

Planning for Palliative Care:  
An analysis of associations between causes of death

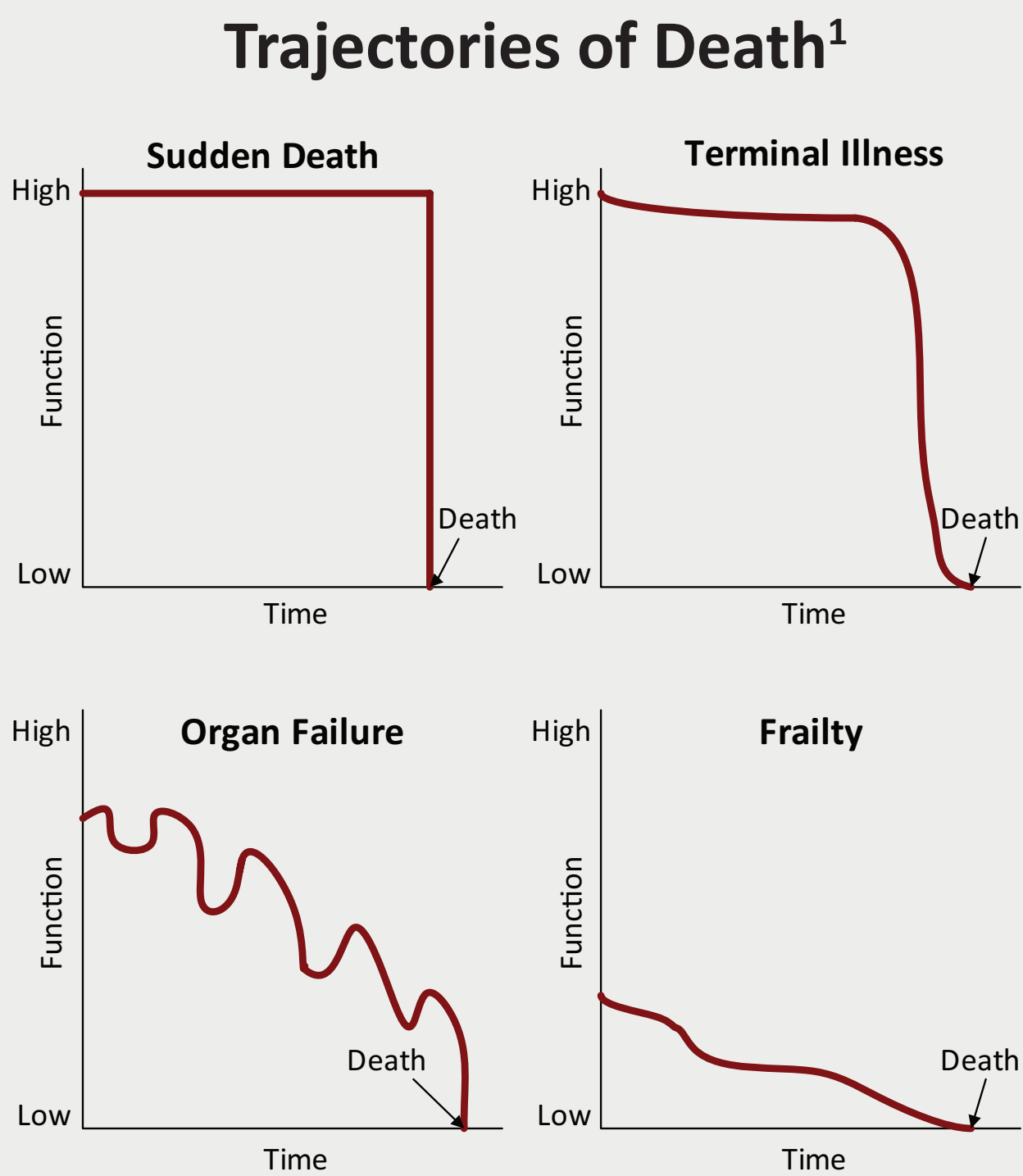
NELS  
ICE | Network for End of Life Studies  
Interdisciplinary Capacity Enhancement

Grace Johnston, PhD<sup>1</sup>; Lynn Lethbridge, MA<sup>1</sup>; Judith Fisher, PhD<sup>1</sup>; Alison Zwaagstra, MHI<sup>2</sup>  
<sup>1</sup>Dalhousie University, <sup>2</sup>Capital District Health Authority, Halifax, Nova Scotia, Canada

Planning for end of life care requires a thorough examination of a person’s health circumstances as death approaches. Clinical research suggests the presence and interaction of conditions influence functional decline near the end of life.

Since most deaths are due to more than one cause, it is important to move beyond the focus of a single underlying cause to assess appropriateness of care at end of life.

Death certificates list multiple causes of death thereby enabling analysis of disease associations that can influence Lunney et al.<sup>1</sup> trajectories of functional decline.



Objective

To better understand needs at the end of life by examining association between causes of death on death certificates.

Methods

All cause of death information was utilized to determine the number of causes for each individual.

This study uses previous research that indicated a minimal set of seven conditions which could potentially benefit from palliative care services<sup>2</sup>.

Diseases were categorized into seven broad disease groups according to ICD-9 and ICD-10 codings.

The number of causes by death trajectory was calculated.

Logistic regression was used to analyze relationships between disease types controlling for sex, age and year of death.

Odds ratios indicate strength of association.

Study Population

All deaths from Nova Scotia, Canada as recorded by in Vital Statistics from 1998-2005 (n=63,431).

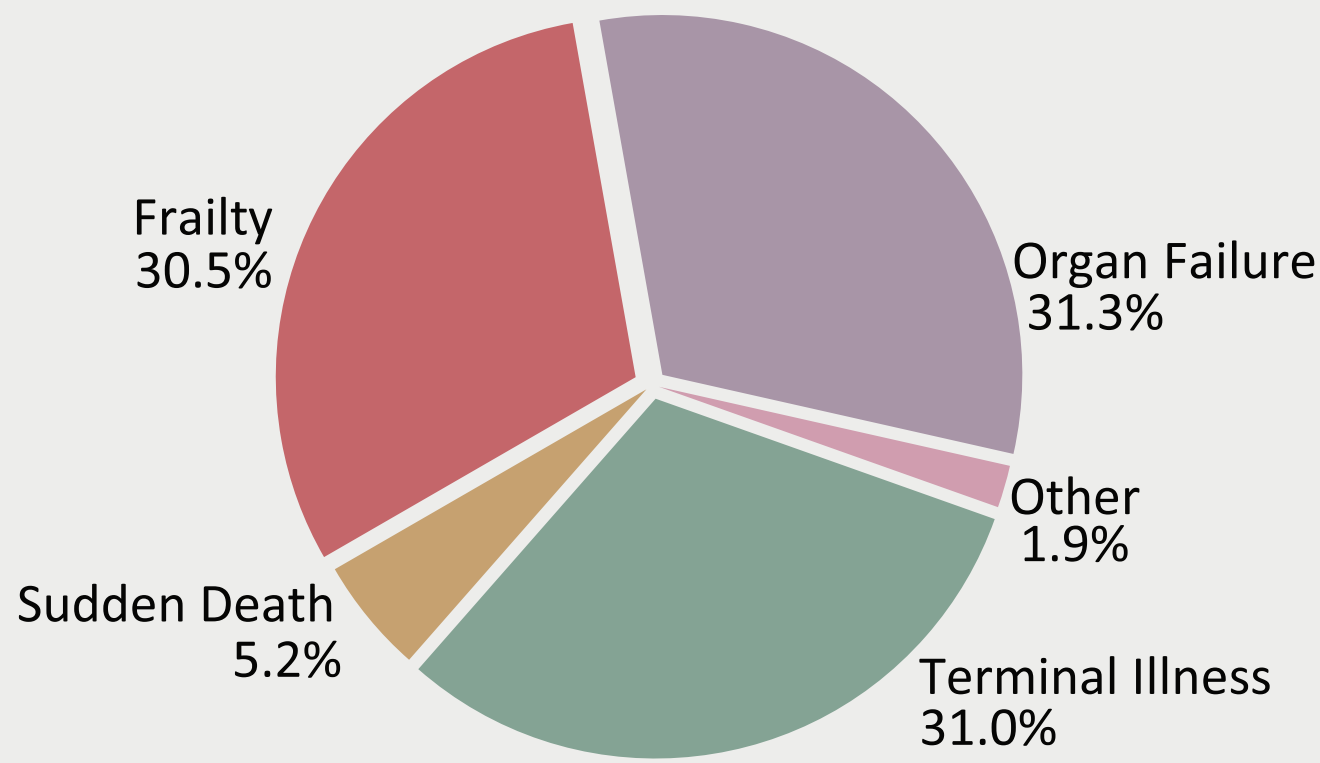
Limitations

Cause of death is difficult to definitively establish, especially when multiple causes are assigned.

Death certificate data were not linked to other data sources, limiting the number of variables.

Time of occurrence of diseases is not available from death certificates. Therefore, sequence of diseases from diagnosis until death could not be examined.

Nova Scotia Death Trajectories 1998 - 2005



Results

Over half (52%) the study population has 3 or more causes of death (Figure 1).

Cancer is the most frequently mentioned cause of death (33%) and is 53.7% of the seven diseases<sup>2</sup> (Table 1).

Cancer has the lowest mean number of causes of death (2.43) followed by Alzheimer’s Disease (2.83) (Figure 2).

Cancer is the main terminal illness (Figure 3).

Alzheimer’s/dementia is the main disease in the frailty category which also includes motor neuron and Parkinson’s disease.

Organ failure decedents have the highest mean number of causes of death (3.13) (Figure 3). Organ failure includes congestive heart failure, renal failure, liver failure, and chronic obstructive pulmonary disease (COPD).

Some variation exists among cancer types in terms of disease associations as a result of disease etiology and process in common.

- Lung cancer occurs with COPD more often than chance expectation while breast, prostate, and colorectal occur less frequently
- Colorectal cancer is associated with liver failure

Statistically significant associations among the diseases in the organ failure group include:

- Heart disease is associated with renal failure and COPD
- Liver failure is associated with renal failure

FIGURE 1: Percentage of Decedents by Number of Causes of Death, all Decedents

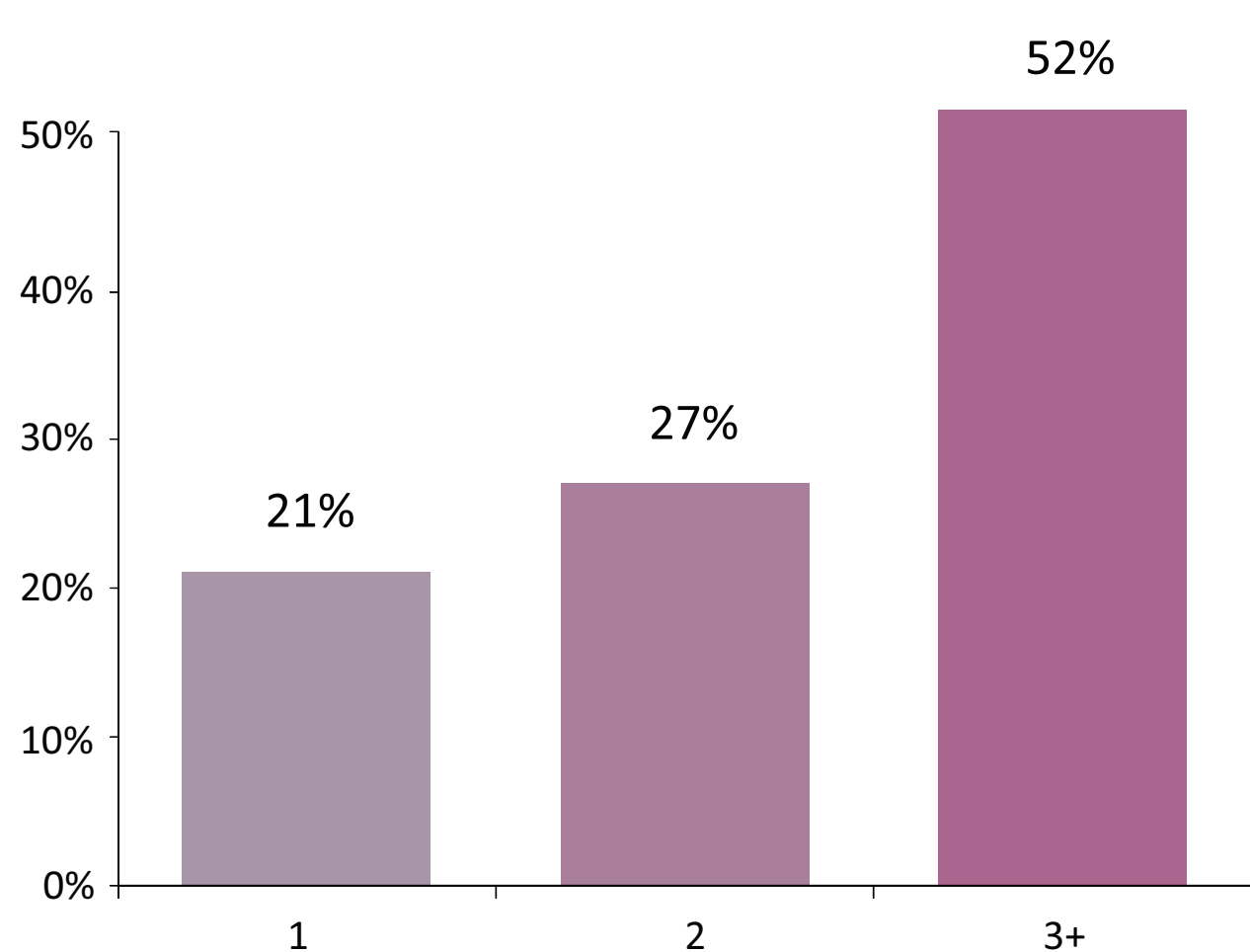


TABLE 1: Percentage of Decedents with Study Disease Mentioned as a Cause of Death 1998-1995

Study Diseases <sup>2</sup>	Number	Disease Mentioned as a Cause of Death	
		All deaths (total=63,431)	Those with any of 7 (total=38,961)
Cancer	20,923	33.0 %	53.7 %
Heart Disease	8,300	13.1 %	21.3 %
COPD	7,359	11.6 %	18.9 %
Renal Failure	5,606	8.8 %	14.4 %
Alzheimer’s	3,087	4.9 %	7.9 %
Motor Neuron	1,159	1.8 %	3.0 %
Liver Failure	705	1.1 %	1.8 %

Note: Percentages in the last column sum to more than 100% since individuals can have more than cause of death

FIGURE 2: Mean Number of Causes by Study Disease

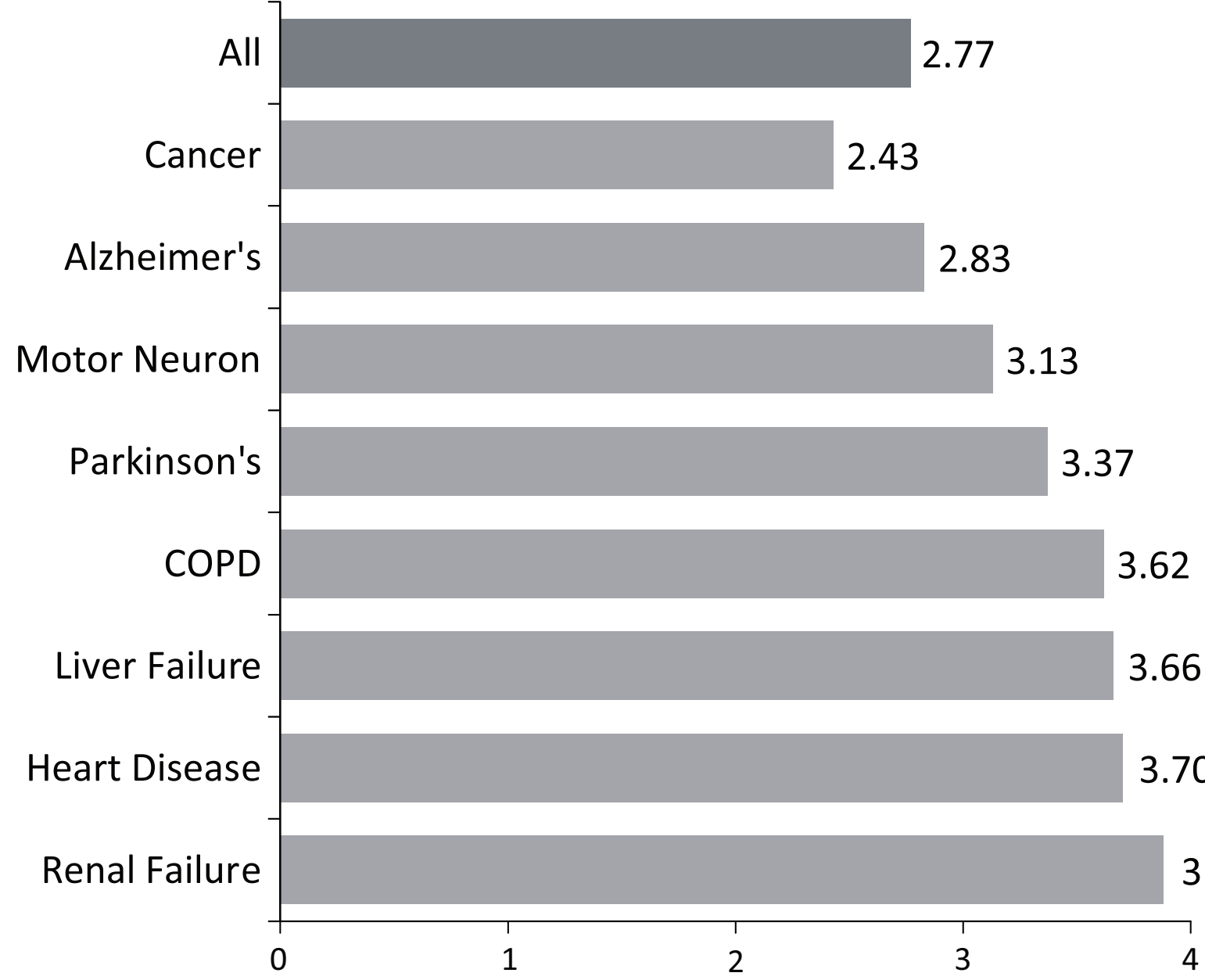


FIGURE 3: Mean Number of Causes of Death by Trajectory

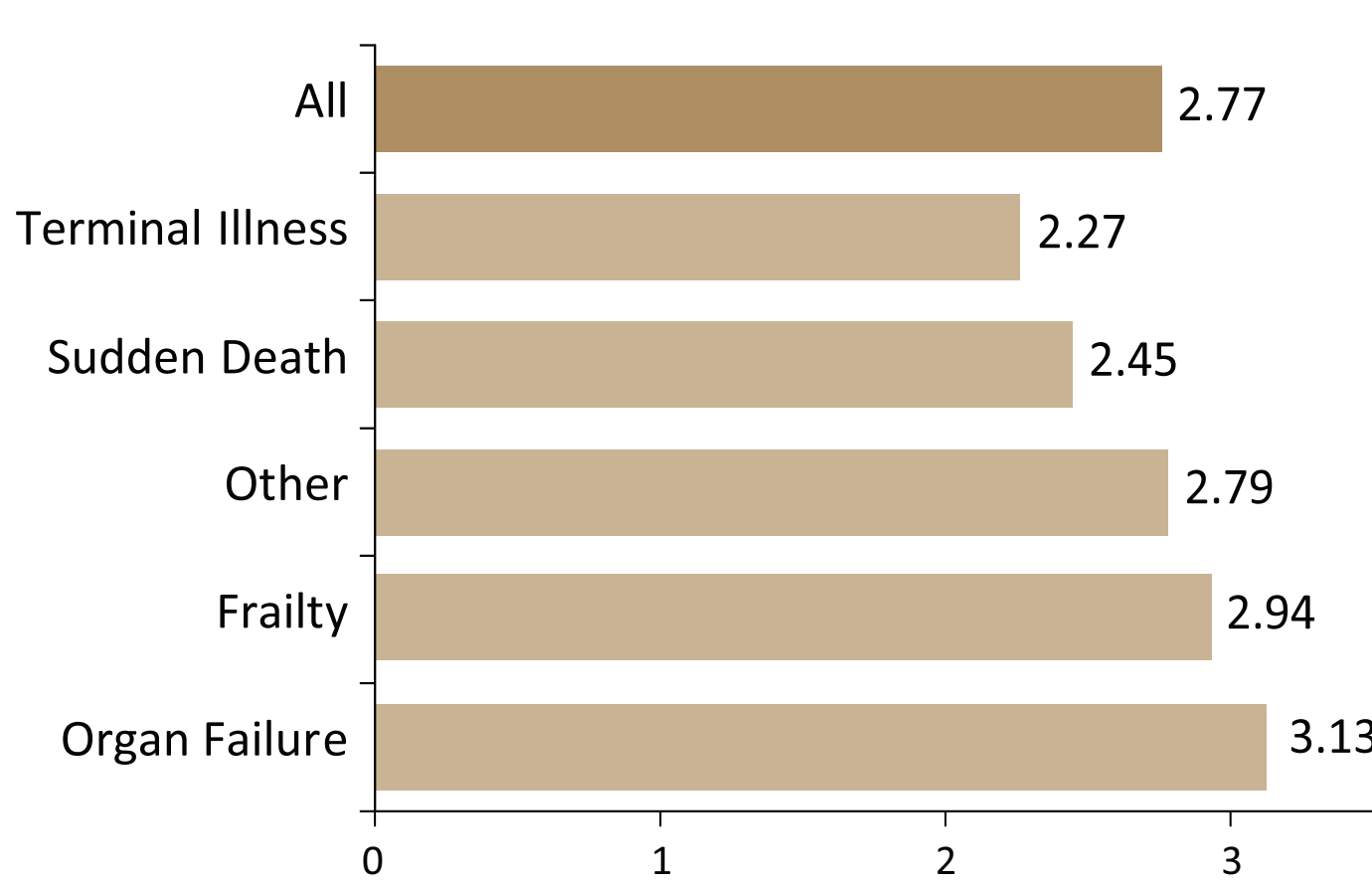


FIGURE 4: Percentage of Individuals in Each Death Trajectory by Study Disease on Death Certificates

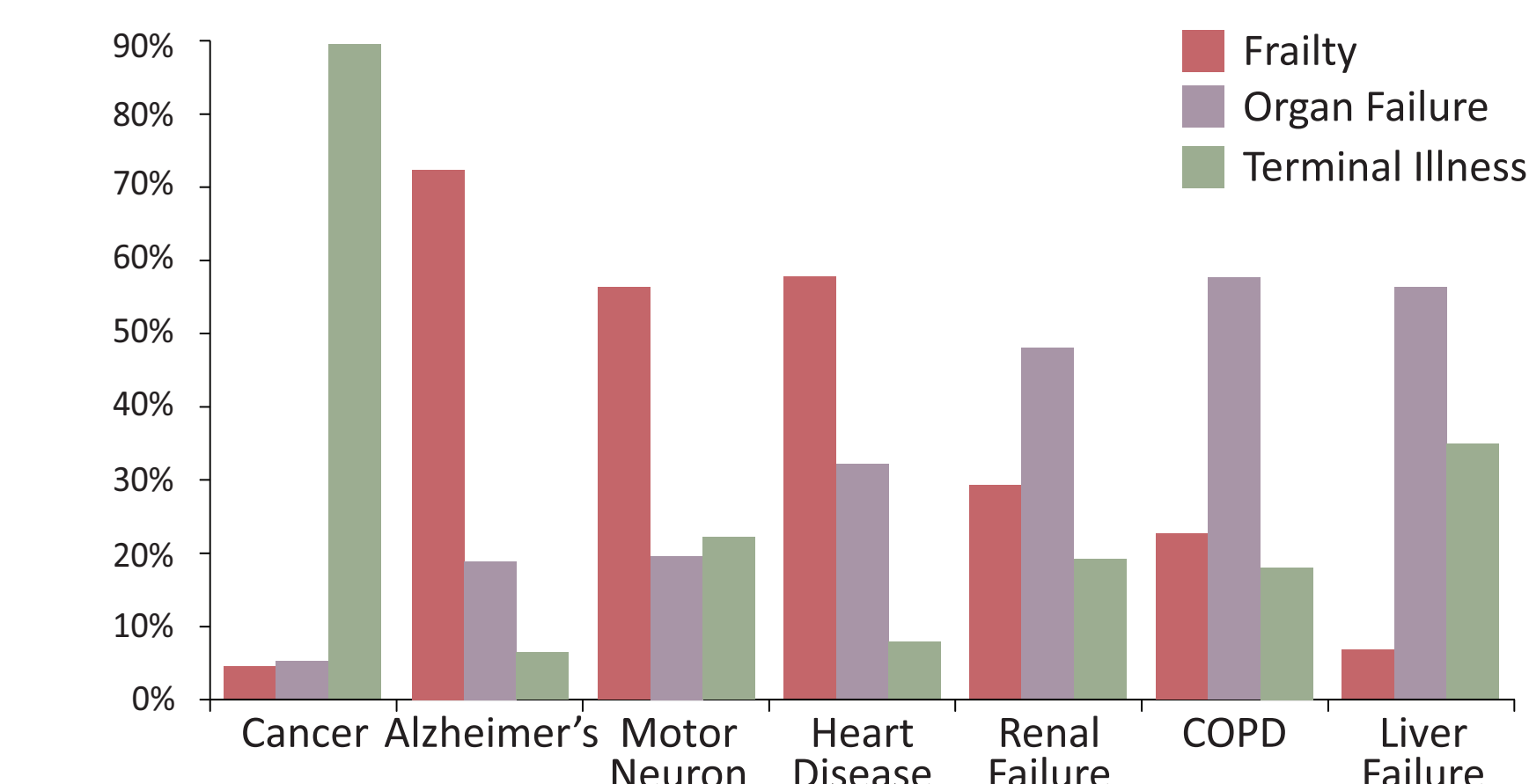


TABLE 2: Logistic Regression Odds Ratios

	Cancer		Alzheimer’s		Motor Neuron		COPD		Heart Disease		Renal Failure		Liver Failure	
	cOR	aOR	cOR	aOR	cOR	aOR	cOR	aOR	cOR	aOR	cOR	aOR	cOR	aOR
Cancer	1.00	1.00	0.23	0.32	0.20	0.21	0.56	0.58	0.22	0.27	0.38	0.40	1.27	<b>1.21</b>
Alzheimer’s	0.23	0.27	1.00	1.00	ns	ns	0.48	0.43	0.63	0.43	0.46	0.39	0.14	0.18
Motor Neuron	0.20	0.21	ns	ns	1.00	1.00	0.46	0.43	0.59	0.53	0.35	0.33	0.23	0.26
COPD	0.56	0.58	0.48	0.48	0.46	0.43	1.00	1.00	1.88	<b>1.82</b>	0.84	0.78	0.52	0.58
Heart Disease	0.22	0.25	0.63	0.42	0.59	0.51	1.88	1.72	1.00	1.00	2.81	<b>2.59</b>	0.68	ns
Renal Failure	0.38	0.40	0.46	0.41	0.35	0.33	0.84	0.77	2.81	2.65	1.00	1.00	2.64	<b>3.00</b>
Liver Failure	1.27	ns	0.14	0.22	0.23	0.26	0.52	0.57	0.68	ns	2.64	3.00	1.00	1.00

cOR = crude odds ratio | aOR = adjusted odds ratio controlled for age, sex and year of death  
ns = not significant at 95% confidence level

TABLE 3: Odds Ratios for Selected Cancer Types in Relation to Study Diseases\*

	Cancer	Alzheimer’s	Motor Neuron	COPD	Heart Disease	Renal Failure	Liver Failure
Cancer (all)	1.00	0.32	0.21	0.58	0.27	0.40	<b>1.21</b>
Breast	-	0.66	0.41	0.33	0.38	0.38	ns
Prostate	-	ns	0.43	0.63	0.52	0.81	ns
Colorectal	-	0.42	0.26	0.40	0.33	0.48	<b>2.19</b>
Lung	-	0.12	0.19	<b>1.43</b>	0.23	0.19	0.32

\*adjusted odds ratio controlled for age, sex and year of death  
ns = not significant at 95% confidence level

Conclusions

Death certificates are a readily-available data source to study health conditions near the end of life. By utilizing all causes of death, associations across diseases can be analyzed.

Understanding needs at end of life is not simply focusing on a single condition but rather the interaction of multiple diseases and how that will affect trajectories of functional decline and therefore services that will be required.

References

<sup>1</sup>Lunney J, Lynn J, Foley D, et al. (2003). Patterns of Functional Decline at the End of Life. *JAMA*, 289 (18); 2387-2392.  
<sup>2</sup>Rosenwax LK, Blackmore AM, & Holman CDJ. (2005). Estimating the size of a potential Palliative Care Population. *Palliative Medicine*, 19; 556-562.

Acknowledgements

NELS ICE research development is supported by a 5-year, \$820,000, Canadian Institutes of Health Research (CIHR) strategic initiative grant for *Interdisciplinary Capacity Enhancement Reducing Health Disparities and Promoting Equity for Vulnerable Populations*.

