

## Supplementary material

Table S1. International Classification of Diseases version 10 codes used to identify children with chronic conditions

Type of chronic condition	Categories	Codes
Mental health/behavioural	Substance abuse	E24.4, F10-F19, F55*, G24.0*, G31.2, G40.5, G62.1, G72.0, G72.1, I42.6, K29.2, K70, K85.2, K85.3, K86.0, O35.4, R78.1*-R78.5*, Y47, Y49, Z50.2, Z50.3, Z71.4, Z71.5, Z72.2*, Z86.4
	Self-harm	X60-X84, Y10-Y34†, Y87.0, Y87.2†, Z91.5
	Other mental health problems	F00-F01, F02.8, F03-F09, F20-F48, F50, F53, F54, F59*, F60-F69, F99*, Z09.3*, Z50.4*, Z86.5, Z91.4*
	Behavioural/developmental disorders	F70-F79, F80.0-F80.2, F80.8, F80.9, F81-F84, F88, F89, F90-F98
Cancer/blood disorders	Neoplasms	C00-C97, D00-D02, D05-D09, D12, D13, D14.1-D14.4, D15, D20, D32-D35, D37-D48, D63.0, E34.0, E88.3, G13.0, G13.1, G53.3, G55.0, G63.1, G73.1, G73.2, G94.1, M36.0, M36.1, M49.5, M82.0, M90.6, M90.7, N08.1, N16.1, Y43.1-Y43.3, Y84.2, Z08, Z51.0-Z51.2, Z54.1, Z54.2, Z85, Z86.0, Z92.3
	Immunological disorders	D80-D84, G53.2, Q98.0
	Anaemia and other blood disorders	D50*, D56.0-D56.2, D56.4, D56.8, D56.9, D57.0-D57.2, D57.8, D58, D61.0, D61.9, D64*, D66, D67, D68.0-D68.2, D68.4-D68.9, D69, D70-D76, M36.2-M36.4, M90.4, N08.2, Z86.2
Chronic infections	HIV	B20-B24, F02.4, R75, Z21
	Tuberculosis	A15-A19, E35.0, K23.0, K67.3, K93.0, M01.1, M49.0, P37.0
	Other	A50, A81, B18, B37.1, B37.5, B37.6, B37.7, B38.1, B39.1, B40.1, B44.0, B44.7, B45, B46, B48.7, B50.0, B50.8*, B51.0, B51.8*, B52.8*, B52.0, B55, B57.2-B57.5, B58.0, B59, B67, B69, B73, B74, B78.7, B90-B94, F02.1, K23.1, K93.1, M00, N33.0, P35.0-P35.2, P35.8, P35.9, P37.1
Respiratory	Asthma and chronic lower respiratory disease	J41-J47
	Cystic fibrosis	E84, P75
	Injuries	S17*, S27*, S28*, T27*, T91.4*
	Congenital anomalies	Q30-Q37, Q79.0

	Other	G47.3, J60-J70, J80-J86, J96.1, J98, P27, Y55.6, Z43.0, Z93.0, Z94.2
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Metabolic/endocrine/digestive/renal/genitourinary	Diabetes	E10-E14, G59.0, G63.2, I79.2, M14.2, N08.3, O24, Y42.3
	Other endocrine	E00, E03.0, E03.1, E07.1, E22.0, E23.0, E25, E26.8, E29.1, E31, E34.1, E34.2, E34.5, E34.8, G13.2, G73.5, Y42.1
	Metabolic	D55, E70-E72, E74-E78, E79.1-E79.9, E80.0-E80.3, E80.5, E80.7, E83, E85, E88.0, E88.1, E88.2*, E88.8, E88.9, G73.6, L99.0, M14.4, M14.3, N16.3
	Digestive	K20, K21.0, K22, K23.8, K25-K28, K29.0, K29.1, K29.3-K29.9, K31, K50-K52, K55, K57, K59.2, K63.0-K63.3, K66, K72-K76, K80-K83, K85.0, K85.1, K85.8, K85.9, K86.1-K86.9, K87.0, K90, M07.4, M07.5, M09.1, M09.2, T86.4, Z43.2-Z43.4, Z46.5, Z90.3, Z90.4, Z93.2-Z93.5
	Renal/GU	D63.8, G63.8, G99.8, I68.8, M90.8, N08.4, N00-N05, N07, N11-N15, N16.0, N16.2, N16.4, N16.5, N16.8, N18, N19, N20-N23, N25, N26, N28, N29, N31, N32, N33.8, N35, N36, N39.1, N39.3, N39.4, N40-N42, N70-N74, N80-N82, N85, N86*, N87, N88, P96.0, T82.4, T83.1, T83.2, T83.4-T83.9, T85.5, T86.1, Y60.2, Y61.2, Y62.2, Y84.1, Z49, Z93.6, Z94.0, Z99.2
	Congenital anomalies of the digestive/renal/GU system	Q38.0, Q38.3, Q38.4, Q38.6-Q38.8, Q39, Q40.2, Q40.3, Q40.8, Q40.9, Q41, Q42, Q43.1, Q43.3-Q43.7, Q43.9, Q44, Q45, Q50.0, Q51, Q52.0-Q52.2, Q52.4, Q54.0-Q54.3, Q54.8, Q54.9, Q55.0, Q55.5, Q56, Q60.1, Q60.2, Q60.4-Q60.6, Q61, Q62.0-Q62.6, Q62.8, Q63.0-Q63.2, Q63.8, Q63.9, Q64, Q79.2-Q79.5, Q87.8, Q89.1, Q89.2
	Injuries	S36*, S37*, S38*, S39.6*, S39.7*, T06.5*, T28*, T91.5*
	Other/unspecific	E66, G63.3, G99.0, M14.5, N92*, Z86.3, Z93.8
Musculoskeletal/skin	Musculoskeletal/connective tissue	G55.1-G55.3, G63.5, G63.6, G73.7, J99.0, J99.1, L62.0, M05, M06, M07.0-M07.3, M07.6, M08, M09.8, M10-M13, M14.0, M14.6, M14.8, M30-M35, M40-M43, M45-M48, M50-M54, M60-M62, M63.8, M80.1-M80.9, M81.1-M81.9, M82.1, M82.8, M84.0-M84.2, M84.8, M84.9, M85, M86.3-M86.6, M89, M90.0, M91-M94, N08.5, Y45.4
	Skeletal injuries/amputations	S13*, S22.0*-S22.2*, S22.5*, S23*, S32*, S33*, S68.3*, S68.4*, S68.8*, S77*, S78*, S87*, S88*, S97*, S98.0*, S98.2*-S98.4*, T02*, T04*, T05*, T20.3*, T20.7*, T21.3*, T21.7*, T22.3*, T22.7*, T23.2*, T23.3*, T23.6*, T23.7*, T24.3*, T24.7*, T25.2*, T25.3*, T25.6*, T25.7*, T29.3*, T29.7*, T30.3*, T30.7*, T31.2*-T31.9*, T32.2*-T32.9*, T87.3-T87.6, T91.2* T91.8*, T92.6*, T93.1*, T93.4*, T93.6*, T94.0*, T94.1*, T95.0*, T95.1*, T95.4*, T95.8*, T95.9*, Y83.5, Z89.1, Z89.2, Z89.5-Z89.8, Z97.1
	Chronic skin disorders	L10, L11.0, L11.8, L11.9, L12-L14, L28, L40-L45, L57, L58.1, L59, L87, L88, L90,

		L92, L95, L93, L98.5, M09.0, Q80, Q81, Q87.0-Q87.5, Q89.4
	Congenital anomalies	Q18.8, Q65.0-Q65.2, Q65.8, Q65.9, Q67.5, Q68.2, Q68.3*-Q68.5*, Q71-Q73, Q74, Q75.3-Q75.9, Q76.1-Q76.4, Q77, Q78, Q79.6, Q79.8, Q82.0-Q82.4, Q82.9, Q86.2, Q89.7-Q89.9
Neurological	Epilepsy	F80.3, G40.0-G40.4, G40.6-G40.9, G41, R56.8, Y46.0-Y46.6
	Cerebral palsy	G80-G83
	Injuries of brain, nerves, eyes or ears	S05*-S08*, S12*, S14*, S24*, S34*, S44*, S54*, S64*, S74*, S84*, S94*, T06.0*-T06.2*, T26*, T90.4*, T90.5*, T91.1*, T91.3*, T92.4*
	Chronic eye conditions	H05.1-H05.9, H13.3, H17, H18, H19.3, H19.8, H21, H26, H27, H28.0-H28.2, H31, H32.8, H33, H34, H35, H40, H42.0, H43, H44, H47, H54.0- H54.2, H54.4, T85.2, T85.3, Z44.2
	Chronic ear conditions	H60.2, H65.2-H65.4, H66.1-H66.3, H69.0, H70.1, H73.1, H74.0-H74.3, H75.0, H80, H81.0, H81.4, H83.0, H83.2, H90.0, H90.3, H90.5, H90.6, H91, Z45.3
	Perinatal conditions	P10, P21.0, P52, P57, P90, P91.1, P91.2, P91.6
	Congenital anomalies of neurological or sensory systems	Q00-Q07, Q10.4, Q10.7, Q11-Q12, Q13.0-Q13.4, Q13.8, Q13.9, Q14-Q16, Q75.0, Q75.1, Q85, Q86.0, Q86.1, Q86.8, Q90-Q93, Q95.2, Q95.3, Q97, Q99
	Other	F02.2, F02.3, G00-G09, G10-G12, G13.8, G14, G20-G23, G24.1-G24.9, G25-G30, G31.0-G31.1, G31.8, G31.9, G32-G37, G43-G46, G47.0-G47.2, G47.4-G47.9, G50-G52, G53.0, G53.1, G53.8, G54, G55.8, G56-G58, G59.8, G60, G61, G62.0, G62.2-G62.9, G64, G70, G71, G72.2-G72.9, G73.0, G73.3, G90-G93, G94.2, G94.8, G95, G96, G98, G99.1, G99.2, I60-I67, I68.0, I68.2, I69, I72.0, I72.5, T85.0, T85.1, Y46.7-Y46.8, Z98.2
Cardiovascular	Congenital heart disease	Q20-Q26, Q89.3
	Other	I00*-I28*, I31*-I39*, I41*, I42.0*-I42.5*, I42.7*-I42.9*, I43.0*, I43.1, I43.2*-I43.8*, I44.1*-I44.7*, I45.1*-I45.9*, I46*-I51*, I52.8, I70*-I71*, I72.1*-I72.4*, I72.8*, I72.9*, I73*-I77*, I79.0*, I79.1*, I79.8*, I81*-I82*, I98*-I99*, M03.6, N08.8, Q27, Q28, S26*, T82.0-T82.3, T82.5-T82.9, T86.2, Y60.5, Y61.5, Y62.5, Y84.0, Z45.0, Z50.0, Z94.1, Z95
Codes indicating non-specific chronic condition	-	R62, R63.3, Z43.1, Z51.5, Z75.5, Z93.1, Z99.3

\*Codes used with severity criteria: length of stay of hospital admission mentioning code >3 days and the discharge date of the admission where the code is more than 30 days before death.

†Codes used with age criteria: Age at death (if from death certificates) or age at admission (if from hospital records) must be 10 years or older.

Table S2. Characteristics of linked data sources used in the study

	<b>England</b>	<b>Scotland</b>	<b>Wales</b>
<b>Mid year estimated population aged 1-18 years in 2010</b>	11,044,663	1,045,716	630,596
<b>% of total UK population aged 1-18 years in 2010</b>	84.0%	8.0%	4.8%
<b>Linked hospital records available from</b>	Finished consultant episodes (FCEs) ending 1st April 1997 onwards	Admissions ending 1st Jan 1981 onwards	FCEs ending 1st January 1998 onwards
<b>Linked mortality-&gt;hospital admission data available from</b>	Deaths registered 1st January 1998 onwards	Deaths registered 1st Jan 1981 onwards (linked to hospital inpatient records)	Deaths registered 1st January 1998 onwards
<b>Number of diagnoses/episode or admission</b>	1997-2001: up to 7/FCE 2002-2006: up to 14/FCE 2007-2010: up to 20/FCE	Up to 6/admission (up to 12/admission in SMR11)	Up to 14/episode
<b>Number of ICD-10 coded causes of death in linked data</b>	Up to 15 mentions	Up to 11 mentions	Underlying cause of death only (January 1998-March 2003). Up to 8 mentions (March 2003 onwards)
<b>Date ICD-10 coding introduced on hospital records</b>	FCEs ending 1st April 1997 onwards	Admissions ending 1st April 1996	FCEs ending 1st January 1998
<b>Date ICD-10 coding introduced on death registration data</b>	Deaths registered 1st January 2001 onwards	Deaths registered 1st January 2000 onwards	Deaths registered 1st January 2001 onwards
<b>Variables used for linkage to death registration records</b>	Hierarchical algorithm based on combinations of: NHS number, date of birth, sex, postcode[237]	Probabilistic linkage based on CHI number, NHS number, dates of birth and death, names, postcode and other unique identifiers [181]	NHS number
<b>Last date of registration in dataset</b>	7th August 2012	3rd May 2012	9th December 2011
<b>Period of linked data included in study</b>	Deaths occurring 2001-2010, linked to hospital discharges 1 <sup>st</sup> April 1997-31 <sup>st</sup> December 2010	Deaths occurring 2001-2010, linked to hospital discharges 1 <sup>st</sup> April 1996-31 <sup>st</sup> December 2010	Deaths occurring 2003-2010, linked to hospital discharges 1 <sup>st</sup> April 1998-31 <sup>st</sup> December 2010
<b>Linkage methods</b>	Deterministic linkage using NHS number, sex, date of birth and postcode	Probabilistic linkage using a number of identifiers including Community Health Index (CHI) number, name, date of birth, postcode, sex	Deterministic linkage using NHS number

Table S3. Distribution by age, sex and year of death children who died in the study population according to whether their death certificate was successfully linked to a hospital record

Variable	Linked n/N (%)	$\chi^2$ -test <i>p</i> *
<b>Age group at death</b>		<0.0001
1-4	5342/5868 (91.0)	
5-9	3064/3460 (88.7)	
10-14	3677/4447 (82.6)	
15-18	6798/9663 (70.4)	
<b>Sex</b>		<0.0001
Male	11087/14247 (77.8)	
Female	7794/9191 (84.8)	
<b>Year of death</b>		<0.0001
2001**	1955/2569 (76.1)	
2002**	1869/2517 (74.3)	
2003	2005/2585 (77.6)	
2004	1954/2446 (79.9)	
2005	1919/2407 (79.7)	
2006	1981/2406 (82.3)	
2007	2026/2380 (85.1)	
2008	1807/2147 (84.2)	
2009	1771/2104 (84.2)	
2010	1594/1877 (84.9)	
<b>Country</b>		<0.0001
England	15960/20104 (79.4)	
Scotland	2195/2391 (91.8)	
Wales	726/943 (77.0)	
<b>Total</b>	18881/23438 (80.6)	

\*  $\chi^2$ -test comparing the distribution of each variable between matched and unmatched records.

\*\*England and Scotland only

Table S4. Percentage of children who died with chronic conditions from two or more groups, by type of condition

<b>Condition</b>		<b>Children with conditions from two or more groups</b>	
<b>Group</b>	<b>Total*</b>	<b>% (95% CI)</b>	<b><i>n</i></b>
Mental/behavioural	4217	50.3% (48.8%, 51.8%)	2121
Cancer/blood	5232	78.8% (77.7%, 79.9%)	4123
Chronic infection	391	94.6% (91.9%, 96.5%)	370
Respiratory	4692	87.4% (86.3%, 88.3%)	4099
Endocrine/metabolic/digestive/ renal/GU	5436	90.0% (89.1%, 90.7%)	4891
Musculoskeletal/skin	2429	95.7% (94.8%, 96.4%)	2324
Neurological/sensory	9032	76.3% (75.4%, 77.1%)	6888
Cardiac	3031	87.5% (86.3%, 88.7%)	2653

\*Note that groups are not mutually exclusive, as each child can have more than one chronic condition