Examining productivity losses associated with health related quality of life using patient data

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Background and Objective

Background: Economic evaluation combines information on costs and benefits to inform priority setting in health care and to inform decisions on the reimbursement of health care interventions. Costs are typically the direct costs of providing health care but can also include indirect costs which occur as a result of having poor health. One such indirect cost is the cost associated with lost productivity in both paid and unpaid work. The inclusion of productivity costs in economic evaluation has the potential to have an impact on the decisions on whether or not to recommend or fund an intervention.

Productivity loss has been measured by asking patients to report the time off work/normal activities due to poor health. However, this information is not collected in all trials or observational studies. A different approach would be to predict the number of days off work/normal activities associated with different levels of health related quality of life (HRQoL). This approach has been undertaken using Dutch respondents based on hypothetical health states (Krol et al, 2013) but not UK patient data.

Objective: To develop a model to predict the number of days off work and days off normal activities using the HRQoL of the patient measured by EQ-5D, ICD chapter and other health and socio-demographic data using UK patient data.

Methods

Data: The data used in this study is the Health Outcomes Data Repository (HODaR). HODaR data is collected as a prospective survey of individuals at the Cardiff and Vale NHS hospitals in Wales, United Kingdom. Data consists of those aged 18 years or over excluding those with psychological illness or learning disability if their primary diagnosis was a psychological illness. The study focuses on inpatients discharged from the hospital between April 2002 and January 2009.

Model: The health of the patient measured by EQ-5D, ICD chapter and other health and socio-demographic data was used to estimate days off work/normal activities. The dependent variables, days off work/normal activities had large spikes at 0 (zero days off work/normal activities) and 42 days (days off work/normal activities every day in the recall period of 6 weeks). A variety of different regression models were estimated that are appropriate for this distribution. Models were compared based on their predictive ability.

Table 1: Predictions for days off work in the last 6 weeks, if employed

Days	Observed		Predicted						
			Tobit	Poisson	RE Poisson	Two-part model	Negative binomial	Zero-inflated negative binomial, constant inflation	Zero-inflated negative binomial, variable inflation
	N	%	%	%	%	%	%	%	%
0	16154	59.56	-	0.81	0.99	40.41	56.92	59.52	59.49
1-7	3694	13.62	38.91	50.99	51.37	18.57	22.87	12.69	12.73
8-14	1239	4.57	47.6	34.74	35	12.7	6.27	8.59	8.55
15-21	914	3.37	12.73	10.27	9.49	8.55	3.47	5.75	5.74
22-28	479	1.77	0.76	2.58	2.35	5.8	2.26	3.91	3.89
29-35	1581	5.83	-	0.51	0.62	3.98	1.61	2.68	2.68
36-41	231	0.60	-	0.08	0.15	2.41	1.02	1.64	1.64
42	2900	10.69	-	0.01	0.05	7.56	5.59	5.22	5.29
Total	27124	100		100	100	100	100	100	100

Table 2: Predictions for days off normal activities excluding paid employment in the last 6 weeks

Days	Observed		Predicted						
			Tobit	Poisson	RE Poisson	Two-part model	Negative binomial	Zero-inflated negative binomial, constant inflation	Zero-inflated negative binomial, variable inflation
	N	%	%	%	%	%	%	%	%
0	31398	56.34	-	0.79	0.51	52.16	43.54	56.23	56.32
1-7	7493	13.46	46.69	52.06	54.40	25.97	16.94	12.59	11.28
8-14	3922	7.04	35.15	31.59	34.18	7.10	14.26	10.51	10.06
15-21	2792	5.01	10.71	8.91	7.98	3.83	9.43	7.11	7.14
22-28	1168	2.08	6.31	3.74	2.31	2.42	5.92	4.63	4.84
29-35	2191	3.91	1.12	1.78	0.51	1.66	3.66	2.98	3.25
36-41	670	1.21	0.02	0.66	0.08	1.06	2.00	1.70	1.93
42	6092	10.93	-	0.46	0.03	5.79	4.23	4.24	5.19
Total	55726	100		100	100	100	100	100	100

Results

The preferred model that most accurately predicted the distribution of the data was the zero-inflated negative binomial with variable inflation which performed best at approximating the spikes at 0 and 42 days. Better health in terms of EQ-5D scores was associated with lower productivity loss in both paid employment and normal activities. Comorbidities were associated with greater productivity loss. ICD codes had varying association with days off work and normal activities depending on the model and dependent variable. Increasing age was associated with greater productivity loss but at a decreasing rate while being female was associated with lower productivity loss.

Discussion and Conclusion

The zero-inflated negative binomial with variable inflation models were suitable for predicting the number of days off work/normal activities. The model choice was driven by the distribution of the data which had large spikes at 0 and 42 days. The relationship between EQ-5D and productivity losses was consistent and significant, where lower EQ-5D score meant higher productivity losses. This result is broadly similar to that reported by Krol et al (2013) although models were different. Patients with comorbidities also consistently had significantly higher productivity losses.

There were a number of limitations:

- Mismatch between the recall period of the EQ-5D which refers to health today and the number of days of work/normal activities which refers to 6 weeks
- Recall bias due to the 6 week recall period
- Models will not be appropriate for predicting productivity losses when: 1) EQ-5D is inappropriate for the patient population; 2) the relationship between EQ-5D, days off paid employment or days off normal activities is inappropriate for the patient population
- Lack of generalizability of HODaR data, for example for patients whose primary diagnosis is a psychological illness
- Problems with valuation of estimated productivity losses as there is no information on type of work or normal activities that is foregone

Despite the above limitations, the analyses in this study utilise a large patient dataset covering a large number of conditions. The estimated models allow productivity losses associated with HRQoL to be estimated using the health of the patient measured using EQ-5Dand ICD chapter for inclusion in economic evaluation.

Reference: Krol, M., Stolk, E., & Brouwer, W. (2013). Predicting productivity based on EQ-5D: an explorative study. *The European Journal of Health Economics*, 1-11.