2	1.9	1.6	2.5	6.7
Pyelonephritis	0.1	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.2	0.2	0.1	0.2
Renal calculus	0.2	0.2	<0.1	<0.1	0.3	0.3	0.4	<0.1	1.2	1.0	1.3	3.4

(Continued)

Table A6. (Continued)

ICD-10 chapter	Scanned at ages <5 years				Scanned at ages 5–14 years				Scanned at ages 15–21 years			
	Overall	Once	2–4 times	≥5 times	Overall	Once	2–4 times	≥5 times	Overall	Once	2–4 times	≥5 times
Renal failure	<i>N</i> = 2840 <0.1	<0.1	<0.1	<0.1	<i>N</i> = 153 <0.1	<0.1	0.1	<0.1	<i>N</i> = 14,859 0.1	<0.1	0.2	0.9
Portal venous hypertension	0.1	<0.1	0.2	<0.1	0.2	0.2	0.3	0.9	0.3	0.1	0.6	2.1
Ovarian cyst	<0.1	<0.1	<0.1	<0.1	0.1	<0.1	0.1	0.3	0.3	0.3	0.4	1.1
XVI Certain conditions originating in the perinatal period	1.6	1.7	1.6	0.7	0.3	0.2	0.3	0.9	0.3	0.3	0.4	0.4
Traumatism at birth, perinatal traumatism	0.4	0.4	0.3	<0.1	0.1	<0.1	0.2	0.3	0.1	0.1	0.1	<0.1
Hydrocephalus of the newborn	0.3	0.3	0.5	<0.1	<0.1	<0.1	<0.1	0.3	<0.1	<0.1	0.1	<0.1
XVII Congenital malformations, deformations and chromosomal abnormalities	16.5	13.9	21.3	32.0	9.9	8.5	13.1	19.3	8.4	7.6	9.6	19.7
Phakomatosis	0.8	0.8	0.8	0.7	0.6	0.6	0.5	0.6	0.3	0.3	0.3	0.4
Dandy–Walker's syndrome	0.7	0.5	1.0	2.6	0.2	0.2	0.4	0.9	0.2	0.1	0.2	1.3
Schizencephaly	0.1	0.2	<0.1	<0.1	0.1	0.1	0.1	0.6	<0.1	<0.1	0.1	<0.1
Down's syndrome	<0.1	<0.1	<0.1	<0.1	0.1	0.1	<0.1	<0.1	0.1	0.1	0.1	0.2
Spina bifida	0.4	0.4	0.6	<0.1	0.4	0.3	0.6	2.1	0.4	0.3	0.6	2.8
Arteriovenous malformation	0.4	0.4	0.3	1.3	0.8	0.7	1.0	2.4	0.8	0.5	1.2	3.0
Scaphocephaly	0.3	0.2	0.8	<0.1	0.1	0.1	0.2	0.3	<0.1	<0.1	0.1	<0.1
Microcephaly	3.8	3.6	4.3	3.9	0.5	0.4	0.7	1.5	0.6	0.6	0.8	1.1
Choanal atresia	0.3	0.3	0.3	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	0.1	<0.1
Craniostenosis	4.4	2.2	7.8	19.6	2.1	1.7	3.1	5.3	1.8	1.6	1.9	6.2
XVIII Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified	27.5	25.6	30.5	41.2	29.1	26.7	36.0	39.5	31.9	27.6	43.2	56.7
Convulsion, spam	0.6	0.8	<0.1	0.7	0.1	0.2	0.1	<0.1	0.2	0.3	0.2	0.2
Pain	0.3	0.3	0.2	<0.1	1.7	1.7	1.6	1.5	2.7	2.5	3.7	2.4
Weight loss	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.3	0.2	0.3	0.4
Dizziness	<0.1	<0.1	<0.1	<0.1	0.6	0.7	0.3	0.3	0.5	0.6	0.5	0.2
Headache	0.5	0.4	0.5	1.3	5.4	5.9	3.4	5.3	5.1	5.2	4.8	5.6

(Continued)

Table A6. (Continued)

ICD-10 chapter	Scanned at ages <5 years				Scanned at ages 5–14 years				Scanned at ages 15–21 years			
	Overall	Once	2–4 times	≥5 times	Overall	Once	2–4 times	≥5 times	Overall	Once	2–4 times	≥5 times
	N = 2840	N = 2058	N = 629	N = 153	N = 9155	N = 6920	N = 1898	N = 337	N = 14,859	N = 11,190	N = 3203	N = 466
Vomiting, nausea	0.8	0.8	0.6	2.0	1.9	1.7	1.7	5.0	1.5	1.3	1.7	3.9
Fever	0.7	0.7	0.6	0.7	0.7	0.5	1.1	1.8	0.9	0.8	1.2	3.4
Neck stiffness	0.1	0.1	0.3	<0.1	0.1	0.1	0.1	<0.1	0.5	0.4	0.7	0.2
Meningism	0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.3	0.2	0.2	0.1	<0.1
Drowsiness	0.3	0.4	<0.1	0.7	0.3	0.3	0.2	1.2	0.3	0.2	0.2	1.3
Macrocephaly	0.5	0.4	0.5	1.3	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Ascite	0.8	0.7	1.3	0.7	1.5	1.0	2.8	3.6	1.9	1.0	3.7	10.3
Haematuria	<0.1	<0.1	<0.1	<0.1	0.1	0.1	0.1	<0.1	0.2	0.2	0.2	0.2
Splenomegaly	0.5	0.4	0.8	0.7	0.9	0.6	1.5	3.9	1.0	0.5	2.3	4.7
Hepatomegaly	0.2	0.2	0.2	0.7	0.2	0.1	0.3	0.3	0.3	0.2	0.6	1.1
Enlarged pancreas	<0.1	<0.1	<0.1	<0.1	0.1	0.1	0.1	<0.1	0.1	0.1	0.2	0.4
Diarrhoea	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	<0.1	0.1	0.1	0.1	<0.1
Fatigue	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	<0.1	0.1	0.1	0.2	<0.1
Twitching	0.1	<0.1	<0.1	0.7	0.2	0.1	0.1	0.6	0.1	0.1	0.1	<0.1
Cough	0.1	0.1	<0.1	<0.1	0.1	0.1	<0.1	<0.1	<0.1	0.1	<0.1	0.2
Pregnancy	0.1	<0.1	0.5	<0.1	0.4	0.4	0.7	<0.1	0.2	0.2	0.2	0.2
Cyst, nodule (if no cancer)	12.7	11.2	14.5	25.5	7.9	6.1	12.4	18.1	8.7	6.9	12.7	26.8
Lymphadenopathy	4.2	3.7	5.4	5.9	5.5	4.9	7.7	4.2	6.7	5.4	10.1	15.2
Haemorrhagia, infarction (excluding ischaemic stroke/cerebral infraction)	0.6	0.6	0.6	1.3	1.0	0.8	1.7	1.5	1.7	1.0	3.2	6.7
Haematoma (unspecified; not classified elsewhere)	8.7	8.1	10.3	10.5	8.8	7.3	13.5	14.5	9.7	7.2	16.6	2<0.1
XIX Injury, poisoning and certain other consequences of external causes	22.7	25.0	18.1	10.5	31.8	33.6	27.9	15.7	33.3	33.1	35.5	24.9
Trauma	22.7	25.0	18.1	10.5	31.7	33.6	27.9	15.7	33.3	33.1	35.5	24.9
Surgery	6.1	2.6	11.6	30.7	7.5	4.1	13.9	41.2	8.1	4.6	16.1	37.3
Tracheostomy	0.1	<0.1	0.2	0.7	0.1	0.1	0.4	<0.1	0.2	0.1	0.4	1.3

(Continued)

Table A6. (Continued)

ICD-10 chapter	Scanned at ages <5 years				Scanned at ages 5–14 years				Scanned at ages 15–21 years			
	Overall	Once	2–4 times	≥5 times	Overall	Once	2–4 times	≥5 times	Overall	Once	2–4 times	≥5 times
	<i>N</i> = 2840	<i>N</i> = 2058	<i>N</i> = 629	<i>N</i> = 153	<i>N</i> = 9155	<i>N</i> = 6920	<i>N</i> = 1898	<i>N</i> = 337	<i>N</i> = 14,859	<i>N</i> = 11,190	<i>N</i> = 3203	<i>N</i> = 466
Craniotomy	2.4	0.4	5.2	17.0	2.4	0.6	5.6	21.1	2.1	0.7	4.8	15.5
Appendectomy	<0.1	<0.1	<0.1	<0.1	0.2	0.2	0.1	<0.1	0.2	0.2	0.2	0.2
Neurosurgery	0.6	0.6	0.2	2.6	0.5	0.3	0.7	1.8	0.5	0.4	0.9	0.9
Nephrectomy	<0.1	<0.1	<0.1	0.7	0.1	0.1	0.1	<0.1	0.1	<0.1	0.2	0.9
Mastoidectomy	<0.1	<0.1	<0.1	<0.1	0.5	0.4	0.8	1.8	0.3	0.3	0.4	0.2
Medical procedures and devices	1.6	1.0	3.2	3.9	2.8	1.7	5.7	8.0	3.8	2.3	7.6	16.5
Implant	0.2	0.1	0.5	<0.1	0.3	0.2	0.4	0.6	0.2	0.2	0.3	<0.1
Transplant	0.7	0.1	1.9	3.3	0.8	0.3	1.8	3.6	1.0	0.5	2.1	6.4
Embolization	0.1	<0.1	0.2	<0.1	<0.1	<0.1	0.1	0.3	0.1	<0.1	0.3	1.3
Catheter or drain (other than VP shunt, cerebral catheter or drain)	0.7	0.7	1.0	0.7	1.8	1.1	3.6	4.7	2.7	1.6	5.2	11.8

Table A7. Distribution (%) of medical conditions retrieved in the radiologist reports of CT scans, by age groups, in CT scans performed in 2000–2008 ($n = 19,664$ scans)

ICD-10 chapter	Overall	Age (in years)				
		<1	1–4	5–9	10–14	15–21
I Infectious and parasitic diseases	4.8	8.8	6.3	3.7	4.2	4.5
Meningitis	1.1	3.3	1.4	0.6	0.3	1.2
Tuberculosis	0.2	<0.1	0.1	<0.1	0.1	0.2
Toxoplasmosis	<0.1	0.1	<0.1	<0.1	0.1	<0.1
Encephalitis	0.4	1.4	1.2	0.4	0.3	0.3
II Neoplasms	4.4	5.3	3.5	3.9	4.5	4.5
Cancer (malignant or unspecified behaviour)	2.8	1.9	2.4	2.8	2.8	2.9
Benign tumour	1.6	3.4	1.1	1.1	1.7	1.5
III Diseases of the blood and blood-forming organs, disorders involving the immune mechanism	0.4	<0.1	0.3	0.3	0.3	0.6
Sarcoidosis	0.1	<0.1	0.1	<0.1	0.1	0.2
Coagulopathy	0.1	<0.1	<0.1	0.1	<0.1	0.1
Immune deficiency (unspecified, acquired or inherited)	0.1	<0.1	0.2	0.1	0.2	0.1
IV Endocrine, nutritional and metabolic diseases	0.7	<0.1	<0.1	0.4	0.9	1.0
Cystic fibrosis	0.7	<0.1	<0.1	0.3	0.7	0.9
V Mental and behavioural disorders	0.4	0.4	0.6	0.6	0.3	0.4
Developmental defect	0.1	0.4	0.4	0.1	<0.1	<0.1
Psychosis	0.1	<0.1	<0.1	<0.1	<0.1	0.2
VI Diseases of the nervous system	25.9	33.6	37.0	33.4	25.3	21.2
Encephalopathy	0.1	0.8	0.1	0.2	0.1	<0.1
Hemiplegia	0.1	0.1	0.1	<0.1	0.1	<0.1
Hydrocephalus	19.2	24.5	29.9	27.0	18.5	14.9
Epilepsy	1.4	2.3	1.6	1.4	1.0	1.3
Intracranial hypertension	1.5	1.8	1.5	1.4	1.4	1.5
Cerebral oedema	2.9	4.6	3.8	3.4	3.0	2.4
Cerebral palsy	0.1	0.1	0.1	<0.1	0.2	0.1
Seventh nerve palsy (Bell's palsy)	0.2	<0.1	0.1	0.4	0.2	0.2
VIII Diseases of the eye and adnexa	1.4	0.2	1.6	1.6	1.7	1.5
Orbital cellulitis	0.3	0.1	1.0	0.8	0.4	0.1
Vision blur	0.1	<0.1	<0.1	0.2	0.2	0.1
Vision defect (unspecified, decreased acuity, visual disturbance, visual loss)	0.1	<0.1	<0.1	0.2	0.2	0.1
Photophobia, photopsia	0.3	<0.1	<0.1	<0.1	0.1	0.6
Diplopia	0.2	<0.1	0.1	0.2	0.3	0.2
Third, fourth and sixth nerve palsy	0.1	<0.1	0.3	<0.1	<0.1	0.1
VIII Diseases of the ear and mastoid process	3.9	1.4	4.3	6.1	6.0	2.9
Otitis	0.2	0.1	0.3	0.1	0.5	0.1
Hearing disorder	0.2	<0.1	<0.1	0.4	0.3	0.1

(Continued)

Table A7. (Continued)

ICD-10 chapter	Overall	Age (in years)				
		<1	1–4	5–9	10–14	15–21
IX Diseases of the circulatory system	26.1	35.7	21.3	19.6	21.1	29.1
Cardiomegaly	0.1	0.1	0.1	0.2	0.2	0.1
Ischaemia stroke, cerebral infraction	5.0	10.1	4.5	2.4	3.2	5.7
Aneurysm	0.7	0.1	0.4	0.4	0.7	0.9
Embolism, thrombosis	1.3	2.6	0.9	1.0	0.8	1.4
Hypertension	0.1	<0.1	<0.1	<0.1	0.1	0.1
Cerebral haemorrhagia	19.5	26.2	15.5	15.1	15.3	22.0
X Diseases of the respiratory system	12.5	5.1	14.4	17.0	13.6	11.7
Pneumonia	0.3	0.2	0.6	0.2	0.1	0.3
Bronchiolitis	0.4	0.9	0.6	0.5	0.4	0.3
Pneumonitis	0.1	0.1	0.1	<0.1	0.1	0.1
Atelectasis	2.4	2.4	5.1	3.3	2.5	1.7
Sinusitis	1.8	<0.1	0.8	1.8	2.4	2.0
Asthma	0.7	0.8	0.8	0.9	0.9	0.5
Bronchiectasis	5.0	1.0	7.7	10.7	6.6	3.1
XI Diseases of the digestive system	1.7	<0.1	0.4	0.7	1.1	2.5
Crohn disease	0.4	<0.1	<0.1	<0.1	0.1	0.7
Appendicitis	0.4	<0.1	0.1	0.4	0.4	0.6
Peritonitis	0.1	<0.1	0.1	0.1	0.1	0.2
Cirrhosis, liver disease	0.1	<0.1	0.1	0.1	0.2	0.1
Pancreatitis	0.5	<0.1	0.1	0.1	0.2	0.8
Colitis	0.1	<0.1	<0.1	<0.1	<0.1	0.3
Constipation	0.1	<0.1	0.1	<0.1	0.1	0.1
XIII Diseases of the musculoskeletal system and connective tissue	8.5	2.6	3.5	5.4	10.2	10.3
Osteomyelitis	0.2	0.1	0.2	0.5	0.4	0.2
Scoliosis	0.5	0.1	0.1	0.3	0.7	0.5
Spondylolisthesis	0.3	<0.1	<0.1	0.2	0.3	0.4
Myositis	0.1	0.1	<0.1	<0.1	0.1	0.1
Osteochondritis	0.7	1.0	1.4	0.4	0.7	0.5
Fibrous dysplasia	0.2	<0.1	0.1	0.1	0.4	0.2
Arthrosis	0.2	<0.1	<0.1	<0.1	0.3	0.4
Spinal stenosis	0.1	<0.1	<0.1	<0.1	0.1	0.1
XIV Diseases of the genitourinary system	1.3	0.2	0.6	0.5	0.6	2.1
Pyelonephritis	0.1	<0.1	0.1	<0.1	<0.1	0.2
Renal calculus	0.8	0.1	0.2	0.2	0.3	1.3
Renal failure	0.1	<0.1	<0.1	<0.1	<0.1	0.1
Portal venous hypertension	0.2	0.1	0.3	0.2	0.2	0.3
Ovarian cyst	0.2	<0.1	<0.1	<0.1	0.1	0.4

(Continued)

Table A7. (Continued)

ICD-10 chapter	Overall	Age (in years)				
		<1	1–4	5–9	10–14	15–21
XVI Certain conditions originating in the perinatal period	0.4	2.5	0.4	0.2	0.1	0.2
Traumatism at birth, perinatal traumatism	0.1	0.5	0.1	0.1	<0.1	<0.1
Hydrocephalus of the newborn	0.1	0.4	0.1	0.1	<0.1	<0.1
XVII Congenital malformations, deformations and chromosomal abnormalities	7.8	15.5	9.2	6.6	8.2	6.6
Phakomatosis	0.3	0.5	0.3	0.4	0.4	0.2
Dandy–Walker’s syndrome	0.2	0.6	0.5	0.2	0.2	0.1
Schizencephaly	<0.1	0.1	0.1	<0.1	<0.1	<0.1
Down’s syndrome	0.1	0.1	0.1	0.1	0.1	0.1
Spina bifida	0.4	0.2	0.4	0.3	0.4	0.4
Arteriovenous malformation	0.6	0.5	0.4	0.4	0.7	0.7
Scaphocephaly	0.1	0.8	0.3	0.1	0.1	<0.1
Microcephaly	0.5	1.9	1.0	0.2	0.3	0.4
Choanal atresia	0.1	0.7	0.1	<0.1	<0.1	<0.1
Craniostenosis	1.8	4.4	2.3	1.3	1.8	1.4
XVIII Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified	29.5	23.1	27.5	25.9	29.1	31.8
Convulsion, spam	0.2	0.3	0.4	0.2	0.1	0.2
Pain	2.2	0.1	0.5	1.4	1.9	3.0
Weight loss	0.2	<0.1	0.1	<0.1	<0.1	0.3
Dizziness	0.4	<0.1	<0.1	0.3	0.5	0.5
Headache	3.9	<0.1	0.8	3.4	5.0	4.8
Vomiting, nausea	1.7	0.5	2.4	1.8	2.0	1.6
Fever	1.0	1.4	1.5	0.9	0.7	1.0
Neck stiffness	0.2	0.1	0.1	<0.1	0.1	0.4
Meningism	0.1	0.1	0.1	<0.1	<0.1	0.2
Drowsiness	0.3	0.4	0.7	0.4	0.2	0.3
Macrocephaly	0.1	0.4	0.2	<0.1	0.1	<0.1
Ascite	1.8	0.6	0.9	1.4	1.7	2.3
Haematuria	0.2	<0.1	<0.1	0.1	0.1	0.2
Splenomegaly	0.9	0.4	0.9	0.8	1.0	1.0
Hepatomegaly	0.2	0.1	<0.1	0.1	0.2	0.3
Enlarged pancreas	<0.1	<0.1	<0.1	<0.1	<0.1	0.1
Diarrhoea	<0.1	0.1	<0.1	<0.1	<0.1	0.1
Fatigue	0.1	0.1	0.1	<0.1	<0.1	0.1
Twitching	0.1	0.3	0.3	0.2	0.1	0.1
Cough	<0.1	0.1	<0.1	<0.1	<0.1	<0.1
Pregnancy	0.3	<0.1	0.3	0.4	0.6	0.2
Cyst, nodule (if no cancer)	8.8	7.8	11.2	7.7	8.6	8.8

(Continued)

Table A7. (Continued)

ICD-10 chapter	Overall	Age (in years)				
		<1	1–4	5–9	10–14	15–21
Lymphadenopathy	5.7	1.2	5.9	5.4	6.0	6.3
Haemorrhagia, infarction (excluding ischaemic stroke/cerebral infraction)	1.2	0.6	0.4	0.8	1.1	1.6
Haematoma (unspecified; not classified elsewhere)	8.2	10.1	6.2	6.9	7.1	8.9
XIX Injury, poisoning and certain other consequences of external causes	28.7	22.5	20.2	24.0	28.7	32.2
Trauma	28.7	22.5	20.2	24.0	28.6	32.2
Surgery	7.9	5.8	7.3	7.3	7.2	8.6
Tracheostomy	0.1	<0.1	0.1	0.1	0.1	0.2
Craniotomy	2.0	1.6	2.4	2.4	1.8	1.9
Appendectomy	0.2	<0.1	0.1	0.1	0.2	0.2
Neurosurgery	0.6	1.5	0.8	0.4	0.6	0.5
Nephrectomy	0.1	<0.1	<0.1	<0.1	0.1	0.1
Mastoidectomy	0.4	<0.1	0.1	0.3	0.7	0.4
Medical procedures and devices	3.8	1.1	2.9	2.8	3.6	4.6
Implant	0.2	<0.1	0.2	0.2	0.1	0.2
Transplant	1.3	0.3	1.9	1.2	1.1	1.4
Embolization	0.1	<0.1	0.1	0.1	0.1	0.2
Catheter or drain (other than VP shunt, cerebral catheter or drain)	2.3	0.8	1.1	1.3	2.2	3.1

Only medical conditions retrieved in $\geq 1\%$ of reports overall are detailed here.

Table A8. Detailed description of radiologist comments reporting malignancies or benign tumours

II Neoplasms	Prior to scan ^a	Suspected disease	Possible diagnosis	Excluded diagnosis	Familial history	Uncertain meaning
Overall ($n = 1827$)	2.7	5.0	38.0	53.3	0.7	0.3
Malignant or unspecified behaviour ($n = 1144$)	0.0	7.2	33.9	57.3	1.0	0.4
Benign tumour ^b (head scans, $n = 278$)	7.9	2.2	41.0	48.9	0.0	0.0
Benign tumour (body scans, $n = 405$)	6.9	0.7	47.7	44.7	0.0	0.0

^aIndication of scan (disease follow-up) or medical history.

^bi.e. haemangioma, lipoma, angiofibroma or sinus osteoma.

Table A9. Distribution (%) of congenital diseases/malformations reported in the radiologist comments, by age group and scanned body part ($n = 3,361$ scans)

XVII Congenital diseases/ malformations	Overall	Age (in years)					Scanned body part				
		<1	1–4	5–9	10–14	15–21	Head	Chest	Abdomen	Spine	Limbs/hips
Unspecified congenital disorders	46.7	35.9	42.0	48.2	53.7	49.1	34.2	79.8	64.4	72.5	96.7
Phakomatosis	4.4	4.6	3.2	7.0	5.0	3.6	5.4	0.7	11.5	<0.1	0.8
Marfan's syndrome	0.3	<0.1	<0.1	<0.1	0.2	0.7	0.1	2.1	<0.1	<0.1	0.4
Crouzon's syndrome	0.1	<0.1	0.2	0.8	<0.1	0.1	0.1	0.3	<0.1	<0.1	<0.1
Dandy–Walker's syndrome	3.4	4.7	6.1	4.4	2.1	2.3	4.7	<0.1	<0.1	<0.1	<0.1
Schizencephaly	0.7	0.7	1.0	1.3	0.8	0.4	1.0	<0.1	<0.1	<0.1	<0.1
Down's syndrome	0.7	0.5	0.5	0.8	0.8	0.7	0.7	0.3	1.1	1.3	0.4
Klippel–Feil's syndrome	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	0.4
Sprengel's deformity	0.1	<0.1	<0.1	<0.1	0.2	0.1	<0.1	0.3	<0.1	<0.1	0.4
Joubert's syndrome	0.2	0.3	0.5	0.3	0.2	<0.1	0.2	<0.1	<0.1	<0.1	<0.1
Spina bifida	4.2	1.9	2.9	4.7	4.5	5.3	3.5	1.0	11.5	25.5	1.2
Arteriovenous malformation	7.3	2.7	3.4	6.5	8.3	10.4	8.4	12.0	3.4	<0.1	<0.1
Biliary atresia splenic malformation syndrome	0.2	<0.1	0.2	<0.1	<0.1	0.4	<0.1	0.3	5.7	<0.1	<0.1
Scaphocephaly	1.3	3.2	1.9	2.1	0.6	0.4	1.5	<0.1	<0.1	<0.1	<0.1
Microcephaly	9.7	18.1	17.2	6.5	3.9	7.2	13.0	<0.1	3.4	0.7	<0.1
Choanal atresia	1.2	4.1	1.2	0.3	0.5	0.4	1.4	0.3	<0.1	<0.1	<0.1
Craniostenosis	22.4	28.5	24.8	19.4	20.8	20.6	29.7	2.7	<0.1	<0.1	<0.1

Only medical conditions retrieved in $\geq 1\%$ of reports overall are detailed here.