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[SUMMARY REPORT
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THE IMPACT ON HOSPITAL UTILISATION AND COSTS OF PROACTIVE PLANNING FOR CONSERVATIVE TREATMENT WITHOUT DIALYSIS IN SELECTED PATIENTS WITH ADVANCED KIDNEY DISEASE

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The impact of hospital utilisation and costs of proactive planning for conservative treatment without dialysis in selected patients with advanced kidney disease.

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Aim

To compare, in patients with advanced chronic kidney disease (CKD), characteristics, hospital utilisation and costs in those with formal planning for renal supportive care (RSC) without renal replacement therapy (RRT) with those for whom RRT is planned ("for RRT") when the patient reaches end stage kidney failure.

Methods

The records of selected patients with CKD seen in the renal specialty clinics of the Royal Brisbane and Women's Hospital (RBWH) and the Logan Hospital in Brisbane, who had enrolled, with informed consent, in the registry of CKD.Queensland (CKD.QLD), before April 2013 for the RBWH cohorts, and before June 2013 for the Logan cohort. Their records were reviewed for formal assignment of a renal supportive care plan (RSC-without RRT), or an ongoing assumption of an intended or actualised RRT pathway ("for-RRT"). Patients selected for record review were those with Stage 4 or 5 CKD at consent to CKD.QLD or at last review, all those in acknowledged palliative care streams, and those who had died or started RRT whilst under surveillance. "For-RRT" patients were characterised at baseline and then followed for admissions to their specified hospitals. The number of admission episodes, length of stay, costs and associated DRGs were documented, until discharge, death, RRT or censor date in April 2014 for the RBWH cohort and June 2014 for the Logan cohort. The specific censor dates were chosen to accommodate a minimum potential observation period of one year from the date of enrolment of the last patient in the study cohorts at each institution. Total costs were estimated from the daily costs of the individual admitting units, as specified by the hospitals, which purportedly accommodate costs of procedures, investigations and medicines. In all groups hospital resource utilisation was calculated with inclusion, and again with exclusion of, dialysis episodes, if these ultimately occurred. Subjects with assignment of an RSC plan were followed over two intervals- from date of consent to date of an RSC assignment, (not yet analysed) and from the date of RSC assignment until discharge, death or censor dates of April 2014 and June 2014 respectively. Some group-based outcomes (rates of RRT, death, and hospital admission, LOS and costs) were expressed as rates per 100 person years of follow up, as well as crude numbers.

Results

The patients

RBWH. Of 1150 CKD patients in the RBWH cohort, 567 patients qualified for review. 126 were assigned an RSC pathway, with only 82 person years of follow up, whilst 346 patients were presumed "for-RRT", with 585 years of follow up. The RSC patients were older than the "for RRT" group (median 81 vs 67 years at consent), more often had a primary renal diagnosis of renalvascular disease (49 vs 36%), and comorbidities of coronary heart disease (62% vs 42%) and cognitive impairment/dementia (16.7% vs 3.1%).

Logan. Of 1,017 CKD patients enrolled in CKD.QLD at Logan, 319 qualified for review. Of these, 84 of these were assigned an RSC pathway, with only 64 person years of follow up. 171 were "for RRT" and they had 274 person years of follow up. The RSC group were older than the "for-RRT" group (median 81 vs 66.6 years at consent), and more often had renalvascular disease (43% vs 25%). They were marginally less likely to have diabetes 56% vs 64%, but more likely to have coronary heart disease (58% vs 41%) and cognitive impairment/dementia (11.1% vs 1.2%).

Incidence of RRT

RBWH. Among the 346 "for RRT" subjects, who had 585 years of follow up, 47 actually started RRT (13.6%) within the study interval (4 later died), with an incidence rate for RRT 8.0 per 100 person years by the censor date. In contrast, and compatible with their management plans, there was little dialysis among the RSC group, representing acute dialyses only, usually for symptom management**.**

Logan. Among the 171 "for-RRT" people, over 274 person years of follow up, 31 (18.1%) started dialysis, with an incidence rate of 11.3 per 100 person years. There were minimal admissions for dialysis in the RSC group.

Deaths

RBWH. Among the 349 patients in the 'for-RRT" group, (with 585 years follow up), 47 died, (13.5%), with a total death rate of incidence rate of 8.0 per 100 person years (identical to the incidence rate of RRT). Of these 47, 43 died before RRT was started, and 4 after RRT had started. Among the 126 people in the RSC group (with 82 person years follow up), 65 had died (51.6%) by the censor date, with rate of 79.3 per 100 person years (ten times the death rate of the "for-RRT" group, without age adjustment).

Logan. Among the 171 "for-RRT" people, over 274 years of follow up, 20 died before starting dialysis (11.7%), and two died after starting dialysis. The total incidence rate of death in that group was 8.0 per 100 person years. Among the 84 in the RSC group, with only 64 years of follow up in total, 35 had died (41%) by the censor date, with rate of 52.2 per 100 person years (6.5 times the death rate of the "for-RRT" group, without age adjustment).

Hospital admissions.

Percent hospitalised. At RBWH, a higher proportion of "for RRT" then RSC people were hospitalised (50.5% vs 36.5%), for indications including dialysis). At Logan as well, a higher proportion of "for-RRT" people than the RSC group were hospitalised (73.1% vs 60.7%) for indications including dialysis, although both proportions were higher than at RBWH

.

Hospital admissions, LOS and costs.

Figures 1, 2 and 3, and Tables 1, 2 and 3 show that, in both RBWH and Logan CKD patients, there were consistent trends for number of hospital admissions, total LOS and total costs in decreasing rank order of "for-RRT" patients with inclusion of dialysis procedures where these occurred, for-RRT patients excluding costs of dialyses where these occurred, RSC patients ("not for RRT") and finally, for patients who were discharged or transferred .

In both settings, the slightly lower costs for the "for-RRT" patients, excluding dialysis, merely reflect the subtraction of dialysis episodes, where these ultimately occurred, from the total admissions.

At RBWH, the costs for the RSC patients (after their RSC decision) was only one quarter (24.6%) of the costs of the "for-RRT" patients and the mean costs per RSC patient was 67% of the costs of the "for-RRT" patients. However, the number of RSC patients was smaller (n=126), and their follow up was very limited (80 person years), so that the time-adjusted costs of the RSC patients (per 100 person years) was the highest of all groups, and 82% higher than for the "for-RRT" group.

At Logan, the costs for the RSC patients (after their RSC decision) was 34% of the costs of the "for-RRT" group, and the mean costs per patient was 69% of the mean costs of the "for-RRT" patients. However, the number of RSC patients was smaller (84 persons) and their follow up period was small (64 person years), so that the time-adjusted costs of the RSC patients (per 100 person years) was the highest of any group, and was 40% higher than that for the "for-RRT" patients.

Death vs Survival (until censor date) and hospital costs

As shown in Figure 4A and 4B, and Table 4A and 4B, hospital costs per 100 person years were greater for patients who died for than those who were still alive at the censor date. This applied for both "for-RRT" patients, and for RSC patient**s.**

At RBWH, the costs of "for –RRT" patients who died were $1,094,453 per 100 person years, and $267,532 per 100 person years for those that were still alive at the censor date. For the RSC patients, those figures were $987,550 vs 365,065 per 100 person years respectively.

At Logan, the costs of "for –RRT" patients who died were $5,299,043 per 100 person years, and $676,776 per 100 person years for those that were still alive at the censor date. For the RSC patients, those figures were $6,357,785 vs $477,749 per 100 person years respectively. The very high value of the figures for those who died are driven in large part by the short period of follow up in the deceased group, which was only 15.2 person years for the "for-RRT" group and 9.8 person years for the RSC group respectively.

DRGs for hospital admissions.

At RBWH, the leading DRGs for hospital episodes of the "for-RRT" group) were, in decreasing rank order, metabolic disorders, hemodialysis, red cell disorders (anaemia-related) and retinal procedures. For the RSC group, the overwhelmingly leading DRGs group were red cell disorders, followed by miscellaneous conditions and procedures not necessarily related to renal disease.

At Logan, the leading DRGs for the "for-RRT" group were overwhelmingly hemodialysis and peritoneal dialysis, with some admissions for anaemia-related conditions, and other miscellanies. For the RSC group, the leading DRGs were chest pain, heart failure, kidney failure with catastrophic manifestations and anaemia-related. The serious nature of the first three suggest resource intensive admissions which are feeding into the high hospital costs of the RSC group.

Discussion

The "for-RRT" groups at RBWH and Logan had not dissimilar incidence rates of RT and similar death rates. Their hospital costs per 100 person years, with dialysis and without dialysis, were not very different. The proportions who died before institution of RRT were similar and only a very few died in both settings within a years of starting RRT.

The separate calculations in "for-RRT" patients including and then excluding admissions for dialysis, were applied for potential evaluation against data from other settings, where dialysis is not performed as a hospital procedure. There were 280 fewer admissions at RBWH and 380 fewer at Logan when dialyses were thus excluded, and the costs were accordingly reduced. For maintenance haemodialysis, which is performed as a single day procedure, this amounts to savings of about $794 per dialysis episode.

At both hospitals, among people in the "for-RRT" streams, as many people died of non-renal causes before reaching end stage kidney failure as those who ultimately commenced RRT. This is not widely appreciated, but is compatible with published literature and confirms the high risk state for non-renal deaths associated with advanced CKD. The low death rate thus far among people who started RRT, confirms that RRT not only averts death from renal failure, but probably delays death from nonrenal causes as well.

At RBWH and Logan, the total admissions, LOS and costs, as well as the average (per person) costs were lower in the RSC group than the "for-RRT group". However, when adjusted for the very short time of follow up, the resource consumption of the RSC group was considerably higher than the "for-RRT" group per 100 person years of follow up.

Those who died had shorter but more resource-intensive course in terms of hospital admissions and costs. At the RBWH, there was some savings in terms of dialysis avoided among those who died in the "for-RRT" group. However, due to short period of follow up, the costs per 100 person years were much higher in those who died. In the RSC stream the total costs of those who died, as well as the costs per 100 person years, are considerably higher than for survivors. At Logan, the time adjusted costs of those who died were much higher both for "for-RRT" patients and for RSC patients than for those who survived to the censor date.

There are many limitations to this summary report, the analyses and interpretations.

- We did not try to interpret the outcomes of the discharge/transfer group, in view of their heterogeneity, their care outside the hospital service areas, and the gaps in continuity of their follow-up data.
- All dialyses were considered elective-part-or-a "for-RRT" plan. In fact, some acute dialyses were done to stabilise a situation and allow more deliberate consideration of prognosis and options or to manage and acute kidney failure event.
- We need more detailed understanding of the causes, procedures and diagnoses associated with admissions, the spectrum of the admitting units, their resource consumption and their potential avoidability. This might involve some individual record review.

- A matter of some importance is that the period of follow up, which is limited by patients' dates of consent to CKD.QLD and the censor date, is relatively short. Already, in May 2015, we have an additional year of follow up, and can repeat the study at intervals. As subjects lose renal function, the number of people on RSC pathways in this study cohort will increase, and additional people in the broader CKD cohorts at these hospitals will become candidates for discussions of treatment pathways as they approach end stage kidney failure.

  Serious limitations are imposed by the RSC definition and its timing. The costs of people in the RSC stream whose RSC decisions antedated the date of consent to CKD.QLD are potentially underestimated. The very short survival interval for some people in the RSC stream who made their RSC decisions close to time of death inflates the time-adjusted resource consumption and death rates in that stream. We anticipate that patients with a considered opportunity and choice for RSC, prior to any urgent requirement at end of (renal) life, will be the ones with the greatest benefit in terms of minimised hospitalisations.

  Moreover, we have not described resource consumption in RSC patients before they made their RSC decisions, and have not done cross-over comparisons. If patients were potential candidates for RRT before they made their RSC decision, our failure to include the earlier part of their course in the analysis misrepresents total costs and time-averaged costs in the "for-RRT" stream.
- We have not performed a matched pair analyses of people on "for-RRT" and RSC pathways, due to the 15 years age difference, the lack of a frailty or functionality index, and inability to match for dementia/cognitive impairment (very low rates amongst "for-RRT" people).
- An intended evaluation of "futile dialysis" (death of a patient occurring within 6 months or a year of starting dialysis) was postponed until we have further follow-up. On current data, this seems uncommon: only 4 of the 47 RBWH people who started dialysis died within a year (and only two within six months), while only 2 of 22 did so at Logan.
- Some of these matters will be pursued in ongoing studies.

Figures and tables

Figure 1.

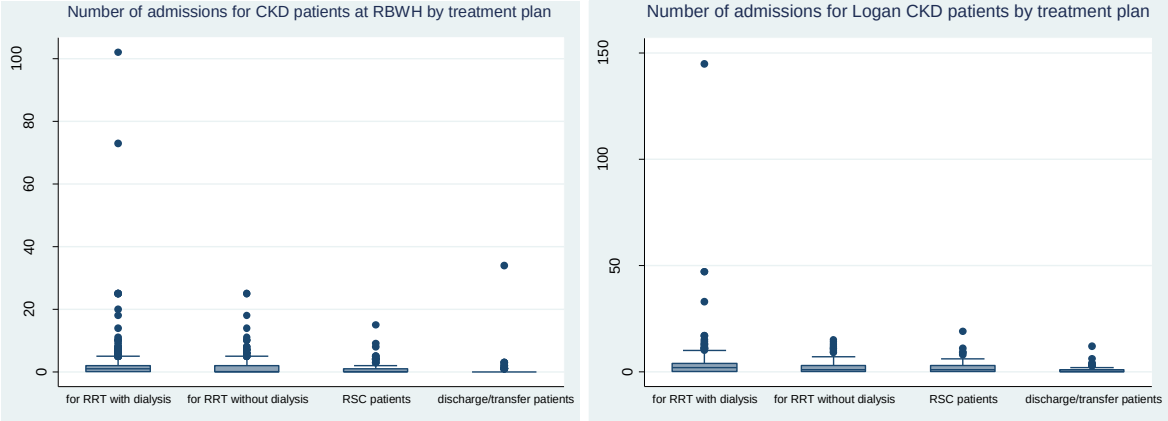

Figure 2

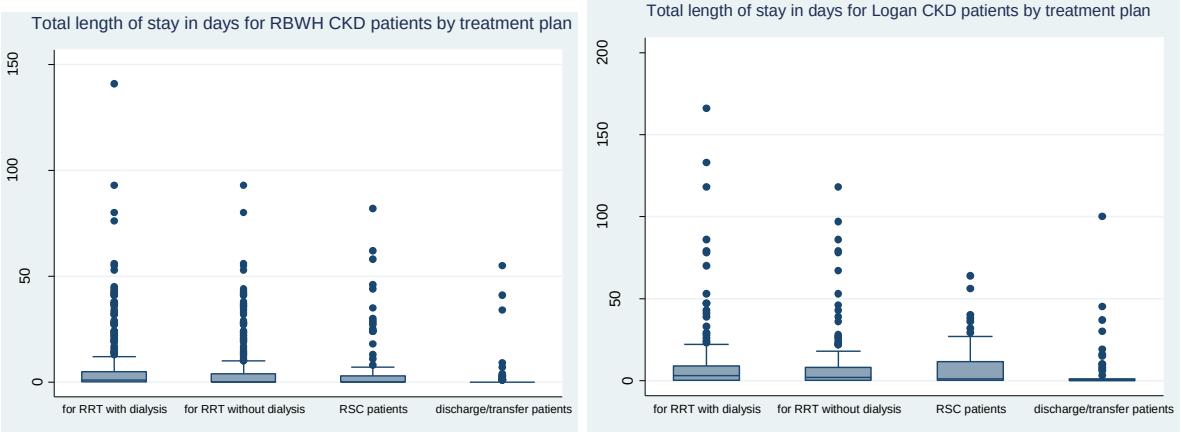

Figure 3

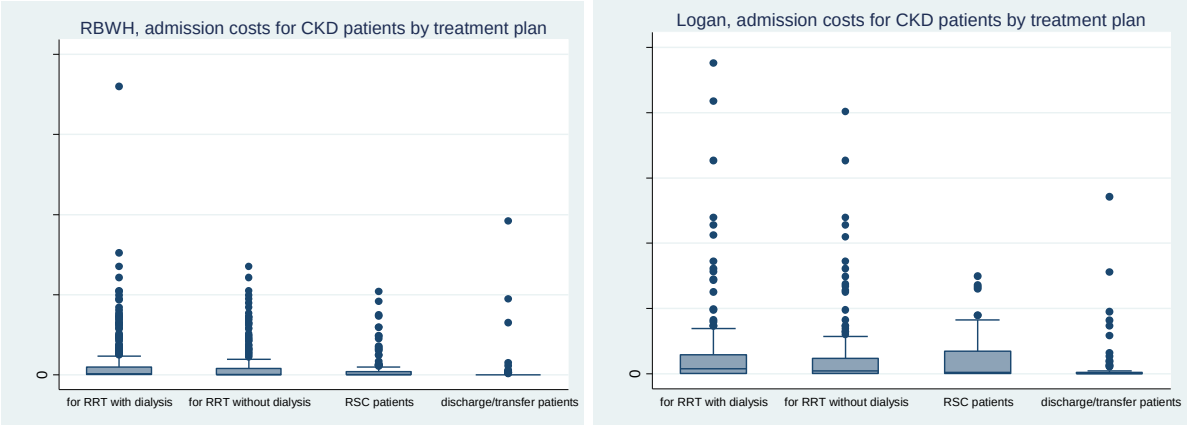

Table 1A. Hospital admission episodes for RBWH CKD Patients by treatment plan

Group	Persons	Person years	Range of episodes	Total episodes	Mean/median per person	Episodes per 100 person yr
For-RRT, dialysis included	346	585	0-102	804	2.3/1	137
For-RRT, dialysis not included	346	585	0-25	524	1.5/0	90
RSC (Not-for-RRT)	126	80	0-15	123	1/0	156
Discharge/transfer	97	95	0-34	62	0.7/0	65

Table 1B. Hospital admission episodes for Logan CKD Patients by treatment plan

Group	Persons	Person years	Range of episodes	Total episodes	Mean/median per person	Episodes per 100 person yr
For-RRT, dialysis included	171	274	0-145	725	4.2/2	265
For-RRT, dialysis not included	171	274	0-15	345	2/1	126
RSC (Not-for-RRT)	84	64	0-19	160	1.9/1	249
Discharge/transfer	64	44	0-12	50	0.8/0	113

Table 2A. Length of stay, days, for hospital admissions for RBWH CKD Patients by treatment plan

Group	Persons	Person years	Range of LOS	Total LOS	Mean/median per person	LOS per 100 person yr
For-RRT, dialysis included	346	585	0-141	2,207	6.4/1	377
For-RRT, dialysis not included	346	585	0-93	1,868	5.4/0	319
RSC (Not-for-RRT)	126	80	0-82	669	5.3/0	848
Discharge/transfer	97	95	0-55	172	1.8/0	181

Table 2B. Length of stay (days) for hospital admissions for Logan CKD Patients by treatment plan

Group	Persons	Person years	Range of LOS	Total LOS	Mean/median per person	LOS per 100 person yr
For-RRT, dialysis included	171	274	0-166	1,180	10.6/3	662
For-RRT, dialysis not included	171	274	0-118	1,431	8.4/1	523
RSC (Not-for-RRT)	84	64	0-64	668	8/1	1,037
Discharge/transfer	64	44	0-100	313	4.9/1	708

Table 3A Costs (Aus$) of hospital admissions for RBWH CKD Patients by treatment plan

Group	Persons	Person years	Range of costs, $	Total costs, $	Mean costs per person, $	Costs per 100 person yr, $
For-RRT, dialysis included	346	585	0-189,072	2,001,654	5,785	341,957
For-RRT, dialysis not included	346	585	0-67,562	1,581,761	4,572	270,224
RSC (Not-for-RRT)	126	80	0-52,007	491,494	3,901	625,233
Discharge/transfer	97	95	0-95,884	209,625	2,207	209,625

Table 3B. Costs (Aus$) of hospital admissions for Logan CKD Patients by treatment plan

Group	Persons	Person years	Range of costs, $	Total costs, $	Mean costs per person, $	Costs per 100 person yr, $
For-RRT, dialysis included	171	274	0-238,002	2,605,527	15,237	952,650
For-RRT, dialysis not included	171	274	0-200,687	2,205,338	12,897	806,330
RSC (Not-for-RRT)	84	64	0-74,841	886,377	10,552	1,376,543
Discharge/transfer	64	44	0-135,569	441,695	6,902	1,001,795

Figure 4A. Hospital costs for CKD patients at RBWH, deceased vs still living at censor date

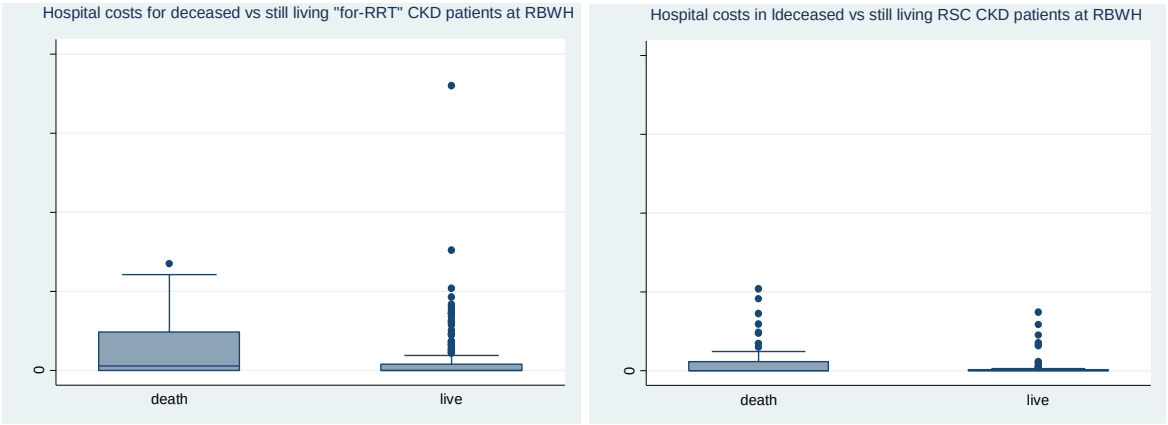

Figure 4B. Hospital costs for CKD patients at Logan, deceased vs still living at censor date

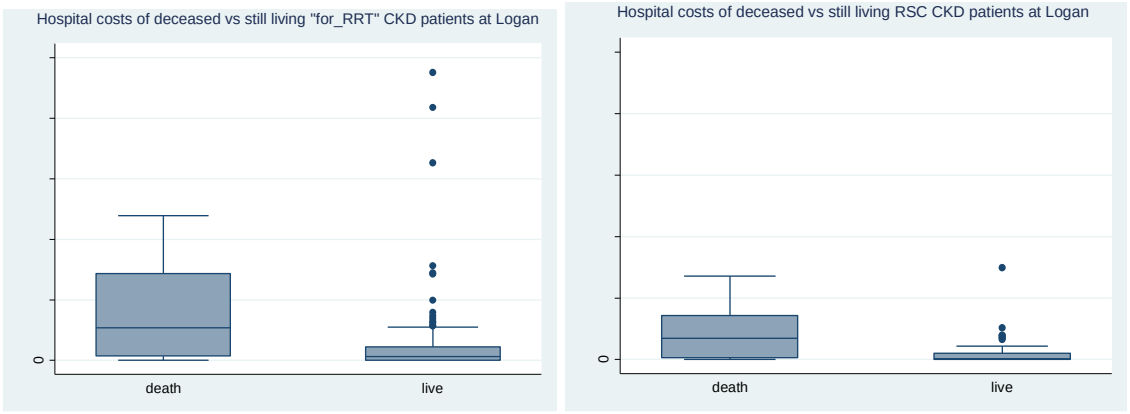

Table 4A. Cost of death vs survival in RBWH CKD patients by treatment plan

		Persons n	Person yr	Total Costs	Cost per 100 person yr
For-RRT	Alive	304	533	2,675,323	267,532
	Dead	42	52.7	1,094,454	1,094,453
RSC (not for RRT)	Alive	67	46.3	169,104	365,065
	Dead	59	33.3	328,480	987,550

Table 4B. Cost of death vs survival in Logan CKD patients by treatment plan

		Persons n	Person yr	Total Costs	Cost per 100 person yr
For-RRT	Alive	151	258	1,699,753	696,776
	Dead	20	15.2	1,799,753	5,299,043
RSC (not for RRT)	Alive	53	54.5	260,607	477,749
	Dead	31	9.8	627,770	6,357,785