

SECTION E SCOTTISH MORTALITY AUDIT RENAL REPLACEMENT THERAPY (SMARRT)

Data on all deaths in adult patients receiving RRT in Scotland are submitted to the SRR via the Scottish Mortality Audit of Renal Replacement Therapy (SMARRT). Cause and contributors to death as well as location of death are recorded. In addition, the clinicians responsible for a patient's care are asked to comment on the presence or absence of areas of clinical concern in patient management prior to death.

A five point scale is used:

1. **There were no areas of concern or for consideration in the management of this patient.**
2. **There were areas for consideration but they made no difference to the eventual outcome.**
3. **There were areas of concern but they made no difference to the eventual outcome.**
4. **There were areas of concern which may have contributed to this patient's death.**
5. **There were areas of concern which CAUSED the death of this patient who would have been expected to survive.**

Those deaths classed as category 4 or 5 are further assessed through a process which may include a review of case note records, discussion at local morbidity and mortality meetings, critical incident review reports or procurator fiscal reports. From analysis of this additional information several recurring themes have emerged.

These themes are:

- **Hyperkalaemia**

Death due to hyperkalaemic arrest. Patient non-concordance with treatment is noted to contribute in >50% of cases.

- **Prescribing**

Death attributed to adverse drug effects - inappropriate drug choices, combinations or monitoring. Most cases involve the use of common drugs including antiplatelet agents/ anticoagulants, opioid analgesics or immunosuppressant medication.

- **Systems of care**

Deaths attributed to failures of communication, inadequate out of hours cover, delays in specialist renal input or inadequate staff training.

- **Infection**

Deaths attributed to severe infection due to delays in its recognition or management, sepsis in the context of immunosuppressive drugs or due to vascular access related infection.

- **Vascular Access**

Deaths attributed to complications of vascular access. Examples include fatal blood loss (intentional and accidental), inadequate dialysis following failure to address poor vascular access or cardiovascular compromise from AVF formation.

● Interventions

Deaths attributed as a direct consequence of an operation or procedure. Examples include recognised bleeding complications of angiography and viscus perforation during endoscopic procedures.

● Other

Deaths following a fall-related fracture, unexpected deterioration during dialysis or noncompliance.

E1 Categories of deaths by year 2008-2015												
Year	Cat 1		Cat 2		Cat 3		Cat 4		Cat 5		Missing	
	n	%	n	%	n	%	n	%	n	%	n	%
2008	375	81.2	55	11.9	14	3.0	14	3.0	2	0.4	2	0.4
2009	355	82.6	54	12.6	6	1.4	11	2.6	4	0.9	0	-
2010	369	86.0	35	8.2	6	1.4	17	4.0	1	0.2	1	0.2
2011	388	86.6	32	7.2	5	1.1	16	3.6	3	0.7	4	0.9
2012	319	80.8	52	13.2	7	1.8	13	3.3	2	0.5	2	0.5
2013	346	77.2	55	12.3	20	4.5	15	3.3	6	1.3	6	1.3
2014	329	76.2	42	9.7	17	3.9	23	5.3	6	1.4	15	3.5
2015	334	72.9	55	12.0	25	5.5	15	3.3	3	0.7	26	5.7
Total	2815	80.4	380	10.9	100	2.9	124	3.5	27	0.8	56	1.6

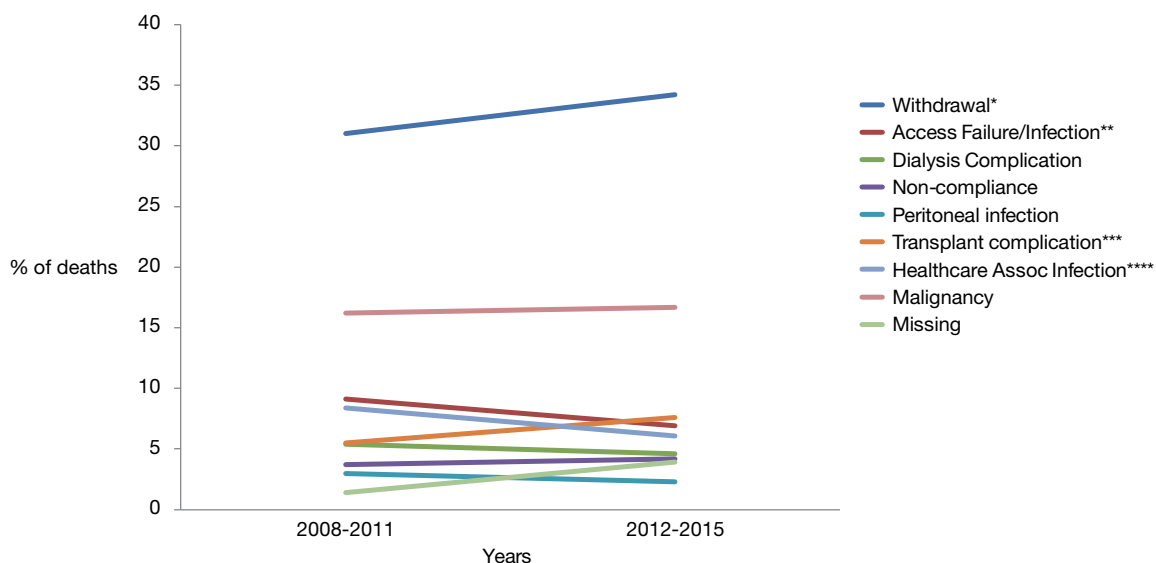
E2 Themes of category 4 and 5 deaths by year 2008-2015															
Year	Hyperkalaemia		Prescribing		Systems of Care		Infection		Vascular Access		Intervention		Other		Total
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	
2008	1	6.3	3	18.8	3	18.8	7	43.8	2	12.5	0	-	0	-	16
2009	0	-	2	13.3	4	26.7	5	33.3	1	6.7	2	13.3	1	6.7	15
2010	0	-	4	22.2	5	27.8	7	38.9	0	-	2	11.1	0	-	18
2011	1	5.3	3	15.8	3	15.8	6	31.6	4	21.1	1	5.3	1	5.3	19
2012	2	13.3	1	6.7	4	26.7	3	20.0	3	20	2	13.3	0	-	15
2013	2	9.5	0	-	9	42.9	3	14.3	1	4.8	4	19	2	9.5	21
2014	0	-	0	-	7	24.1	11	37.9	5	17.2	2	6.9	4	13.8	29
2015	0	-	4	22.2	6	33.3	5	27.8	0	-	1	5.6	2	11.1	18
Total	6	4	17	11.3	41	27.2	47	31.1	16	10.6	13	8.6	11	7.3	151

The emergence of recurring themes highlights the important role of SMARRT as a quality improvement tool. Our aim is to complete SMARRT forms as close to the point of death as possible so that the results of SMARRT and the output of any clinical incident reviews can be shared with all local clinical governance committees across the country.

E3 Location of death by year 2008-2015														
Year	Usual Residence		Hospital		Hospice		Community Hospital		Other		Unknown		Missing	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%
2008	89	19.3	318	68.8	6	1.3	12	2.6	6	1.3	7	1.5	24	5.2
2009	89	20.7	303	70.5	7	1.6	10	2.3	5	1.1	5	1.2	11	2.6
2010	87	20.3	298	69.4	9	2.1	9	2.1	11	2.6	7	1.6	8	1.9
2011	110	24.6	299	66.9	11	2.5	12	2.7	5	1.1	0	-	10	2.2
2012	93	23.5	270	68.3	13	3.3	5	1.3	9	2.3	0	-	5	1.3
2013	98	21.9	312	69.6	11	2.5	13	2.9	5	1.1	2	0.4	7	1.6
2014	81	18.8	291	67.3	16	3.7	9	2.1	3	0.7	0	-	32	7.4
2015	103	22.5	281	61.4	16	3.5	13	2.8	2	0.4	1	0.2	42	9.2
Total	750	21.4	2372	67.8	89	2.5	83	2.4	46	1.3	22	0.6	139	4.0

E4 Factors contributing to death 2008-2015																		
Year	With-drawal		Access failure/ infection		Dialysis complications		Non-compliance		Peritoneal Infection		Trans-plant Complication		Health-care Associated Infection		Malignancy		Missing	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
2008	143	31.0	50	10.8	29	6.3	21	4.5	14	3.0	19	4.1	55	11.9	59	12.8	8	1.7
2009	127	29.5	30	7.0	23	5.3	15	3.5	18	4.2	27	6.3	34	7.9	76	17.7	1	0.2
2010	127	29.6	44	10.3	20	4.7	13	3.0	11	2.6	29	6.8	44	10.3	79	18.4	12	2.8
2011	152	33.9	37	8.3	24	5.4	16	3.6	10	2.2	23	5.1	16	3.6	73	16.3	4	0.9
2012	128	32.4	30	7.6	21	5.3	23	5.8	7	1.8	28	7.1	21	5.3	62	15.7	7	1.8
2013	159	35.5	24	5.4	23	5.1	21	4.7	13	2.9	32	7.1	30	6.7	73	16.3	9	2.0
2014	144	33.3	32	7.4	19	4.4	23	5.3	11	2.5	33	7.6	28	6.5	76	17.6	19	4.4
2015	162	35.4	33	7.2	17	3.7	6	1.3	9	2.0	39	8.5	26	5.7	79	17.2	32	7.0
Total	1142	32.6	280	8.0	176	5.0	138	3.9	93	2.7	230	6.6	254	7.3	577	16.5	92	2.6

E5 Trends in factors contributing to death by era 2008-2011 and 2012-2015



Chi-square tests: *p=0.014, **p=0.023, ***p=0.008, ****p=0.009

Comparing trends from each era from 2008-2011 and 2012-2015 there has been a significant decrease in access failure/infection and healthcare associated infection. In this same time we have observed a significant increase in withdrawal of renal replacement therapy and transplant complications.

Withdrawal from Dialysis

In April 2016 the SMARRT steering group published findings from an analysis of factors influencing withdrawal from dialysis using these national data¹. A summary of those findings is outlined.

Analysis of SMARRT data returns from 2008 to 2014 inclusive shows that withdrawal from dialysis was the third most common primary cause of death among patients with ERF treated by RRT. In those aged over 75 years at the time of death it was the second commonest cause after cardiovascular disease.

From 01 January 2008 to 31 December 2014 there were 2596 deaths in Scotland among patients receiving RRT for ERF. Of these, haemodialysis was the final mode of treatment in 2401 cases (92.5%). Data on cause of death was available in more than 98%. Dialysis withdrawal was the primary cause of death in 497 patients (19.1%) and a contributory factor in another 442. There was significant variation between adult renal units in the proportion of deaths attributed to dialysis withdrawal (range 3.3-55.8%).

1. Findlay MD, Donaldson K, Doyle A et al. Factors influencing withdrawal from dialysis: a national registry study. *Nephrol Dial Transplant* 2016; Published ahead of print April 21 2016, doi: 10.1093/ndt/ gfw074

Multivariable regression analysis highlighted female sex, older age, and previous history of cerebrovascular disease or chronic obstructive pulmonary disease as factors associated with dialysis withdrawal. There was no such association between withdrawal and late referral, socio-economic deprivation, diabetes or rurality. Patients withdrawing from dialysis were more likely to die at home or in a hospice (32.4% vs 20.8%).

Analysis of free text from SMARRT data returns allowed recurring themes influencing the decision to withdraw from dialysis to be identified. A word cloud was generated illustrating themes appearing more frequently with more prominence (E6). The most frequently mentioned factor was patient choice. Other comments portrayed an image of physical and psychological decline accelerated by acute illnesses.

A second word cloud was produced using free text comments for those who died from causes other than dialysis withdrawal, but where withdrawal was thought to contribute to death. This demonstrated the common illnesses and co-morbidity that precede a decision to withdraw from renal replacement therapy (E7).

Withdrawal from dialysis is a frequently recorded cause of death for Scotland's dialysis population, influencing more than one third of all deaths over a 7 year study period. Early recognition and discussion of the issues is likely to facilitate the planning of end of life care.

E6 Themes identified from clinician free text comments where dialysis withdrawal was primary cause of death 2008-2014



The font size is related to the frequency of the theme.

E7 Themes identified from clinician free text comments where dialysis withdrawal contributed to but did not cause death 2008-2014



The font size is related to the frequency of the theme.