

Quality choice with reputation effects: Evidence from hospices in California

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Motivation

Hospices provide palliative care to dying patients.

Useful to study because:

1. **Large industry, deficiencies in service quality**
2. **Insightful for regulated-price healthcare markets**
3. **Analyze quality choice under reputation effects**
 - Reputation of a firm reflects its past quality choices.
 - Current quality $\uparrow \implies$ reputation $\uparrow \implies$ future sales \uparrow

I show that hospices dynamically choose quality to build up reputation and attract consumers. Then I study counterfactual policies that incentivize better quality.

Hospice industry

Hospices provide palliative care to dying patients.

- Serve patients at residences.
- Regular visits for pain-control, living arrangements.
- More visits \implies higher quality.

Hospice quality = Average visits-per-patient.

- Paid fixed rate per-patient per-day by Medicare.

Hospices

Reputation is an important driver of choice.

- Quality not contractible: hospice unilaterally decides visits.
- Goodwill and name recognition \rightarrow patient's choice.
- Good track record \implies greater referrals, better known and reviewed \implies greater market share.

Structural model

Estimate structural model of hospice industry using yearly firm-level data from California for 2002-2018.

Reputation of a hospice = stock of its current and past quality choices, partially depreciates every period.

1. Demand: Consumers choose from set of hospices.
 - Influenced by hospice characteristics and reputations.
2. Supply: Firms choose quality every year.
 - Dynamic oligopoly model.
 - Trade off improving reputation with higher cost.

Results: Estimation

Demand estimation:

1. Reputation plays important role in consumer choice.
 - Hospices which chose high quality in the past have higher current market share.
2. Reputation depreciates at annual rate of 53%.
 - Quality choices 4 years ago affect current market share.

Results: Estimation

Supply estimation:

1. Additional visit per patient costs the hospice around \$200.
 - Includes staff wages, cost of medical supplies and operation.
2. For-profits more efficient than non-profits by \$75-105 per visit.
3. Rural hospices suffer cost disadvantage of \$18-30 per visit.

Results: Counterfactuals

Simulating effects of alternative policies:

1. Persistence of reputation $\uparrow \implies$ Quality \uparrow
 - E.g. review sites
2. Medicare prices $\uparrow \implies$ Quality \uparrow
 - Response varies with differentiation from rivals.
3. Compared to current per-day scheme, a hybrid per-day and per-visit scheme achieves same quality at nearly 30% lower Medicare spending.

Contributions

1. Estimate a novel structural model of reputation accumulation through quality choice.
2. Importance of reputation for i) patients choosing medical providers and ii) medical providers choosing quality.
3. Contribute to a very sparse literature on hospices, evaluate policies to improve outcomes.

Quality provision

Hospices typically provide care at residence of patient.

- Regular visits to patient.
- Hospice **unilaterally decides** how many visits to provide.

Type of care is relatively low-skill.

- No curative treatment.
- Pain management and ease-of-living.
- Content of visits similar across hospices.

Examples of hospice care

Reputation

How a hospice is chosen:

- Social worker at hospital.
- Patient's physician.
- Word-of-mouth from community and support groups.
- Online search.

Reputation

Key industry details:

1. Quality of care = total visits to patient.
 - More visits \implies regular checkups and adjustments, symptom management, availability during emergencies.
2. Reputation drives consumer choice. [Sources](#)
 - Non-contractible quality, goodwill and name recognition.
 - Good track record \implies greater referrals, better known and reviewed \implies greater market share.
3. Past information on service quality can **persist and diffuse over time** via social workers, physicians, and surrounding community.

Reimbursement

Majority of patients in my data are paid for by Medicare.

Payer	% of patients
Medicare	83.7
Medi-Cal	7.37
Private insurance	6.37
Selfpay	1.65
Charity	0.82

Table 1: Percentage of total patients covered by each payer type.

Reimbursement

Under Medicare:

1. Patient: hospice care is essentially free.
2. Hospice: paid a **fixed rate per-day** of patient enrollment.
 - Payment does **not** vary by number of visits.
 - Payment varies across counties and over time. Reflects a “national” rate and a cost index of the county.

Data

Data on hospices in California :

- Home Health Agencies And Hospice Annual Utilization Reports.
- 2002-2018.
- Yearly data at the **firm level**.
- For each hospice-year: total patients served, total visits made by staff, hospice characteristics, etc.

Combine with: data on population sizes (by age), mortality rates, and Medicare hospice reimbursement rates.

Data

Market defined at county level.

- Can rule out broader market definitions using data.

Restrict attention to 28 counties.

- Some do not see hospice presence.
- Drop markets with > 24 hospices: numerical challenges and different industry dynamics.
- Sample selection in line with majority of IO papers using dynamic oligopoly models.

Data

Measure of quality of a hospice = $\frac{\text{total visits}}{\text{total patients served}}$

	10%	25%	50%	75%	90%
Visits-per-patient	17.17	21.88	27.83	37.66	52.48

Table 2: Distribution of average visits-per-patient.

Data

	Min	10%	25%	50%	75%	90%	Max
firm count	1.0	1.0	1.0	2.0	4.0	7.0	23.0

Table 3: Distribution of firm-count.

Entry and exit:

- Occur in 10% of county-years.
- Between 1 and 5.

Structural model: Demand

The utility of consumer i for hospice j in period t is given by:

$$u_{ijt} = \alpha_{m(j)} + X'_{jt}\beta + \psi_{jt} + \xi_{jt} + \zeta_i + (1 - \sigma)\tilde{\epsilon}_{ijt}$$

$$\xi_{jt} = \rho\xi_{jt-1} + \epsilon_{jt}$$

where ϵ_{jt} is distributed independently with mean zero.

Reputation follows a stock transition equation:

$$\psi_{jt} = (1 - \tau)\psi_{jt-1} + \eta a_{jt}$$

where a_{jt} is the average-visits-per-patient made by hospice j in period t .

Assuming $\psi_{j0} = 0$ (i.e. a new entrant has a reputation of zero):

$$\psi_{jt} = \eta[a_{jt} + (1 - \tau)a_{jt-1} + (1 - \tau)^2 a_{jt-2} + \dots]$$

Structural model: Demand

$$u_{ijt} = \alpha_{m(j)} + X'_{jt}\beta + \xi_{jt} + \zeta_i + (1 - \sigma_n)\tilde{\epsilon}_{ijt} + \\ \eta[a_{jt} + (1 - \tau)a_{jt-1} + (1 - \tau)^2a_{jt-2} + \dots]$$

$$\xi_{jt} = \rho\xi_{jt-1} + \epsilon_{jt}$$

Key parameters:

1. τ = how fast the effect of past quality choices depreciates.
2. η = importance of reputation for consumer choice.

Structural model: Supply

Intuition: marginal cost is increasing linearly in quality choice.

The cost of serving each patient at quality a_j is given by:

$$MC_j(a_j) = \gamma_0 + \left(\gamma_{1,k(j)} + \gamma_{fp} FP_j + \gamma_{rural} RURAL_j \right) a_j$$

where $k(j)$ denotes the type of the hospice j .

All patients of hospice j receive quality a_j .

Structural model: Supply

$$\bar{\pi}(a_j, a_{-j}, x_m; \theta) = M_m s_j(a_j, a_{-j}, x_m) [P_m^{MCAR} - MC_j(a_j; \theta)]$$

where:

- θ = cost parameters.
- x_m = state variable in market m .
- a_{-j} = actions of rivals.
- M_m = market size.
- P^{MCAR} = Medicare per-day rate \times 60 days.

Structural model: Supply

Combine to form dynamic model of quality choice under competition.

Incumbent's value function:

$$V_j(x_m, \epsilon_j^a; \theta) = \max_{a_j \in \mathcal{A}} \mathbb{E} \left[\bar{\pi}(a_j, x_m; \theta) + \epsilon_j^a(a_j) + \beta V_j(x'_m, \epsilon_j'^a; \theta) \mid a_j, x_m \right]$$

where

- $\epsilon_j^a(a_j)$ = choice-specific errors for hospice j choosing action a_j (*i.i.d* T1EV)

Structural model: Timing

For period t and market m :

1. Incumbents observe x_{mt} and structural errors, and make quality choices.
2. Reputation stock of each incumbent evolves.
3. Consumers observe x_{mt} , reputation stocks, and structural errors, then choose a hospice.
4. Incumbents stay/exit.
5. Potential entrants enter/stay out.
6. All state variables evolve.

Estimation: Demand

Using Berry (1994):

$$\ln(s_{jt}) - \ln(s_{0t}) = \alpha_m + X'_{jt}\beta + \sigma_n \ln(s_{j|gt}) + \xi_{jt} + \eta[a_{jt} + (1 - \tau)a_{jt-1} + (1 - \tau)^2 a_{jt-2} + \dots]$$

where

- s_{jt} = market share of hospice j .
- s_{0t} = market share of outside option.
- $s_{j|gt}$ = hospice j 's within-hospice market share.

Estimation: Demand

$$\ln(s_{jt}) - \ln(s_{0t}) = \alpha_m + X'_{jt}\beta + \sigma_n \ln(s_{j|gt}) + \xi_{jt} + \\ \eta[a_{jt} + (1 - \tau)a_{jt-1} + (1 - \tau)^2 a_{jt-2} + \dots]$$

$$\xi_{jt} = \rho \xi_{jt-1} + \epsilon_{jt}$$

Estimated simultaneously with two-step GMM.

- Moment conditions built around ϵ_{jt} .
- Standard IO instruments: BLP IVs (sum of rivals and rival characteristics), fuel prices.

Estimation: Supply

Two-stage estimator from Bajari, Benkard and Levin (2007) used to estimate the cost parameters.

1. Use simulation methods to derive model-predicted quality choices.
2. Choose cost parameters to match with observed quality choices.

Results: Demand

$$u_{ijt} = \alpha_{m(j)} + X'_{jt}\beta + \psi_{jt} + \xi_{jt} + \zeta_i + (1 - \sigma_n)\tilde{\varepsilon}_{ijt}$$

$$\xi_{jt} = \rho\xi_{jt-1} + \epsilon_{jt}$$

$$\psi_{jt} = (1 - \tau)\psi_{jt-1} + \eta a_{jt}$$

	Demand
τ	0.530 (0.156)
ρ	0.756 (0.072)
σ_n	0.597 (0.034)
η	0.012 (0.003)

Results: Demand

	Demand
Hospice inpatient unit	0.011 (0.112)
Pediatric program	0.223 (0.071)
Bereavement services	0.008 (0.037)
Day care for adults	0.038 (0.169)
For-profit	-0.291 (0.081)
Agency type: free-standing	-0.168 (0.133)
Agency type: home health based	-0.287 (0.152)
Agency type: hospital-based	-0.259 (0.159)

Results: Supply

$$MC_j(a_j) = \gamma_0 + \left(\gamma_1 + \gamma_{fp} FP_j + \gamma_{rural} RURAL_j \right) a_j$$

$$MC_j(a_j) = \gamma_0 + \left(\gamma_1 + 1(\text{type}_j = 2)\gamma_{12} + \gamma_{fp} FP_j + \gamma_{rural} RURAL_j \right) a_j$$

	No types	With cost-types
γ_1	1343.728 (32.311)	1541.100 (48.872)
γ_{fp}	-740.676 (93.892)	-532.156 (116.642)
γ_{rural}	125.534 (54.289)	206.063 (74.825)
γ_{12}		-594.847 (111.097)

Counterfactuals

To evaluate different policy measures, I solve the model for 3 firms with no entry or exit.

Also see if differentiated hospices react differently.

$$\begin{aligned}u_{ijt} &= \alpha_{m(j)} + X'_{jt}\beta + \psi_{jt} + \xi_{jt} + \zeta_i + (1 - \sigma)\tilde{\varepsilon}_{ijt} \\ &= \Pi_{jt} + \psi_{jt} + \zeta_i + (1 - \sigma)\tilde{\varepsilon}_{ijt}\end{aligned}$$

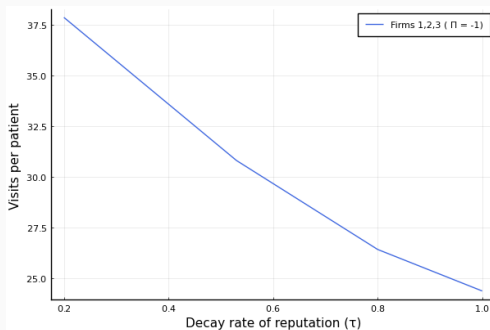
where $\Pi_{jt} = \alpha_{m(j)} + X'_{jt}\beta + \xi_{jt}$ reflects how much hospice j differentiates along non-reputation dimensions.

Impose that a hospice's Π_j remains constant over time for clarity.

Counterfactuals: reputation persistence

First set of counterfactuals involves the persistence of reputation.

Mimics policies like online review sites that make quality information widely available and easier to find.



Counterfactuals: Medicare prices

Medical providers have frequently complained that Medicare reimbursement rates are too low.

Study how hospice quality changes as Medicare rates increase:

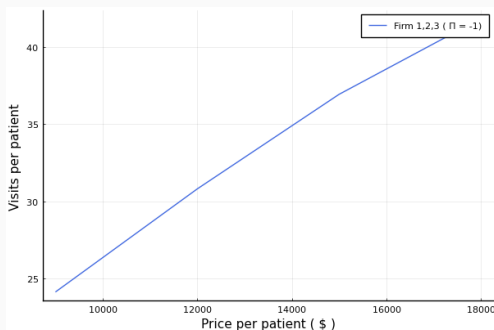


Figure 1: $\Pi_1 = \Pi_2 = \Pi_3 = -1$.

Counterfactuals: Medicare prices

Comparison between static vs reputation setting:

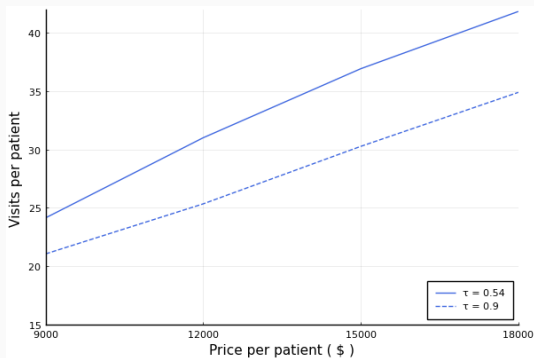


Figure 2: Average quality choice by hospice against increasing Medicare rates. $\Pi_1 = \Pi_2 = \Pi_3 = -1$.

Counterfactuals: contract design

Marginal cost per visit = \$200

The following contract structures all achieve 29 average visits-per-patient:

Per-day rate	Per-visit rate	Medicare cost
186.7	0.0	1.0
150.0	50.0	0.93
100.0	110.0	0.82
50.0	170.0	0.71

Conclusion

1. Show importance of reputation for patients choosing hospices and hospices choosing quality.
2. Estimate a structural model of reputation accumulation to estimate hospice cost function.
3. Policy counterfactuals:
 - Persistence of reputation \uparrow and Medicare prices $\uparrow \implies$ hospice quality \uparrow .
 - A hybrid per-day and per-visit reimbursement scheme achieves the same quality as the current per-day scheme at nearly 30% lower spending.

Examples of hospice care

Examples of hospice care:

- Pain medication
- Medical supplies
- Dressing bedsores
- Giving physical and speech therapy
- Bathing and feeding
- Respite for primary caregiver.

Choosing a hospice

- AmericanHospice.org: **“What do others say about this hospice?** Get references both from people you know and from people in the field – e.g., local hospitals, nursing homes, clinicians. **Ask anyone that you have connections to if they have had experience with the hospice and what their impressions are.** Geriatric care managers can be a particularly good resource, **as they often make referrals to hospices and hear from families about the care that was provided.** Anecdote and word of mouth won’t paint a full picture but they are still valuable data points... How long has the hospice been in operation? If it has been around for a while, that’s an indication of stability.”

Choosing a hospice

- HospiceFoundation.org: “Seek professional opinions. Ask clinicians, professional caregivers at nursing homes, geriatric care managers, or end-of-life doulas about their experience with a hospice. Talk to friends, family, and neighbors **who have used hospice services and get their opinions about the experience with a provider.**”
- Vitas.com: “Evaluate the hospice provider’s **history and reputation** before you decide. How long has it been in business? ... **What do other patients or families say about their experiences?**”

Choosing a hospice

- Caringinfo.org: “Most hospice programs use family satisfaction surveys to obtain feedback about their services so they can make improvements. Ask the hospice to share a summary of their **family satisfaction scores for the last several months with you**. You can also ask to see their latest state or Medicare inspection report to see if there are care provision problems. Finally, you could ask to **see the hospice provider’s list of complaints from the past 12 months.**”