



CHAPTER 3

Mortality in End Stage Kidney Disease

Reporting the survival of patients on renal replacement therapy in Australia and New Zealand and causes of death in this population.

Contents

Suggested citation.....	2
Survival.....	3
Cause of Death	7
Withdrawal from Renal Replacement Therapy.....	8
References	9

Suggested citation

ANZDATA Registry. 42nd Report, Chapter 3: Mortality in End Stage Kidney Disease. Australia and New Zealand Dialysis and Transplant Registry, Adelaide, Australia. 2019. Available at:
<http://www.anzdata.org.au>

Survival

Overall survival for patients who started renal replacement therapy (RRT) in the period 2009-2018 is shown in figure 3.1 using the Kaplan-Meier method to calculate survival curves. Table 3.1 shows the survival at 1, 2 and 5 years for incident renal replacement therapy patients by age group of the same period. These data are not censored at transplantation.

Figure 3.1.1 - Survival on Renal Replacement Therapy - Australia 2009-2018

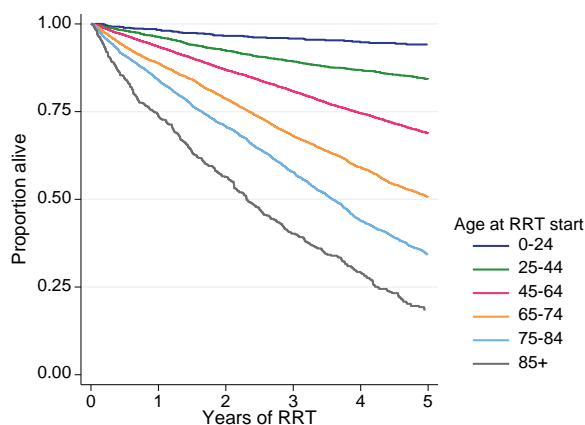


Figure 3.1.2 - Survival on Renal Replacement Therapy - New Zealand 2009-2018

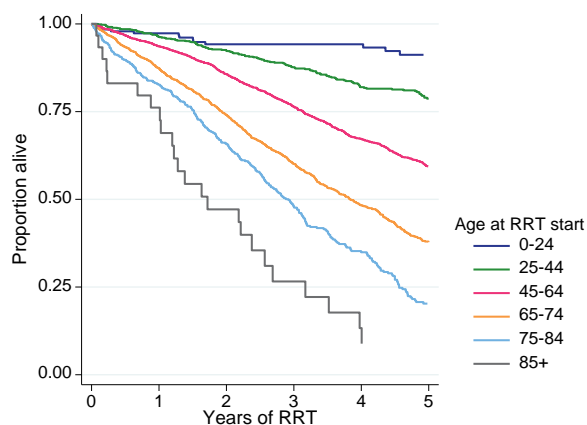


Table 3.1 Survival (95% CI) Among People Who Commenced Renal Replacement Therapy 2009-2018

Age at RRT start	Years	Australia	New Zealand
0-24	1	98 (97, 99)	97 (94, 99)
	2	97 (95, 98)	94 (89, 97)
	5	94 (92, 96)	91 (85, 95)
25-44	1	96 (96, 97)	96 (95, 97)
	2	92 (91, 93)	92 (90, 94)
	5	84 (83, 86)	79 (75, 82)
45-64	1	94 (93, 94)	94 (93, 95)
	2	87 (86, 88)	86 (84, 87)
	5	69 (68, 70)	59 (57, 62)
65-74	1	89 (88, 90)	87 (85, 89)
	2	79 (78, 80)	74 (71, 77)
	5	51 (49, 52)	38 (34, 41)
75-84	1	84 (83, 85)	83 (79, 86)
	2	71 (69, 72)	66 (61, 70)
	5	34 (32, 36)	20 (16, 25)
85+	1	74 (70, 77)	76 (56, 88)
	2	56 (52, 60)	47 (28, 64)
	5	18 (15, 22)	9 (2, 24)

To allow for international comparisons, survival of non-indigenous patients who commenced RRT with dialysis in 2009-2018, censored at transplantation, is shown in table 3.2. The Indigenous populations of Australia and New Zealand experience a unique burden of end stage kidney disease that is explored in further detail in Chapter 10 and Chapter 11.

Table 3.2 Survival (95% CI) Among Non-Indigenous People Who Commenced Dialysis 2009-2018

Age at start	Years	Australia	New Zealand
0-24	1	98 (96, 99)	97 (89, 99)
	2	96 (93, 98)	95 (83, 98)
	5	88 (80, 93)	87 (62, 96)
25-44	1	97 (96, 97)	97 (94, 98)
	2	92 (91, 94)	92 (88, 95)
	5	76 (73, 79)	76 (67, 83)
45-64	1	93 (92, 94)	93 (91, 94)
	2	85 (85, 86)	84 (82, 87)
	5	60 (59, 62)	52 (47, 56)
65-74	1	89 (88, 89)	88 (85, 90)
	2	78 (77, 79)	74 (71, 78)
	5	48 (47, 50)	37 (32, 42)
75-84	1	84 (83, 85)	81 (77, 85)
	2	71 (69, 72)	64 (58, 69)
	5	34 (32, 36)	19 (14, 24)
85+	1	74 (70, 77)	73 (52, 86)
	2	56 (52, 60)	45 (25, 63)
	5	18 (15, 22)	5 (0, 21)

Unadjusted death rates for dialysis and transplantation during 2018 are shown in table 3.3 for various groups. This table includes all episodes of dialysis and transplantation (i.e. analyses are not censored at first transplant date), and deaths are attributed to the modality in use at the time of death. For this table, episodes of treatment include all people treated in 2018, regardless of year of first treatment.

Mortality rates are generally higher with older age, diabetes and coronary artery disease. The comparison between indigenous rates (and some other comparisons) will be subject to several confounders. Comparisons of mortality rates with the general population (stratified by gender) are shown in figures 3.2 and 3.3.

Population and death estimates for Australia and New Zealand used for the calculation of mortality rates in this chapter were sourced from the Australian Bureau of Statistics (2018)^{1,2} and Stats NZ (2018)^{3,4}.

Table 3.3 Death Rates per 100 patient-years during Renal Replacement Therapy - 2018

Category	Level	Dialysis			Transplant		
		Rate	Lower CI	Upper CI	Rate	Lower CI	Upper CI
Country	Australia	13.7	13.1	14.3	2.0	1.7	2.2
	New Zealand	14.4	13.1	15.9	2.7	2.0	3.5
Age	<25	1.5	0.4	3.9	0.2	0.0	0.8
	25-44	5.4	4.4	6.5	0.4	0.2	0.7
	45-64	10.1	9.3	10.9	1.4	1.1	1.7
	65-84	17.9	17.0	18.9	5.1	4.4	5.9
	85+	38.8	33.7	44.4	6.4	0.8	23.0
Diabetes status	Non-diabetic	11.9	11.1	12.7	1.5	1.3	1.8
	Type 1 diabetes	16.2	13.3	19.6	2.2	1.3	3.5
	Type 2 diabetes	15.5	14.7	16.4	3.7	3.1	4.5
Coronary disease	No	9.7	9.0	10.3	1.3	1.1	1.5
	Yes	19.2	18.2	20.3	4.9	4.1	5.7
Ethnicity	Aus Non-Indigenous	14.5	13.8	15.2	1.9	1.7	2.2
	NZ Non-Indigenous	15.1	12.9	17.6	2.7	2.0	3.7
	Aus Indigenous	11.3	9.9	12.9	2.5	1.0	5.1
	Aus Māori	9.7	5.3	16.2	3.1	0.4	11.2
	NZ Māori	17.5	14.9	20.4	2.8	1.0	6.2
	Aus Pacific	6.9	4.8	9.6	3.5	1.1	8.1
	NZ Pacific	9.8	7.7	12.3	1.8	0.4	5.1

Figure 3.2.1 - Prevalent Dialysis Mortality - Australian Patients vs General Population

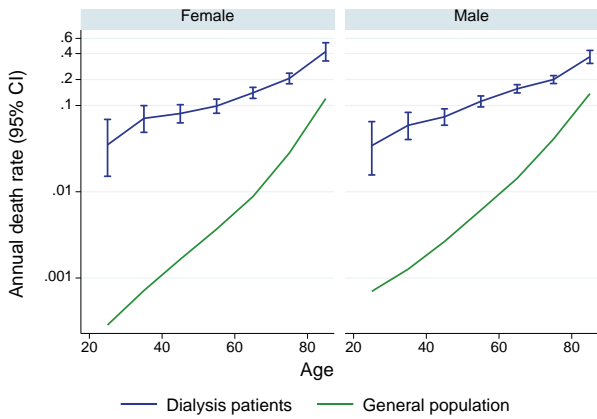


Figure 3.2.2 - Prevalent Transplant Mortality - Australian Patients vs General Population

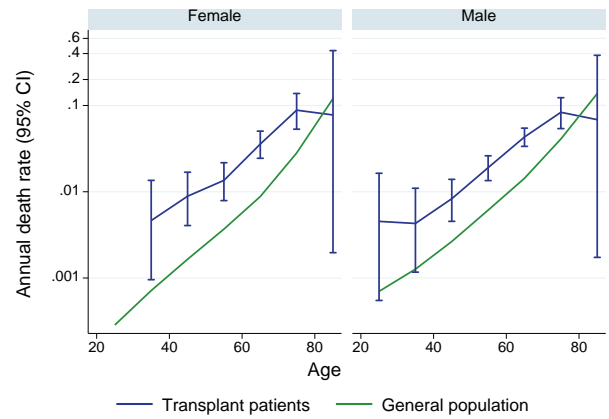


Figure 3.3.1 - Prevalent Dialysis Mortality - New Zealand Patients vs General Population

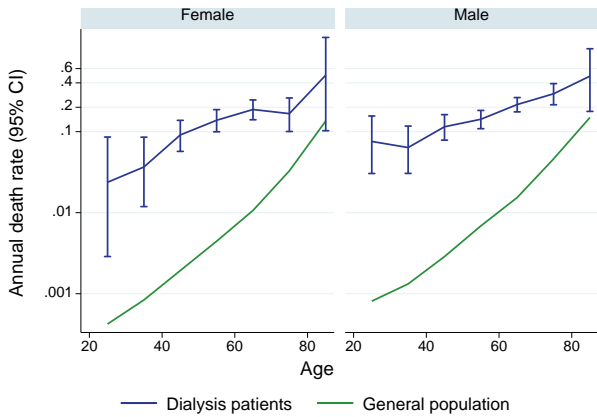
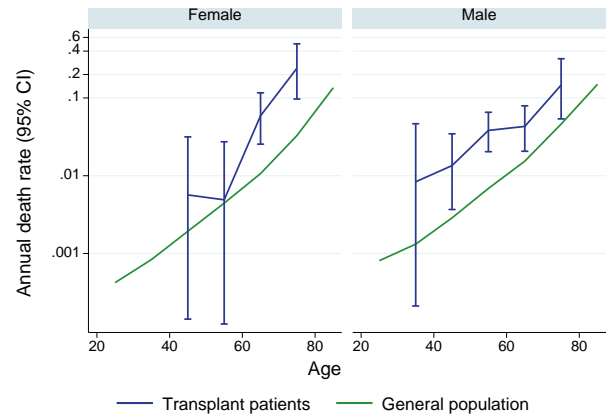


Figure 3.3.2 - Prevalent Transplant Mortality - New Zealand Patients vs General Population



The evolution of mortality rates over time is shown in figure 3.4. In Australia, there has been a steady improvement in first-year mortality. For New Zealand, the trends are less clear, in part reflecting the lower precision with smaller numbers. Note the different y axis scales in each graph.

Figure 3.4.1 - Dialysis Mortality Rates in Australia - 2009-2018

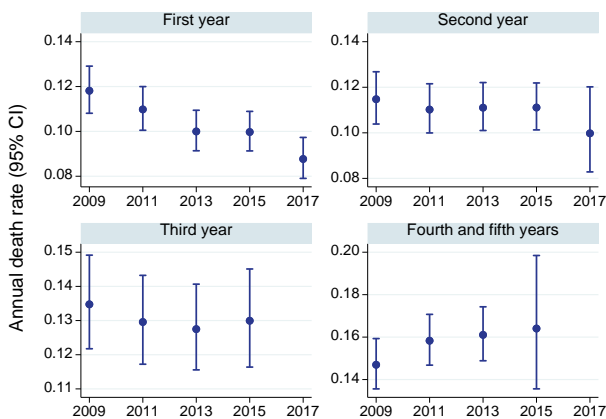
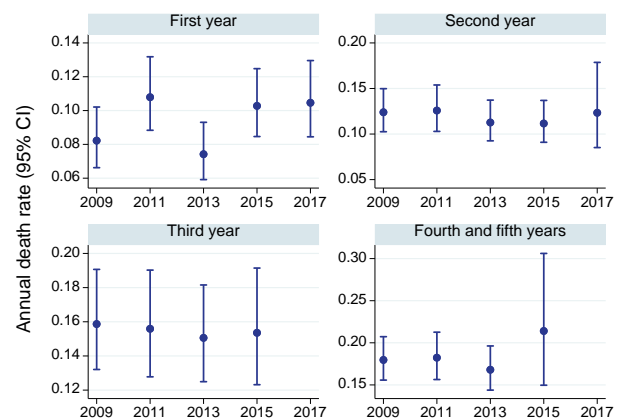


Figure 3.4.2 - Dialysis Mortality Rates in New Zealand - 2009-2018



Another perspective on survival during dialysis is presented in table 3.4. Median survival is the time to which 50% of people can expect to survive. Table 3.5 shows the median survival of older people who started dialysis treatment, by various categories. These survival data are censored at the time of transplantation, and include those who started dialysis in the period 2009-2018. In addition to the median, the 25th and 75th centiles are included to give an indication of the range of observed survivals. Some figures are not observed - for example if half of a cohort have not yet died it is not possible to observe a median survival. These occurrences are indicated by * in the tables. The survival times amongst younger people are likely to be strongly affected by the selection bias (fitter people will be progressively transplanted and not be included in the analysis from that point).

Table 3.4 Median Survival on Dialysis by Age 2009-2018

Country	Age at start	Median (25th and 75th centiles), years
Australia	0-24	* (7.1, *)
	25-44	9.4 (5.2, 10.0)
	45-64	6.3 (3.3, *)
	65-74	4.8 (2.3, 8.0)
	75-84	3.6 (1.6, 6.0)
	85+	2.3 (0.9, 4.3)
New Zealand	0-24	* (*, *)
	25-44	7.9 (4.9, *)
	45-64	5.4 (2.9, 9.1)
	65-74	3.7 (1.9, 6.2)
	75-84	2.9 (1.5, 4.6)
	85+	1.7 (1.0, 3.2)

Table 3.5 Survival on Dialysis by Age and Comorbidity Amongst Older People; Years (Median, 25th and 75th centiles) 2009-2018

Age at Start	Any Vascular Disease	Diabetes	Australia	New Zealand
65-69	No	No	7.4 (3.1, *)	4.6 (2.7, 7.4)
	No	Yes	5.6 (3.3, 8.2)	4.6 (2.5, 6.9)
	Yes	No	4.3 (1.7, 7.7)	4.2 (1.9, 6.4)
	Yes	Yes	4.3 (2.3, 7.2)	2.9 (1.6, 5.3)
70-74	No	No	6.2 (2.7, *)	4.7 (2.2, 7.0)
	No	Yes	5.4 (2.6, *)	5.1 (2.6, 7.0)
	Yes	No	4.2 (1.9, 7.8)	2.7 (1.5, 4.6)
	Yes	Yes	3.8 (1.8, 6.3)	2.9 (1.7, 5.4)
75-79	No	No	4.8 (2.6, 8.0)	4.0 (2.1, 5.3)
	No	Yes	4.4 (2.5, 6.8)	3.5 (2.7, 4.8)
	Yes	No	3.7 (1.7, 6.0)	2.4 (1.2, 4.5)
	Yes	Yes	3.3 (1.5, 5.8)	2.8 (1.3, 4.3)
80-84	No	No	3.6 (1.8, 6.2)	2.7 (1.5, 4.1)
	No	Yes	3.2 (1.5, 5.2)	3.2 (2.2, 5.2)
	Yes	No	3.2 (1.3, 5.8)	2.2 (1.0, 4.4)
	Yes	Yes	2.9 (1.3, 4.7)	2.8 (1.4, 5.5)
85+	No	No	3.2 (1.4, 4.7)	2.4 (1.0, 2.6)
	No	Yes	2.4 (1.3, 4.7)	1.0 (0.9, 1.6)
	Yes	No	2.1 (0.8, 4.0)	1.4 (0.7, 3.2)
	Yes	Yes	2.3 (0.9, 4.2)	2.7 (1.7, 5.0)

Cause of Death

The focus of this section is on deaths reported during 2018. The cause of death reported to ANZDATA is not necessarily the same as that reported on the death certificate⁵. ANZDATA specifically records a range of reasons for “withdrawal from treatment”. The cause of death in these instances is a person’s underlying renal failure, however, these data help to understand the reasons why individuals choose to cease renal replacement therapy. This often relates to an underlying comorbidity and is further explored in table 3.7.

For the purposes of these analyses, deaths were attributed to the modality in use at the time of death. In both Australia and New Zealand, a greater proportion of deaths due to cancer is seen among patients with kidney transplants, whereas among dialysis patients, deaths to cardiovascular causes and withdrawal from treatment predominate (figure 3.5). Figure 3.6 and table 3.6 show the relationship between cause of death and age at death.

Figure 3.5 - Cause of Death by Modality - Deaths Occurring During 2018

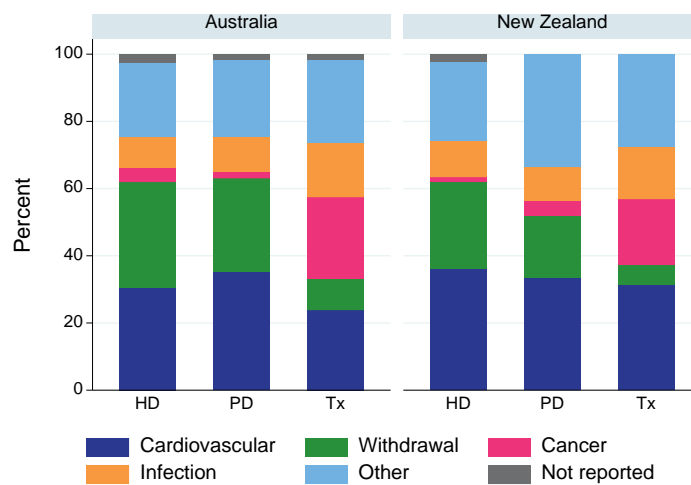


Figure 3.6 - Cause of Death by Modality and Age at Death - Deaths Occurring During 2018

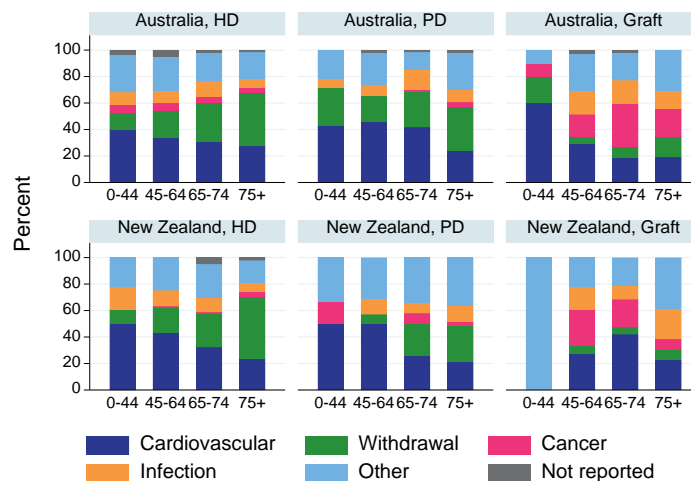


Table 3.6 Cause of Death by Modality and Age at Death - Deaths Occurring During 2018

Country	Cause of Death	Haemodialysis					Peritoneal Dialysis					Graft				
		0-44	45-54	65-74	75+	Total	0-44	45-54	65-74	75+	Total	0-44	45-54	65-74	75+	Total
Australia	Cardiovascular	25	132	133	189	479	6	28	28	26	88	6	21	19	10	56
	Withdrawal	8	81	127	272	488	4	12	18	35	69	2	4	8	8	22
	Cancer	4	21	20	24	69	0	0	1	4	5	1	12	33	11	57
	Infection	6	36	49	49	140	1	5	10	10	26	0	13	18	7	38
	Other	18	102	92	134	346	3	15	9	30	57	1	20	21	16	58
	Not reported	2	18	9	10	39	0	1	1	2	4	0	2	2	0	4
	Total		63	390	430	678	1561	14	61	67	107	249	10	72	101	52
New Zealand	Cardiovascular	9	47	33	11	100	3	21	13	7	44	0	5	8	3	16
	Withdrawal	2	21	26	22	71	0	3	12	9	24	0	1	1	1	3
	Cancer	0	1	1	2	4	1	0	4	1	6	0	5	4	1	10
	Infection	3	13	11	3	30	0	5	4	4	13	0	3	2	3	8
	Other	4	27	26	8	65	2	13	17	12	44	1	4	4	5	14
	Not reported	0	0	5	1	6	0	0	0	0	0	0	0	0	0	0
	Total		18	109	102	47	276	6	42	50	33	131	1	18	19	13

Withdrawal from Renal Replacement Therapy

During 2018 there were 579 deaths in Australia and 98 in New Zealand attributed to withdrawal from therapy (table 3.7). The vast majority of these were among patients receiving dialysis therapy. “Psychosocial” reasons were the most commonly cited reasons for withdrawal. However, the coding of these categories is clearly somewhat subjective.

Table 3.8 shows a breakdown of patients who withdrew and died in 2018 by age and duration of RRT.

Table 3.7 Reason for Withdrawal from Renal Replacement Therapy - 2018

Country	Reason for withdrawal	HD	PD	Graft
Australia	Withdrawal-Psycho Social Reasons	166	27	4
	Patient Refused Treatment (Specify)	13	1	1
	Withdrawal-Cardiovascular Comorbid Conditions	122	12	4
	Withdrawal-Cerebrovascular Comorbid Conditions	37	6	3
	Withdrawal-Peripheral Vascular Comorbid Conditions	39	9	2
	Withdrawal-Malignancy	92	9	8
	Withdrawal-Dialysis Access Difficulties	19	5	0
New Zealand	Withdrawal-Psycho Social Reasons	13	7	0
	Patient Refused Treatment (Specify)	3	3	0
	Withdrawal-Cardiovascular Comorbid Conditions	30	6	1
	Withdrawal-Cerebrovascular Comorbid Conditions	11	2	0
	Withdrawal-Peripheral Vascular Comorbid Conditions	7	5	0
	Withdrawal-Malignancy	6	1	2
	Withdrawal-Dialysis Access Difficulties	1	0	0

Table 3.8 Time from Renal Replacement Therapy Start to Death, in Patients Who Withdrew and Died in 2018

Time from first RRT (years)	Australia					New Zealand				
	0-44	45-54	65-74	75+	Total	0-44	45-54	65-74	75+	Total
<1 year	1	16	26	29	72	0	1	6	4	11
1-2 years	3	13	23	23	62	0	7	2	1	10
2-5 years	5	32	38	97	172	1	9	15	13	38
5+ years	5	36	66	166	273	1	8	16	14	39
Total	14	97	153	315	579	2	25	39	32	98

References

¹ Australian Bureau of Statistics, 2018, Australian Demographic Statistics, Jun 2018, time series spreadsheets, cat. no. 3101.0, viewed 20 Dec 2018, <http://www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/3101.0Jun%202018?OpenDocument>

² Australian Bureau of Statistics, 2018, Deaths, Australia 2018, cat. no. 3302.0, viewed 2 Oct 2019, <http://www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/3302.02018?OpenDocument>

³ This work is based on/includes Stats NZ's data which are licensed by Stats NZ for re-use under the Creative Commons Attribution 4.0 International licence. Stats NZ, 2018, Estimated Resident Population by Age and Sex (1991+) (Annual-Jun), NZ Infoshare, viewed 20 Dec 2018, <http://archive.stats.govt.nz/infoshare/>

⁴ This work is based on/includes Stats NZ's data which are licensed by Stats NZ for re-use under the Creative Commons Attribution 4.0 International licence. Stats NZ, 2018, Deaths by Age and Sex (Annual-Dec), NZ Infoshare, viewed 2 Oct 2019, <http://archive.stats.govt.nz/infoshare/>

⁵ Sypek MP, Dansie KB, Clayton P, Webster AC, McDonald S. Comparison of cause of death between ANZDATA and the Australian National Death Index. *Nephrology*. 2018 Mar 1. doi: 10.1111/nep.13250.