Life expectancy in catastrophic injury claims

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Overview

- *Admissibility of life expectancy evidence*
  - *Dodds v (1) Arif (2) Aviva Insurance Ltd* [2019] EWHC 1512 (QB)
  - *Chaplin v Pistol* [2020] EWHC 1543 (QB)
  - Applications for permission
- Brain injury cases
- Spinal injury cases

12 King's Bench Walk

Dodds v (1) Arif (2) Aviva Insurance Ltd [2019] EWHC 1512 (QB)

- Master Davison
- Carol Dodds run over crossing the road
- Suffered a moderate-severe tbi resulting in substantial cognitive impairment
- She was 73 at the time of the accident and 75 at the time of this hearing
- Defendant wanted statistical life expectancy evidence from Prof. Bowen-Jones
- C's medical evidence said life expectancy unlikely to be "significantly affected"
- Court refused permission and said it was a matter for the medical experts
- Offered guidance

Dodds

- Life expectancy evidence was required
- Injury had potentially affected the Claimant's life expectancy
- This could be obtained from the clinical experts
- Did not yet at least need bespoke life expectancy expert evidence
- Statistical or actuarial evidence should be restricted to:-
  - Cases where the clinical experts could not opine
  - Or required help from an actuarial expert
  - Or where they wish to derive help from statistical material but cannot agree upon how to deploy it.

Dodds- 2 categories

- Life Expectancy evidence can be used:-
  - 1. Where there is clear evidence the Claimant (or a dependant is atypical regardless of the injury
  - 2. Where the injury itself has impacted on life expectancy. Normal route is for CLINICAL evidence
  - Statistical evidence only
    - 1. Where Clinicians cannot opine at all
    - 2. Where Clinicians need help
    - 3. Where Clinicians cannot agree on how to deploy the statistical approach
- Good practice to canvass the approach with the other party before instruction of the experts.

Chaplin v Pistol [2020] EWHC 1543 (QB)

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- Jay J approved the judgment of Master Davison in *Dodds*:
- 33. At para 19 of his judgment in *Dodds v Arif [2019] EWHC 1512 (QB)*, Master Davison summarised the effect of the authorities, in my view accurately, as follows:

"For these reasons, it seems to me that bespoke life expectancy evidence from an expert in that field should be confined to cases where the relevant clinical experts cannot offer an opinion at all or state that they require specific input from a life expectancy expert (see e.g. Mays v Drive Force (UK) Limited [2019] EWHC 5), or where they deploy, or wish to deploy statistical material, but disagree on the correct approach to it. This case does not, or does not yet, fall into any of these categories."

Applications for permission

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- Be cautious about getting your experts to state that they cannot express a view
- Better to get them to state that statistical input is needed
- If permission is refused you may need to revert back to them

- Where permission is refused
  - How do I get my clinician to deal with life expectancy?
  - It may be necessary to help the clinicians understand the literature

Brain injury cases

- These issues are most relevant to brain and spinal injury cases
- Starting point is the Ogden Tables 8th Edition
- Using the 0% column gives the projected average life expectancy for a male or female person of a given age.
- So the tables project forwards and take into account potential improvements in life expectancy over the person's life time

LE is reduced in severe TBI cases. Why?

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- Short term:-
  - The brain damage itself
- Longer term even after survival for 2 years. Why?:-
  - Epilepsy
  - Suicide
  - Respiratory infections and pneumonia
  - Meningitis?
  - Circulatory system disease due to immobility or increased risk of DVT,
  - Increased susceptibility of aging as effect of injured brain?

TABLE 17-1

Causes of Death for Persons Injured at Ages 10 or Older Who Died 5 or More Years Later

CAUSE OF DEATH (ICD-9 CODES)	NUMBER	%
Cancer (140–239)	9	7
Seizures (345, 436, 780.3)	14	10
Circulatory (390–459, except 436)	26	19
Respiratory (460–519)	15	11
Digestive (520–579)	6	4
Urinary/kidney (580–599)	4	3
Choking/suffocation (910–915)	3	2
Other external (800+, except 910–915)	13	10
All other causes, including missing	45	33
Total	135	100

Causes of death in TBI

Literature overview

- Walker and Erculei- Death rate 3-4 times in head injured world war II soldiers
- Walker et al- 574 WW1 tbi injured men- 4 year reduction
- Roberts- 469 patients unconscious for more than 1 week. 366 discharged alive. Most could walk unassisted- 5 year reduction
- Strauss, Shavelle and Anderson- 946 children & Adolescents, 5-21 yrs, Crude scales of mobility (none, poor/fair/good) 2-40 years reduction in life
- Shavelle and Strauss- Excess death rates-Death rates small for those who could walk and high for the non-ambulatory
- Harrison-Felix- 2178 persons, Average 7 year reduction. Extremely severe- 50% of normal

Key factors

- Age
- Severity of disability
- Time since injury- mortality risk declines after first 2 years
- Sex- Males have greater mortality. But PVS – no difference
- MOBILITY- most powerful predictor- no mobility risk of death 4 times higher
- Feeding ability- Sharp contrast in survival between those who required feeding tube those fed orally by others and those who could feed themselves. Inability to feed is a good indirect measure of neurological compromise
- Cognitive effects alone had modest effect on life expectancy
- Epilepsy strongly associated with reduced survival
- Maladaptive behavior such as drug use- Exhibited *greater LE than others* – If you are well enough to abuse drugs, the injury itself is not impacting on LE.
- Quality of care
- Pre-accident lifestyle factors

The Key literature

ORIGINAL RESEARCH

Long-Term Survival After Traumatic Brain Injury Part II: Life Expectancy

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Abstract

Objectives: To compute the life expectancy of persons with traumatic brain injury (TBI) based on validated prognostic models from 2 cohorts, to compare mortality and life expectancy of persons with TBI with those of the U.S. general population, and to investigate trends toward improved survival over the last 2 decades.

Design: Survival analysis.

Setting: Postdischarge from rehabilitation units and long-term follow-up at regional centers.

Participants: Two cohorts of long-term survivors of TBI (N=12,481): the Traumatic Brain Injury Model Systems (TBIMS) cohort comprised 7365 persons who were admitted to a TBIMS facility with moderate to severe TBI and were assessed at ≥1 years postinjury, and the California Department of Developmental Services (CDDS) cohort comprised 5116 persons who sustained a TBI and received long-term services from the CDDS.

Interventions: Not applicable.

Main Outcome Measures: Life expectancy.

Results: The estimates of age-, sex-, and disability-specific life expectancy of persons with TBI derived from the CDDS and TBIMS were similar. The estimates of age- and sex-specific life expectancy were lower than those of the U.S. general population. Mortality rates of persons with TBI were higher than those of the U.S. general population. Mortality rates did not improve and the standardized mortality ratio increased over the study period from 1988 to 2010.

Conclusions: Life expectancy of persons with TBI is lower than that of the general population and depends on age, sex, and severity of disability. When compared, the survival outcomes in the TBIMS and CDDS cohorts are remarkably similar. Because there have been no marked trends in the last 20 years, the life expectancies presented in this article may remain valid in the future.

Archives of Physical Medicine and Rehabilitation 2015;96:1000-5

Life Expectancy Table (US) for TBI

Table 1 Life expectancy: Additional years (SE) for persons with TBI

	CDDS				TBIMS				
Sex/Age (y)	Does Not Walk, Fed by Others	Does Not Walk, Self-Feeds	Some Walking	Walks Well	Does Not Walk, Fed by Others	Does Not Walk, Self-Feeds	Some Walking	Walks Well	General Population
Female									
10	26 (1.4)	47 (1.8)	57 (1.9)	62 (1.5)	ND	ND	ND	ND	71.2
20	24 (1.6)	38 (1.7)	47 (1.8)	53 (1.4)	25 (2.5)	38 (1.6)	47 (1.7)	54 (1.7)	61.4
30	21 (1.8)	30 (1.5)	38 (1.7)	44 (1.4)	19 (1.9)	30 (1.4)	38 (1.6)	45 (1.7)	51.6
40	17 (1.9)	23 (1.3)	30 (1.6)	35 (1.3)	14 (1.4)	23 (1.2)	30 (1.4)	37 (1.6)	42.0
50	13 (2.1)	16 (1.1)	23 (1.4)	27 (1.2)	10 (1.0)	17 (1.0)	23 (1.3)	29 (1.5)	32.8
60	8 (2.5)	11 (0.9)	16 (1.2)	20 (1.0)	7 (0.8)	12 (0.8)	17 (1.1)	22 (1.3)	24.1
Male									
10	26 (1.4)	47 (1.8)	51 (1.5)	57 (1.1)	ND	ND	ND	ND	66.3
20	24 (1.6)	38 (1.7)	42 (1.5)	47 (1.1)	25 (2.5)	38 (1.6)	40 (1.1)	48 (1.1)	56.6
30	21 (1.8)	30 (1.5)	33 (1.4)	39 (1.1)	19 (1.9)	30 (1.4)	32 (0.9)	40 (1.0)	47.4
40	17 (1.9)	23 (1.3)	25 (1.3)	30 (1.0)	14 (1.4)	23 (1.2)	25 (0.8)	32 (0.9)	38.1
50	13 (2.0)	16 (1.1)	19 (1.2)	23 (1.0)	10 (1.0)	17 (1.0)	18 (0.7)	24 (0.9)	29.2
60	8 (2.4)	11 (0.9)	13 (1.0)	16 (0.9)	7 (0.8)	12 (0.8)	13 (0.6)	18 (0.8)	21.1

NOTE. The TBIMS does not contain data for persons under age 17.
Abbreviation: ND, no data.

Problems

- Whether a particular individual can be properly classified within the group
- Clinicians tend to have difficulty with this and may well need help
- Is the person's condition typical within the group
- What are the co-morbidities
- Does a good care package help
- These are average survival times not specific to the individual
- These are for the USA. The UK has better average life expectancy than the USA so it is necessary to adjust

Calculation- an example

- Take A, a male aged 13 at the accident and now 15
- Suffered a catastrophic TBI
- Fed by others, orally
- Cannot walk
- Significant spasticity of all 4 limbs
- Life expectancy in the US would be to age 81.75 years of age

Table 1 Life expectancy: Additional years (SE) for persons with TBI

	CDDS				TBIMS				
Sex/Age (y)	Does Not Walk, Fed by Others	Does Not Walk, Self-Feeds	Some Walking	Walks Well	Does Not Walk, Fed by Others	Does Not Walk, Self-Feeds	Some Walking	Walks Well	General Population
Female									
10	26 (1.4)	47 (1.8)	57 (1.9)	62 (1.5)	ND	ND	ND	ND	71.2
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Male									
10	26 (1.4)	47 (1.8)	51 (1.5)	57 (1.1)	ND	ND	ND	ND	66.3
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NOTE. The TBIMS does not contain data for persons under age 17.
Abbreviation: ND, no data.

Male aged 15 LE, Does not walk fed by others- 25 years life expectancy ie age 40 or 49% of his US Life Expectancy.

Applying that to UK Life Expectancy

- The Ogden Tables 8th Edition
  Table 1 for a 15 year old male

Table 1 Multipliers for pecuniary loss of life (males)

Age at date of trial	Multiplier calculated with allowance for projected mortality from the 2018-based population projections and rate of return of:													Age at date of trial
	-2.00%	-1.50%	-1.00%	**-0.75%**	-0.50%	**-0.25%**	0.00%	0.50%	1.00%	1.50%	2.00%	2.50%	3.00%	
0	254.93	189.83	144.12	**126.51**	111.60	**98.93**	88.13	70.95	58.19	48.57	41.20	35.48	30.97	0
1	249.12	186.26	141.94	**124.81**	110.27	**97.90**	87.34	70.49	57.93	48.43	41.14	35.47	30.98	1
2	242.63	182.15	139.32	**122.71**	108.60	**96.56**	86.26	69.79	57.47	48.14	40.95	35.34	30.90	2
3	236.22	178.06	136.70	**120.61**	106.90	**95.19**	85.16	69.07	57.00	47.82	40.74	35.20	30.80	3
4	229.95	174.03	134.10	**118.51**	105.21	**93.83**	84.05	68.34	56.52	47.50	40.52	35.05	30.70	4
5	223.80	170.07	131.52	**116.43**	103.53	**92.47**	82.95	67.61	56.04	47.18	40.30	34.90	30.60	5
6	217.79	166.17	128.98	**114.37**	101.86	**91.11**	81.84	66.88	55.54	46.84	40.08	34.75	30.49	6
7	211.91	162.33	126.46	**112.33**	100.20	**89.76**	80.74	66.14	55.05	46.51	39.85	34.59	30.38	7
8	206.16	158.55	123.96	**110.30**	98.54	**88.40**	79.63	65.40	54.54	46.16	39.61	34.42	30.27	8
9	200.53	154.83	121.50	**108.28**	96.89	**87.05**	78.53	64.65	54.03	45.81	39.37	34.26	30.15	9
10	195.02	151.17	119.05	**106.28**	95.25	**85.71**	77.42	63.89	53.51	45.46	39.12	34.08	30.03	10
11	189.62	147.57	116.63	**104.29**	93.62	**84.36**	76.31	63.13	52.99	45.09	38.87	33.90	29.90	11
12	184.35	144.03	114.24	**102.32**	92.00	**83.02**	75.20	62.37	52.46	44.72	38.61	33.72	29.77	12
13	179.19	140.55	111.88	**100.37**	90.38	**81.68**	74.09	61.60	51.93	44.35	38.34	33.53	29.63	13
14	174.14	137.12	109.54	**98.44**	88.78	**80.35**	72.98	60.83	51.39	43.97	38.07	33.34	29.49	14
15	169.20	133.75	107.23	**96.52**	87.18	**79.02**	71.87	60.06	50.84	43.58	37.80	33.14	29.35	15
16	164.38	130.44	104.94	**94.61**	85.59	**77.70**	70.76	59.28	50.29	43.19	37.51	32.93	29.20	16
17	159.67	127.19	102.69	**92.73**	84.02	**76.38**	69.66	58.50	49.74	42.79	37.23	32.72	29.04	17
18	155.06	124.00	100.46	**90.87**	82.46	**75.07**	68.56	57.72	49.18	42.39	36.94	32.51	28.89	18
19	150.57	120.86	98.26	**89.02**	80.91	**73.76**	67.46	56.93	48.62	41.98	36.64	32.29	28.73	19

Re A- Example

12 King's Bench Walk

- approach adopted by the English Courts -- map percentages of US period measures of longevity onto the UK cohort estimates found in the Ogden Tables
- *Robshaw v United Lincolnshire Hospitals NHS Trust* [2015] EWHC 923 (QB) contains a discussion of this issue with the Judge also accepting the argument that favourable economics, i.e. the award of substantial damages, can in itself enhance life expectancy.
- Uninjured LE 86.87 years
- 49% = 42.57 years of age.
- There will however be variances and subtleties in an individual case

Conclusion on severe TBI cases

- There may be considerable reduced life expectancy in Severe/catastrophic TBI cases
- The key factors are mobility and ability to feed.
- People may fall between groups.
- It is for the lawyers failing which the statisticians to help the clinicians
- The clinical view must come first
- If the clinicians cannot opine or need help then actuarial evidence may be needed.

Spinal cord injury: context

- Life expectancy following SCI has improved significantly since the 1950s
- But it still remains well below that of the general population
- Why is that important to PI lawyers?
  - Claimants
  - Defendants

SCI: causes of injury

Table 1 Demographic and injury characteristics by SCI period

	Decade of injury			
	1943–1969 (n = 1272)	1970–1989 (n = 1876)	1990–2010 (n = 2335)	Combined (n = 5483)
Aetiology (%)				
Traffic accident	46.9	49.6	43.1	46.1
Fall	30.5	29.4	33.2	31.3
Sport	6.4	13.2	14.8	12.3
Hit by object	10.8	4.9	2.1	5.1
Violence	4.9	2.4	4	3.7
Other aetiology	0.5	0.5	2.8	1.5

SCI: causes of death

Table 14–6 Standardized Mortality Ratios for Underlying Cause of Death among Persons with Spinal Cord Injuries Who Survive at Least 24 Hours Postinjury

Cause of Death	*Actual Deaths*	*Expected Deaths*	*SMR*
Septicemia	122	1.9	64.2
Cancer	71	82.0	0.9
Diseases of the Nervous System	30	5.1	5.9
Ischemic Heart Disease	91	78.4	1.2
Diseases of Pulmonary Circulation	113	2.4	47.1
Nonischemic Heart Disease	171	26.7	6.4
Cerebrovascular Disease	41	18.6	2.2
Diseases of Arteries	17	5.0	3.4
Pneumonia and Influenza	228	6.4	35.6
Other Respiratory Diseases	58	12.8	4.5
Diseases of the Digestive System	67	17.8	3.8
Diseases of the Urinary System	49	4.5	10.9
Symptoms and Ill-Defined Conditions	102	7.4	13.8
Unintentional Injuries	72	51.8	1.4
Suicide	80	16.6	4.8
Homicide and Legal Intervention	15	21.8	0.7
All Other External Causes	32	2.3	13.9
Residual	44	23.2	1.9
Unknown	198		

SCI: most common causes of death

- Pneumonia / other respiratory diseases
- Pulmonary embolus
- Disease of the urinary system
- Septicemia

SCI: life expectancy

- Long-term survival after traumatic spinal cord injury: a 70-year British study (G Savic, MJ DeVivo, HL Frankel, MA Jamous, BM Soni and S Charlifue) 2017
- Analyses long-term survival after SCI over a 70-year period, identifies mortality risk factors and estimates current life expectancy according to:
  - Gender
  - Age
  - Neurological grouping

Neurological groupings

- The data was analysed according to the following groupings:
  - those with a ventilator dependent SCI regardless of the level or grade of injury
  - those with a high tetraplegia C1–C4 and AIS/ Frankel grade A, B or C (C1–4 ABC)
  - those with a low tetraplegia C5–C8 and AIS/Frankel grade A, B or C (C5–8 ABC)
  - those with a paraplegia and AIS/Frankel grade A, B or C (para ABC)
  - those with an incomplete SCI of AIS/Frankel grade D regardless of the level of injury (all Ds)

2017 Savic: Table 3a

Table 3a Estimated current life expectancy for male first year survivors by age and neurological grouping, calculated using the logistic regression method, expressed in remaining years of life and as percentage of the mean life expectancy in the general population (England and Wales 2012–2014 period life tables)

	General population	*AIS/Frankel D*		*Para ABC*		*C5–8 ABC*		*C1–4 ABC*		*Ventilated*	
	Mean	*Mean*	*% General population*	*Mean*	*% General population*	*Mean*	*% General population*	*Mean*	*% General population*	*Mean*	*% General population*
	Years	*Years*	*%*	*Years*	*%*	*Years*	*%*	*Years*	*%*	*Years*	*%*
					MALE life expectancy						
Current age											
10	69.7	61.6	88.4	55.8	80.1	48.4	69.4	43.4	62.3	34.3	49.2
15	64.8	57	88	51.4	79.3	44.3	68.4	39.5	61	31	47.8
20	59.9	52.4	87.5	47	78.5	40.1	66.9	35.5	59.3	27.7	46.2
25	55	47.8	86.9	42.5	77.3	35.8	65.1	31.4	57.1	24	43.6
30	50.2	43.1	85.9	38	75.7	31.6	62.9	27.4	54.6	20.4	40.6
35	45.3	38.5	85	33.5	74	27.3	60.3	23.4	51.7	16.9	37.3
40	40.6	34.2	84.2	29.4	72.4	23.6	58.1	19.9	49	14.1	34.7
45	35.9	29.9	83.3	25.4	70.8	19.9	55.4	16.6	46.2	11.3	31.5
50	31.3	25.9	82.7	21.7	69.3	16.7	53.4	13.6	43.5	9.1	29.1
55	26.9	21.9	81.4	18	66.9	13.4	49.8	10.7	39.8	6.8	25.3
60	22.6	18.3	81	14.8	65.5	10.7	47.3	8.4	37.2	5.2	23
65	18.5	14.9	80.5	11.8	63.8	8.2	44.3	6.3	34.1	3.8	20.5
70	14.7	11.9	81	9.3	63.3	6.3	42.9	4.7	32	2.8	19
75	11.3	9.3	82.3	7.2	63.7	4.8	42.5	3.5	31	2.1	18.6
80	8.3	7	84.3	5.5	66.3	3.5	42.2	2.5	30.1	1.5	18.1

Abbreviation: AIS, American Spinal Injury Association (ASIA) Impairment Scale.

Approach to evaluating life expectancy

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King's Bench Walk

- Start with period life expectancy of the average male / female in the general population of same age
- Apply the percentage loss for the average SCI male / female of same age and same grade of SCI
- Consider where an individual falls relative to this average based on SCI and non-SCI factors

Period v cohort life expectancy

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- Period life expectancy
  - Does not factor in improvement in life expectancy with time
  - So could lead to underestimation

- Cohort life expectancy
  - Does factor in future improvements in life expectancy
  - BUT, life expectancy after traumatic spinal cord injury has been improving at a slower rate than that of the general population [Savic et al. 2017]
  - So could lead to overestimation

Trends in life expectancy

12 King's Bench Walk

Table 4 Trends in life expectancy by study decades for a 20-year-old male first year survivor, expressed in remaining years of life and as percentage of the mean life expectancy in the general population for England and Wales for the relevant time period (decade of observation)

	General population	*AIS/Frankel D*		*Para ABC*		*C5–8 ABC*		*C1–4 ABC*		*Ventilated*	
	Mean	*Mean*	*% General population*	*Mean*	*% General population*	*Mean*	*% General population*	*Mean*	*% General population*	*Mean*	*% General population*
	Years	*Years*	*%*	*Years*	*%*	*Years*	*%*	*Years*	*%*	*Years*	*%*
					20-year-old male life expectancy						
Study period											
1943–1949	48.8	30.5	62.5	25.5	52.3	19.7	40.4	16.2	33.2	10.7	21.9
1950–1959	50	36	72	30.8	61.6	24.6	49.2	20.7	41.4	14.4	28.8
1960–1969	50.8	43.2	85	37.7	74.2	31.1	61.2	26.8	52.8	19.7	38.8
1970–1979	51.7	44.9	86.8	39.4	76.2	32.7	63.2	28.5	55.1	21.1	40.8
1980–1989	53.2	49	92.1	43.6	82	36.8	69.2	32.3	60.7	24.7	46.4
1990–1999	55.2	50.3	91.1	45	81.5	38.2	69.2	33.7	61.1	25.9	46.9
2000–2009	57.6	50.8	88.2	45.3	78.6	38.4	66.7	33.9	58.9	26.1	45.3
2010–2014	59.8	52.4	87.6	47	78.6	40.1	67.1	35.5	59.4	27.7	46.3

Abbreviation: AIS, American Spinal Injury Association (ASIA) Impairment Scale.

Non-SCI factors

- Smoking
- BMI
- Blood pressure
- Physical activity
- Alcohol / substance history
- Family history
- Socio-economic class

SCI factors

- Years since injury
- Level / grade of SCI
- Family support
- Compensation
- Medical history post-SCI

Post-injury survival

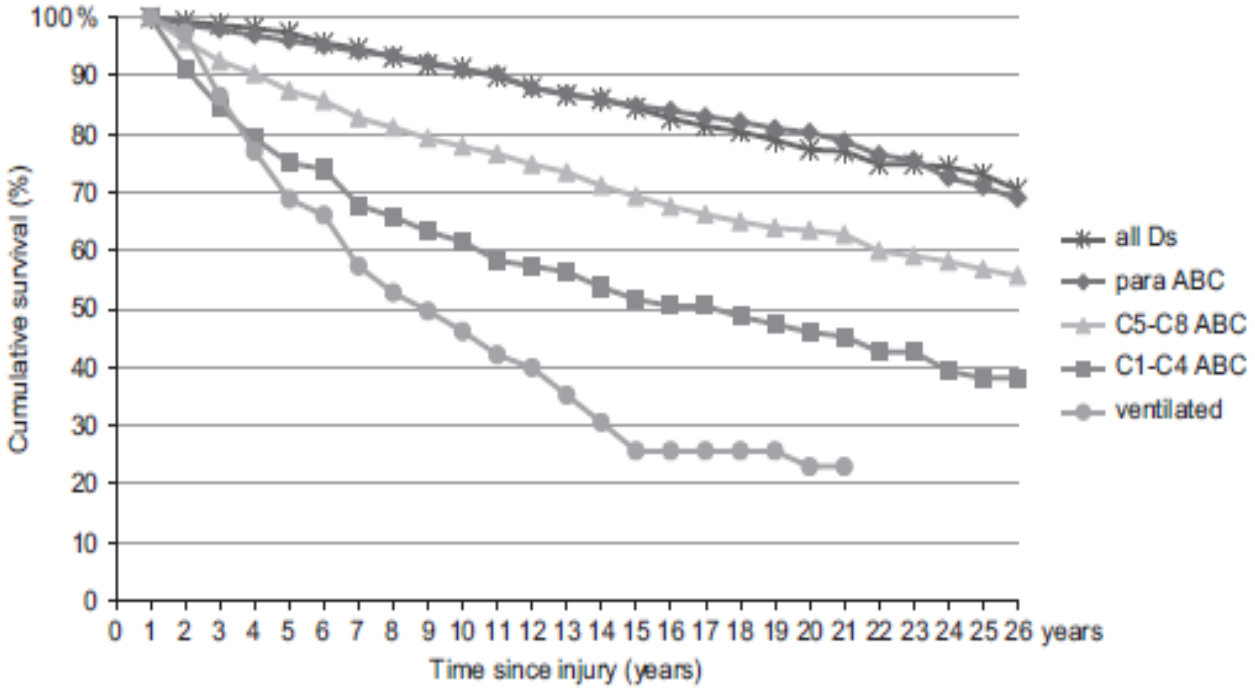

Figure 1 Cumulative 25 year survival curve versus time since injury for 1980–2014 study period by five neurological groups. A full color version of this figure is available at the *Spinal Cord* journal online.

The literature / data

- UK evidence where available
  - Then countries with similar systems for hospital and community care e.g. Australia
  - Only use USA data if only data available as health and community care so different
- 2017 Long-term survival after traumatic spinal cord injury: a 70-year British study (G Savic, MJ DeVivo, HL Frankel, MA Jamous, BM Soni and S Charlifue)
- 2018 Comparison of statistical methods for calculating life expectancy after spinal cord injury
- 1995 Spinal Cord Injury: Clinical Outcomes from the Model Systems: Chapter 14 Long-Term Survival and Causes of Death (DeVivo, Stover)

12
King's Bench Walk

THE END