Weill Cornell Medicine

The Charlson Comorbidity Index: A System for Identifying Patients with High Future Healthcare Costs

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Background & Unmet Need

- Health costs in the U.S. have been rising significantly, at a pace that is unsustainable

- To have the best chance of reducing costs, interventions must target those patients who are most likely to incur future high costs

- Previous work by the Congressional Budget Office determine that multiple chronic conditions was the best predictor of sustained high costs

- However, there is no consensus about the criteria to define multiple chronic diseases and the definition varies considerably between studies

- **Unmet Need:** Method to define and categorize patients with multiple comorbidities to improve predictions of high healthcare cost producers

Technology Overview

- **The Technology:** Application of the Charlson Comorbidity Index (CCI) to identify patients who will incur high future healthcare costs

- The CCI was originally developed to predict survival, and is a measure of aggregate chronic disease burden

- Here, the CCI was used to predict health costs in the subsequent year, performing as well as prior cost and Diagnostic Cost Group (DCG) in identifying patients in the top 5% or 10%

- As the comorbidity index increased, total yearly costs increased significantly (P<.001)

- The CCI may therefore be used prospectively to identify patients who are likely to incur high costs, and aid in the development of cost mitigation strategies

Inventors:
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Patents:
US Application Filed

Available for non-exclusive licenses

Publications:
Charlson et al. *PLoS One.* 2014.
Charlson et al. *BMC Health Serv Res.* 2014.

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Technology Applications

- Predicts and identifies patients who will incur high future healthcare costs and high futures rates of hospitalization
- Enables optimal healthcare resource management to control costs

Technology Advantages

- Demonstrated ability to predict high healthcare utilizers
- Allows healthcare systems to intervene early to help patients better manage chronic conditions

Supporting Data / Figures

Comorbidity	Hospitalizations							
	None		One		Two		Three or more	
Adults Adults	Percent	Cost	Percent	Cost	Percent	Cost	Percent	Cost
0–1	95.0%	$ 2,190	4.2%	$15,536	0.6%	$36,404	0.2%	$ 59,105
2–3	91.7%	$ 4,704	6.5%	$20,400	1.2%	$42,413	0.5%	$ 88,281
4	90.0%	$ 6,492	7.5%	$22,584	1.8%	$52,961	0.7%	$ 61,981
5–7	85.6%	$ 8,999	9.9%	$26,737	2.6%	$52,027	1.9%	$105,352
≥8	76.0%	$15,928	13.6%	$42,987	4.4%	$64,817	6.0%	$126,995
Children								
0–1	98.1%	$ 955	1.6%	$11,534	0.2%	$30,836	0.1%	$ 56,690
2–3	95.0%	$2,260	3.9%	$15,891	0.9%	$ 58,071	0.2%	$ 34,700
≥4	88.9%.	$5,684	5.5%	$10,182	0.8%	$ 18,558	4.7%	$79,314

The numbers of patients in each comorbidity group are shown in Table 1.
Costs adjusted for age, gender, major mental health diagnoses, and zip code of residence.

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Independent variables	Adults			Children			Both		
	t	p	R^2	t	p	R^2	t	p	R^2
Prior year costs	175.6	<.01	.31	97.0	<.01	.20	205.6	<.01	.37
Comorbidity index	104.0	<.01	.20	17.2	<.01	.17	114.3	<.01	.25
Prior year hospitalization	28.1	<.01	.11	16.3	<.01	.07	34.9	<.01	.18
Prospective Risk Score	125.8	<.01	.20	51.2	<.01	.07	139.1	<.01	.26

Each model had only the single independent variable in the first column, controlling for age, gender and mental health diagnosis.
t indicates the strength of the association and the p value the statistical significance. R^2 is the explained variance, that is, the extent to which the prior year variables predict subsequent year costs; the higher the R^2, the greater the explanatory or predictive power.

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Figure 1: The Charlson Comorbidity Index correlates with increasing healthcare costs and is a strong predictor of future healthcare utilization.

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