

Supplementary material 2

Current epidemiology of cerebrospinal fluid shunt surgery in UK & Ireland (2004-2013)

Report on case ascertainment

Case ascertainment was audited using reporting rates (percentage of reported over reportable shunt procedures), calculated by comparing the number of cases reported to the UKSR against the number of reportable cases as determined from the operating theatre log books in each unit. Units will be referred to as centre, or centre-year for each year they were audited. This was calculated as a percentage for both primary and revision procedures. There was one value for each type of case ascertainment (reporting rate) per centre and year (centre-year) included in the audit. Case ascertainment of each centre-year was grouped into high ($\geq 75\%$ reporting rate) versus low ($< 75\%$ reporting rate) case ascertainment for comparison. Average case ascertainment was calculated for each year, and overall for all centre-years.

Case ascertainment information was available from 39 out of 46¹ centres included in the study, for a median of 4 (out of 10) years per centre (Table S2-3). The median (range) number of centres that were audited each year was 16 (8-25).

Case ascertainment over time and across centres

Case ascertainment on primary shunts and shunt revisions varied by centre-year, ranging from 22.9 to 100% among primary shunts and 26.3 to 100% among revisions (Table S2-3). Of the 170 centre-years with audit data on case ascertainment, there were 115 (67.6%) centre-years with high case ascertainment on primary shunts, and 99 (58.2%) centre-years with high case ascertainment on shunt revisions.

Case ascertainment on primary shunts over time and across regions

Based on data from centres and years included in the audit, average case ascertainment on primary shunts per year ranged from 76.2% (in 2008) to 84.4% (in 2005) (Table S2-1). Overall, the average case ascertainment on primary shunts for all centre-years was 79.5% (Table S2-1).

¹ Some of these 46 centres were joined during study period, resulting in 41 centres in total.

Table S2-1 – Average of centres’ average case ascertainment on primary shunts per year^[1]

	Years										Overall
	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	
Average of centres’ case ascertainment	81.8%	84.4%	79.8%	78.1%	76.2%	78.9%	81.3%	76.7%	77.6%	80.7%	79.5%

^[1] Based on data from centres and years included in the audit

Variations in average case ascertainment on primary shunts per centre-year resulted in variations in case ascertainment by geographical region too (Figure S2-1), ranging from 59.9% in Scotland (based four centres audited out of the seven centres included in the UKSR) to 99.8% in the East Midlands (based on the only centre included in the UKSR from this region).

Average case ascertainment on primary shunts (colours in map), number of centres audited at least once, number of centres included in the UKSR, and percentage years with at least one centre audited

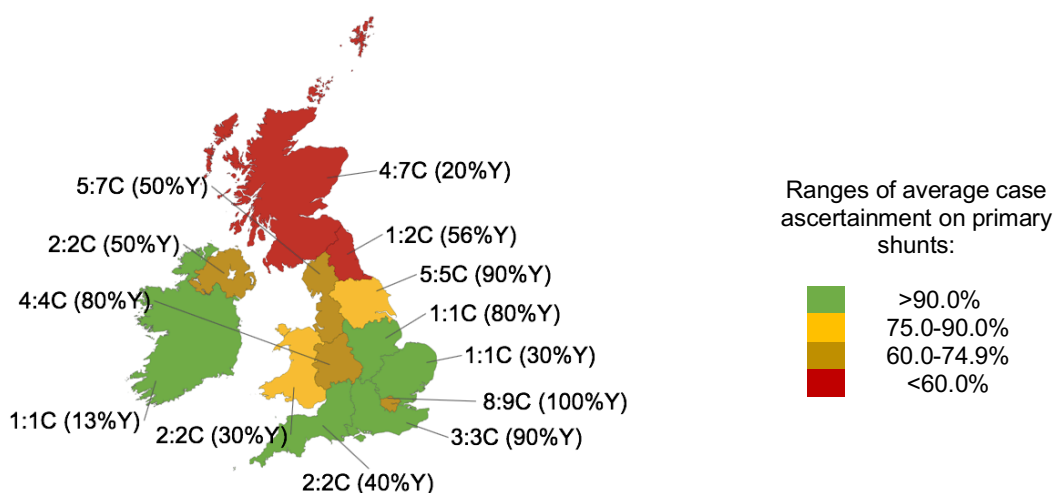


Figure S2-1 – Average case ascertainment on primary shunts (colours in map), ratio of number of centres audited at least once to number of centres included in the UKSR (ratio in labels), and percentage of years with at least one centre audited (percentage in labels), by the geographical region of the centre. C: centres; Y: years.

Primary and revision procedures by group of case ascertainment

Centre-years with unknown case ascertainment (on primary or revision shunts) had similar distribution of primary and revision procedures to that of centre-years with high case ascertainment (Figure S2-2 and Figure S2-3).

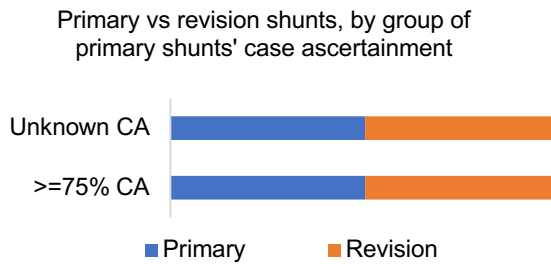


Figure S2-2 – Distribution of procedure type (primary vs. revision), by group of $\geq 75\%$ versus unknown primary shunts' case ascertainment. CA: case ascertainment

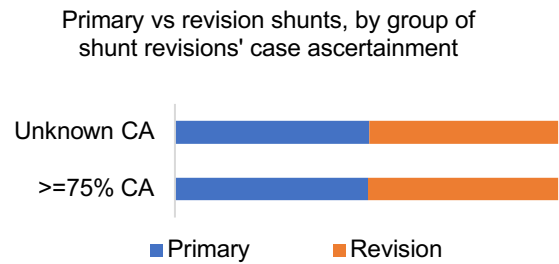


Figure S2-3 – Distribution of procedure type (primary vs. revision), by group of $\geq 75\%$ versus unknown shunt revisions' case ascertainment. CA: case ascertainment

Distribution of diagnostic group by group of case ascertainment on primary shunt

Centre-years with unknown case ascertainment had very similar distribution of diagnostic groups to that of centre-years with high average case ascertainment, in all age groups (Figure S2-4, Figure S2-5, Figure S2-6 and Figure S2-7), and slightly lower percentage of patients with missing diagnosis (9.7% versus 11.2%).

Overall, there were no large differences in the distribution of diagnoses between groups of case ascertainment (Figure S2-4). By age group, there were some differences in these distributions (Figure S2-5 to Figure S2-7).

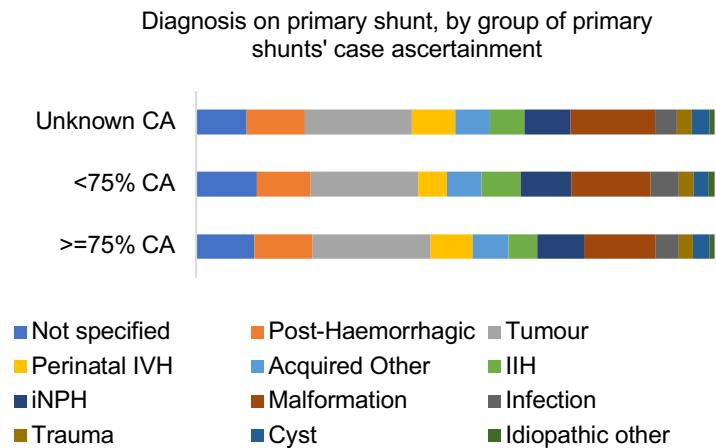


Figure S2-4 – Distribution of diagnostic groups, by group of $\geq 75\%$ versus $< 75\%$ case ascertainment on primary shunt procedures. CA: case ascertainment

Centre-years with low average case ascertainment on primary shunts had a lower percentage of infants with perinatal IVH (27.2% versus 34.8%), while they had higher percentages of infants with malformations (39.1% versus 33.3%) (Figure S2-5).

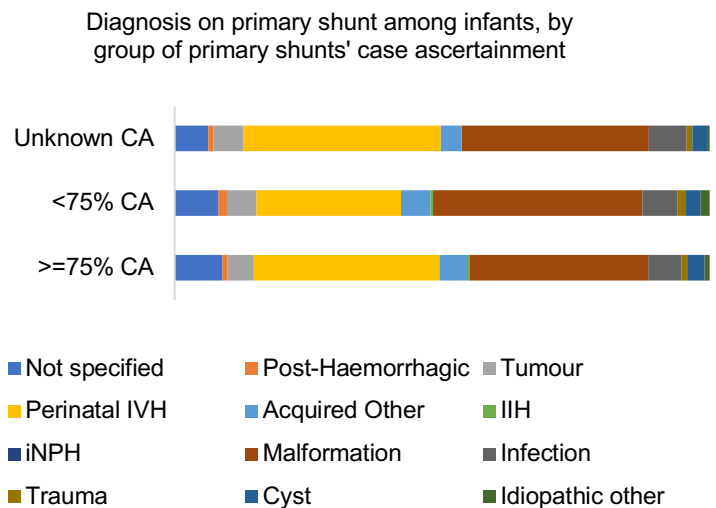


Figure S2-5 – Distribution of diagnostic groups among infants, by group of $\geq 75\%$ versus $< 75\%$ case ascertainment on primary shunt procedures. CA: case ascertainment

Centre-years with low average case ascertainment on primary shunts had lower percentage of children with tumours (22.2% versus 31.4%), while they had higher percentage of children with malformations (27.8% versus 17.9%) (Figure S2-6).

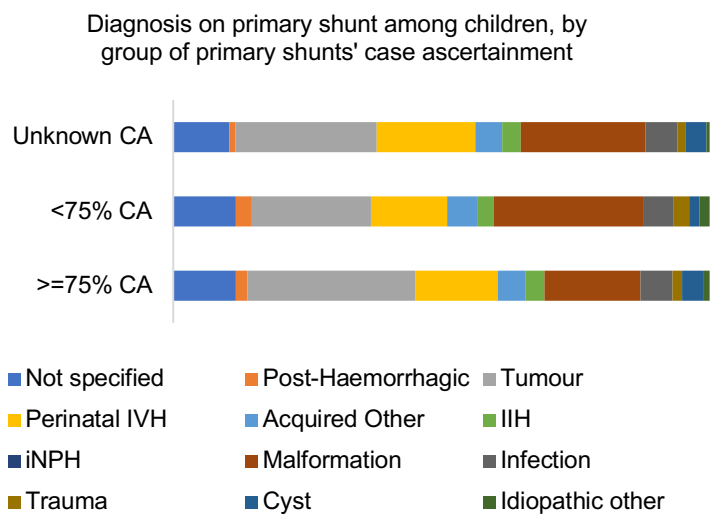


Figure S2-6 – Distribution of diagnostic groups among children, by group of $\geq 75\%$ versus $< 75\%$ case ascertainment on primary shunt procedures. CA: case ascertainment

Amongst adults, there were no large differences between groups of case ascertainment in the distribution of diagnoses per centre-year (Figure S2-7).

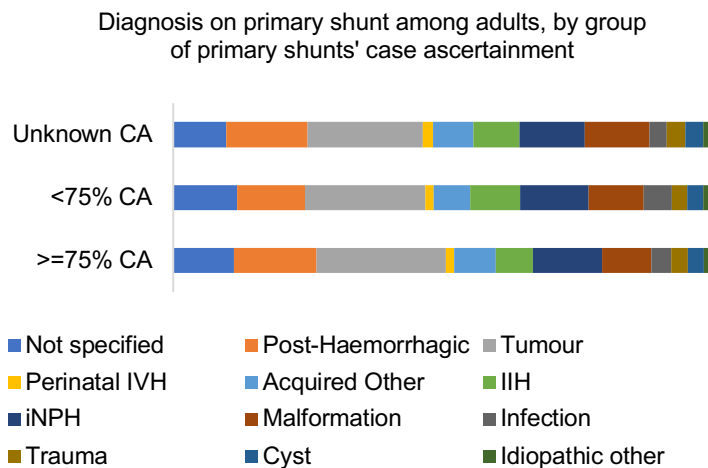


Figure S2-7 – Distribution of diagnostic groups among adults, by group of $\geq 75\%$ versus $< 75\%$ case ascertainment on primary shunt procedures. CA: case ascertainment

Case ascertainment on shunt revisions over time and across regions

Based on data from centres and years included in the audit, average case ascertainment on shunt revisions per year ranged from 75.1% (in 2011) to 80.0% (in 2004 and 2010) (Table S2-2). Overall, the average case ascertainment on shunt revisions for all centre-years was 77.5% (Table S2-2).

Table S2-2 – Average of centres' average case ascertainment on shunt revisions per year^[1]

	Year										
	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Overall
Average of centres' average case ascertainment	80.0%	79.1%	75.2%	79.7%	75.2%	75.9%	80.0%	75.1%	76.9%	79.2%	77.5%

^[1] Based on data from centres and years included in the audit

Distribution of reasons for revision, by group of case ascertainment on shunt revisions

There was a small number of cases in many of the reasons for revision, per case ascertainment group and age group, and therefore the differences identified in this report should be interpreted with caution.

Unknown versus high average case ascertainment

Centre-years with unknown case ascertainment on shunt revisions had very similar distribution of reasons for the first revision of a primary shunt to that of centre-years with high average case ascertainment, in all age groups (Figure S2-8 to Figure S2-11), and a slightly lower percentage of cases with no reason specified (57.1% versus 61.0%). By age group, when comparing centre-years with unknown vs. high case ascertainment on shunt revisions, there was a slightly higher percentage of infants with shunt infection (19.8% vs. 13.6%) and slightly lower percentage of infants with underdrainage (59.9% vs. 67.9%) (Figure S2-9) while there was a slightly lower percentage of children with shunt infection (8.2% vs. 17.9%) and slightly higher percentage of children with underdrainage (68.6% vs. 63.2%) (Figure S2-10).

Low versus high average case ascertainment

Centre-years with low average case ascertainment on shunt revisions, as compared to those with high average case ascertainment, had lower percentage of cases with missing first reason for revision of primary shunt overall (45.9% versus 61.0%) and by age group, including among infants (40.5% versus 60.5%), children (46.7% versus 65.6%) and adults (48.0% versus 60.0%).

Among cases with a reason for first revision specified in the registry, the distribution of these were similar, showing only slight differences, and particularly when analyses were stratified by age group (Figures S1-8 to S1-11).

Overall, centre-years with low average case ascertainment on shunt revisions had higher percentage of patients with underdrainage than centre-years with high average case ascertainment (66.7% versus 60.4%), while they had similar or slightly lower percentages of most other reasons for revision.

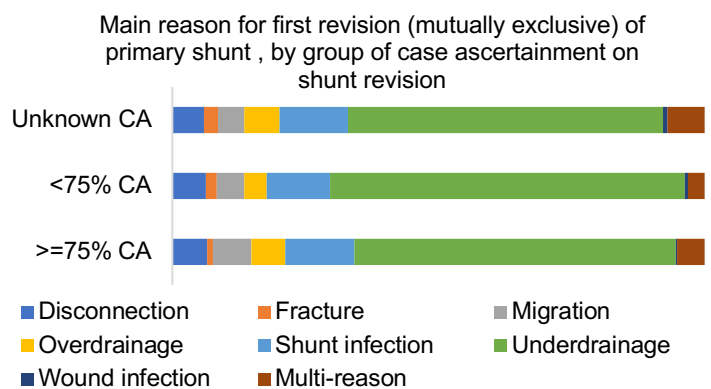


Figure S2-8 – Distribution of reason for first revision of primary shunt, by group of $\geq 75\%$ versus $< 75\%$ case ascertainment on shunt revision procedures (excluding revisions with no reason specified). CA: case ascertainment

Among infants with known reason for first revision, centre-years with low average case ascertainment on shunt revisions had higher percentage of cases with underdrainage (82.0% versus 67.0%), while they had lower percentages of cases in most other reasons for revision, particularly disconnection (0% vs. 5.8%).

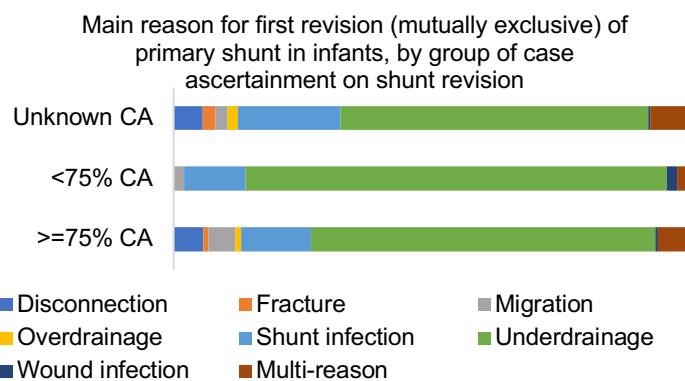


Figure S2-9 – Distribution of reason for first revision of primary shunt among infants, by group of $\geq 75\%$ versus $< 75\%$ case ascertainment on shunt revision procedures (excluding revisions with no reason specified). CA: case ascertainment

Among children with known reason for first revision, centre-years with low average case ascertainment on shunt revisions had lower percentage of cases with shunt infection (4.2% versus 17.9%) and disconnection (0% versus 4.3%), while they had higher percentage of cases with overdrainage (16.7% vs. 6.8%) as well as with all other reasons for revision.

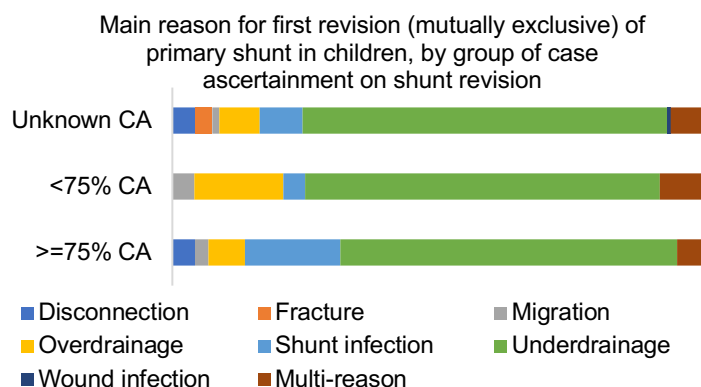


Figure S2-10 – Distribution of reason for first revision of primary shunt among children, by group of $\geq 75\%$ versus $< 75\%$ case ascertainment on shunt revision procedures (excluding revisions with no reason specified). CA: case ascertainment

Among adults with known reason for first revision, centre-years with low average case ascertainment on shunt revisions had slightly higher percentage of cases with disconnection (10.3% versus 7.2%), while they had slightly lower percentage of cases with overdrainage (3.4% vs. 8.1%).

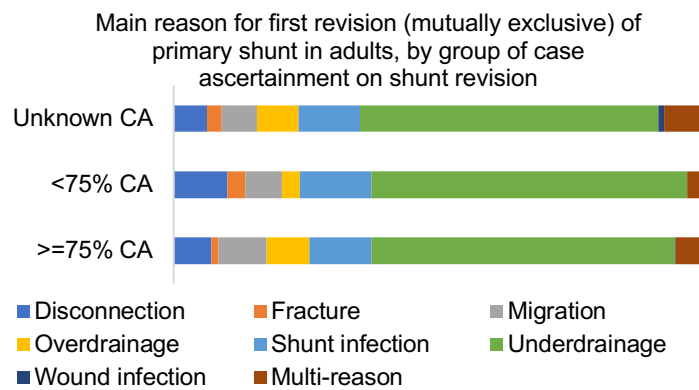


Figure S2-11 – Distribution of reason for first revision of primary shunt among adults, by group of $\geq 75\%$ versus $< 75\%$ case ascertainment on shunt revision procedures (excluding revisions with no reason specified). CA: case ascertainment

