Incorporating multiple causes of death into estimation of fatal burden: Findings from Australia

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The **multiple cause weighting strategy** applied in this study **highlights** the importance of **several conditions that would remain under-represented in fatal burden of disease** metrics if only conventional unweighted measures were applied.

BACKGROUND

Deaths in Australia and other high-income countries increasingly involve multiple conditions. However, key burden of disease measures typically only use the underlying cause of death (UC). We quantified sex and cause-specific years of life lost (YLL) based on UC compared with a method integrating multiple causes of death.

RESULTS

- A total of 469,658 deaths registered over 2015-17 were included in the study.
- Considering all-cause mortality, which do not consider causes of death involved, YLL rates were 113.4/1000 for males and 79.9/1000 for females.

METHODS

Causes of death for all deaths in Australia (2015-17), mapped to 136 groups based on International Classification of Diseases Version 10 (ICD-10), were ascribed using 1) the UC only and 2) a multiple cause weighting (WT) strategy, which ascribed 50% weight to the UC and apportioned the remaining 50% equally across the contributing causes reported in Part II of the death certificate. Applying the Global Burden of Disease 2010 life table, YLL_{UC} and YLL_{WT} rates by sex were calculated and compared using relative and absolute measures.

Table 1. Top 20 causes of YLL by underlying cause of death (UC) and multiple cause weighting strategy (WT)

	Females					Cause of death group		Males				
YLL_{UC}		YLL_{WT}		$YLL_{WT}-YLL_{UC}$			YLL_{UC}		YLL_{WT}		$YLL_{WT}-YLL_{UC}$	
Rank	Crude Rate	Rank	Crude Rate	Absolute Diff	%Change from YLL_{UC}		Rank	Crude Rate	Rank	Crude Rate	Absolute Diff	%Change from YLL_{UC}
1	5.95	1	5.07	-0.88	-15%	Ischaemic heart disease	1	12.87	1	11.4	-1.47	-11%
8	2.64	10	1.63	-1.00	-38%	Suicide	2	8.04	3	5.23	-2.81	-35%
2	4.96	4	4.21	-0.75	-15%	Lung cancer	3	7.14	2	5.94	-1.20	-17%
3	4.89	3	4.62	-0.27	-5%	Breast cancer	-	-	-	-	-	-
5	4.46	5	3.76	-0.71	-16%	Cerebrovascular disease	4	4.21	7	3.65	-0.56	-13%
7	3.16	7	2.85	-0.31	-10%	Colorectal cancer	5	4.20	6	3.75	-0.45	-11%
6	3.37	6	3.31	-0.06	-2%	COPD	6	4.13	4	4.31	0.17	4%
4	4.79	2	4.9	0.11	2%	Dementia & Alzheimer's disease	7	3.44	8	3.56	0.12	4%
9	2.14	8	2.70	0.57	27%	Diabetes	8	3.15	5	4.11	0.96	31%
-	-	-	-	-	-	Prostate cancer	9	3.12	9	2.91	-0.21	-7%
20	1.06		0.66	-0.40	-38%	Accidental poisoning-drugs	10	2.77	20	1.7	-1.07	-39%
12	1.76	11	1.57	-0.19	-11%	Other blood cancers	11	2.66	11	2.38	-0.28	-11%
						Residual-external causes	12	2.43	14	2.01	-0.42	-17%
10	1.82	9	1.84	0.01	1%	Perinatal conditions (incl SIDS)	13	2.37	12	2.38	<0.01	0.20%
11	1.78	12	1.56	-0.22	-12%	Pancreatic cancer	14	2.25	15	1.95	-0.30	-13%
						Alcohol induced diseases	15	2.15	10	2.87	0.72	33%
13	1.45	15	1.31	-0.14	-10%	Ovarian cancer	-	-	-	-	-	-
-	-	-	-	-	-	Liver cancer	17	2.07	18	1.76	-0.31	-15%
-	-	-	-	-	-	RTI: motor vehicle occupants	18	2.04	17	1.81	-0.22	-11%
14	1.42	16	1.21	-0.20	-14%	Cancer unknown primary	19	1.93	-	1.64	-0.29	-15%
16	1.16	20	1.08	-0.08	-7%	Brain cancer	20	1.89	19	1.73	-0.16	-8%
-	0.8	13	1.47	0.67	84%	Renal failure		0.90	16	1.85	0.95	105%
13	1.45	15	1.31	-0.14	-10%	Ovarian cancer	-	-	-	-	-	-
15	1.23	17	1.21	-0.02	-2%	Congenital conditions	-	-	-	-	-	-
17	1.14	-	1.02	-0.12	-10%	Residual-malignant neoplasms	-	-	-	-	-	-
19	1.07	-	0.98	-0.09	-8%	Pneumonia	-	-	-	-	-	-
-	0.75	18	1.12	0.38	51%	Atrial fibrillation	-	-	-	-	-	-
-	0.22	14	1.36	1.14	516%	Hypertension	-	-	-	-	-	-
	51.34		47.90	-3.44	-7%	**Top 20 causes combined**		74.93		67.38	-7.55	-10.1%
	(64.2%)		(59.9%)			**(% contribution of top 20 causes)**		(66.1%)		(59.4%)		
			79.92			**All-cause (not considering causes)**		113.44				

RESULTS continued

- Cancers, cardiovascular diseases, external causes, respiratory diseases and nervous system diseases were the five biggest contributors to YLL according to both methods, contributing at least 76% of the total by UC and 82% with WT.
- For the top 20 causes combined, YLL_{WT} rates were 10% lower for males (YLL_{WT}=74.93/1000 vs YLL_{UC}=67.38/1000) and 7% lower for females (YLL_{WT}=51.34/1000; YLL_{UC}=47.90/1000).
- Compared with YLL_{UC}, YLL_{WT} rates were lower for ischaemic heart disease and all cancers, while they were higher for diabetes and dementia, and for COPD in males (Table 1).
- With multiple-cause weighting, renal failure emerged among the top 20 causes of YLL, as did atrial fibrillation and hypertension among females (Table 1).
- Causes with large relative increases in YLL_{WT} compared to YLL_{UC} included metabolic disorders, obesity, substance abuse, mood disorders and osteoarthritis, while those with large relative decreases included suicide, accidental poisoning by drugs, lung cancer (in males), septicaemia, falls and hypertensive diseases (Figure 1).

Figure 1. Top 10 causes with largest relative increase and top 10 causes with largest relative decrease from YLL(UC) to YLL(WT)
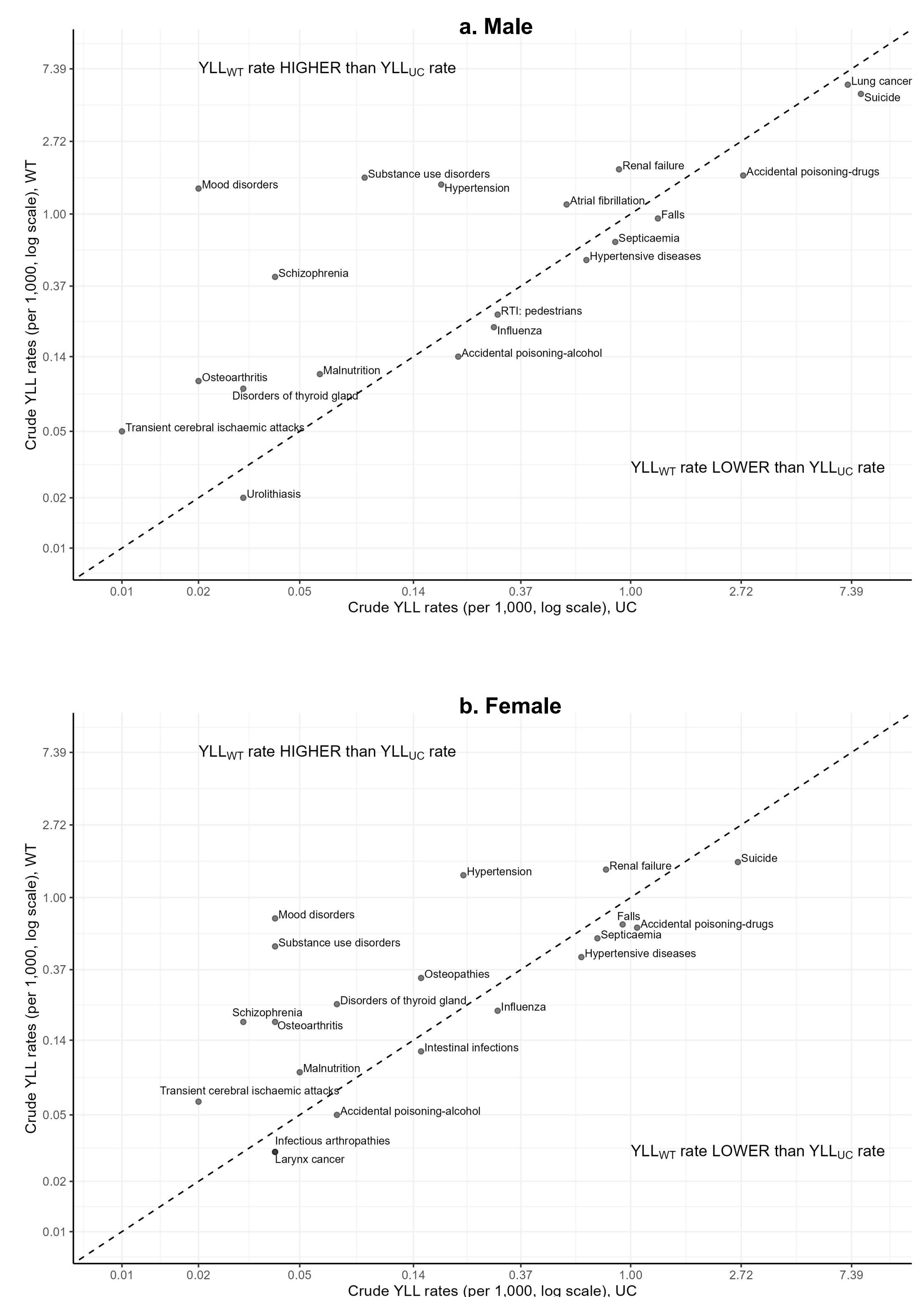

Figure 1 is based on ranking of cause groups by relative difference (%Change from YLL_{UC}); ten cause groups with the largest relative increase and ten with the largest relative decrease are plotted. Large relative increase in YLL_{WT} compared to YLL_{UC} were observed for causes above the diagonal dotted line. Causes with large relative decrease in YLL_{WT} compared to YLL_{UC} are shown below the diagonal dotted line.

CONCLUSIONS

Many of the leading contributors to YLL are preventable, and our findings incorporating multiple causes of death into estimation of fatal burden provide a more complete picture of burden disease in Australia and informs identification of targets for prevention, potentially leading to improved prevention strategies.

ADDITIONAL KEY INFORMATION