# Measuring the relative performance of providers of a health service: a summary*

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**Abstract**

"Measuring the relative performance of providers of a health service" (Ackerberg, Machado and Riordan, 2001) compares the performance of publicly funded agencies providing treatment for alcohol abuse in Maine. The methodology estimates a Wiener process that determines the duration of completed treatments, while allowing for agency differences in the effectiveness of treatment, standards for completion of treatment, patient attrition, and the characteristics of patient populations. Notably, the Wiener process model separately identifies agency fixed effects that describe differences in the effectiveness of treatment, and effects that describe differences in the unobservable characteristics of patients. The estimated model enables hypothetical comparisons of how different agencies would treat the same populations. The study concludes that Maine could have significantly reduced treatment costs without compromising health outcomes by identifying and transferring best practices.

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This paper details the methodology and main results of "Measuring the relative performance of providers of a health service" (Ackerberg, Machado and Riordan (2001); hereafter AMR).

AMR develops a methodology to compare the performance of different agents engaged in similar activities that are not directly comparable. This methodological approach has potentially broad scope of application in fields of education and health. AMR's specific application is the relative performance evaluation of agencies providing alcohol abuse treatment in Maine. The study quantifies the relative advantages of certain treatment providers (e.g. greater retention of patients, greater effectiveness at improving health status), and estimates the potential cost-savings from identifying and transferring best practices. Such transfers might be accomplished by mergers, information exchange, or training.[1]

In order to compare the performance of treatment agencies, AMR considers both health benefits and treatment costs. The novelty of the methodology lies in the modeling and estimation of health benefits.[2] The production of health improvement takes time, is uncertain, and is not perfectly observable. More specifically, the health treatment process is modeled as illustrated in Figure 1: a patient enters a treatment program with an initial scalar-valued health status ($h_0$), health status evolves stochastically through time in response to treatment ($h_t$), and treatment is completed when the patient's health status crosses an upper threshold ($\overline{h}$). In addition, and in conformity with the data, the model allows for patient attrition, i.e. some patients leave treatment before attaining $\overline{h}$. $h_t$ is assumed to be a Wiener process, conferring an Inverse Gaussian distribution on the time it takes to complete treatment[3]. This, in turn, enables a maximum likelihood estimation of the process.

In this context, it is easy to understand why performance comparisons are difficult: first, the initial health status ($h_0$) of patients may vary substantially across agencies and may not be perfectly observable; second, agencies may have different completion criteria ($\overline{h}$) when faced with similar patients; third, agencies may differ in their effectiveness at improving health status; and lastly, agencies may have different attrition rates.

[1] A good survey on substance abuse treatment is McLellan et al. (1997). Some interesting studies related to Maine's substance and alcohol treatment programs are: Commons, McGuire, and Riordan (1997), Lu (1999), Lu and McGuire (2001), Machado (2001), and Shen (1998). Studies comparing the effectiveness of different programs include: Emrick (1975), McLellan et al. (1997), McLellan et al. (1993), Anglin and Hser (1990), and Apsler and Harding (1991). Other studies that go deeper and search for active ingredientes that explain the differences in effectiveness: Ball and Ross (1991), Finney et al. (1996), Moos, Finney and Cronkite (1990), Joe, Simpson and Sells (1994), Longabaugh et al. (1993), McLellan et al. (1993a, 1998), and Walsh et al. (1991). Studies considering the cost-effectiveness of treatment programs include: Apsler (1991), Longabaugh et al. (1983), Long et al. (1998), Machado (2001), and Walsh et al. (1991).

[2] Other approaches to estimating treatment effects are discussed in Manski (1996).

[3] See Lancaster (1990) for a discussion of the Wiener process as a duration model.

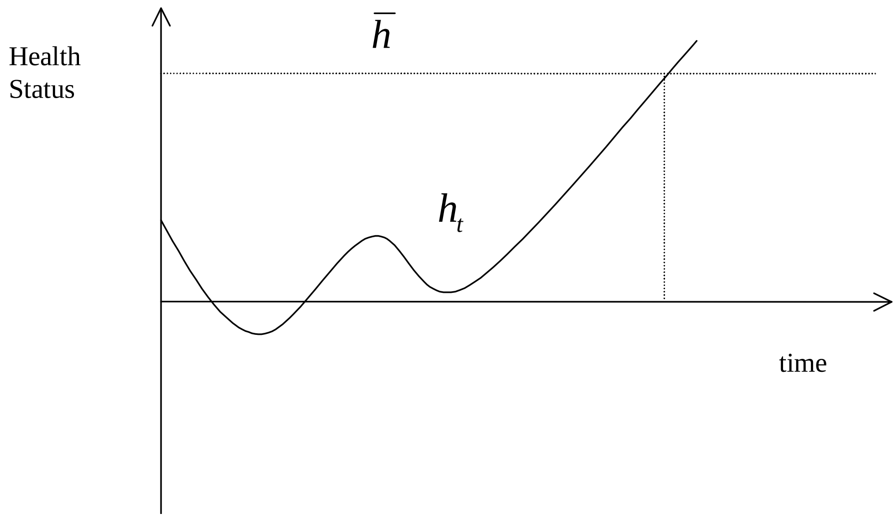


Figure 1: Health care treatment process

AMR models each of these features in a different equation, thus identifying their separate contributions to performance outcomes.

The structural model assumes that initial health status, the completion threshold, the attrition rate, and the rate of health improvement are functions of observable patient characteristics, agency fixed effects, and an unobservable patient characteristic. The model controls for selection due to this unobserved heterogeneity, thus distinguishing agency differences in the treatment process (treatment effects) from unobserved population characteristics (population effects). There are two important assumptions of the model that allow this distinction: first, that treatment effects are unrelated to a patient's initial health status; second, that there is a *scalar* unobservable patient characteristic[4]. These restrictions work together to allow the decomposition of the estimated agency dummy variable coefficients into treatment and population effects.

This separate identification of treatment and population effects makes it possible to control for case-mix while measuring the relative performance of treatment providers. The AMR treatment model is complemented with a separate reduced form model of treatment costs. The cost equation has the same general

[4] This identification strategy is similar to that used by Olley and Pakes (1996) in their study of productivity in the telecommunications industry. AMR adopted a strutural approach in the spirit of of Eckstein and Wolpin (1999), Keane and Wolpin (1997) and Olley and Pakes (1996), in preference to an instrumental variable approach (Imbens and Angrist (1994), Heckman (1997)).

structure as the equations in the treatment model. Moreover, estimates from the treatment model are employed to identify treatment and population effects in the cost model. Together the two models assemble all the information needed to measure the relative performance of treatment providers for any population of patients.

The data used to estimate the model are drawn from an admission-discharge data set of patients receiving outpatient alcohol abuse treatment from publicly-funded agencies in Maine. The data set matches patients to treatment agencies. Although health status is not directly observable, the data includes indicators of health status at admission and discharge. The estimation carried out in AMR indicates that the 15 agencies comprising the sample have significantly different treatment effects, i.e. their practices determining different treatment effectiveness, completion standards, patient retention, and unit costs. Moreover, the patient populations of the 15 agencies have different observable *and* unobservable characteristics.

AMR uses the estimated treatment and cost models to simulate the health improvement and costs of treatment for any population of patients in any of the 15 agencies. The idea is to hold the population effects constant, while allowing the treatments effects to vary with agency assignment. As a result, the simulations measure the relative performance of agencies for various populations. Superior performance is interpreted as a manifestation of "best practices". If the best practices of a superior agencies were adopted by the actual treatment agency, then Maine would be able to deliver the same amount of health improvement at a lower cost. The computation of the potential savings is shown in Table 1.

The first column of Table 1 presents the profitable transfers and savings obtained when health improvement is measured by the latent health variable in the AMR model. The second column presents the same results when health improvement is measured by the abstinence rate. The results are ordered by the total cost savings, i.e. transfers that save the most costs are listed first[5]. Using the latent health status to measure health improvement, the transfer of best practices from Agency 10 to Agency 5 saves $46,000, which is more than 2% of the total budget of the 15 agencies. There are a total of ten cost-saving transfers, amounting to savings of $163,000, or 7.4% of the total budget. Bootstrapped standard errors show that these cost savings

[5]Note that while the direct effect of these transfers is to save money, there is also an additional benefit of improved health outcomes. In some cases the reassignment a patient population to a superior agency not only saves money but produce more health improvement. Both outcome variables (latent health improvement and abstinence) goes up about 1-2% with the simulated transfers of best practices.

| Using health improvement | | | | Using abstinence | | | |
|---|---|---|---|---|---|---|---|
| Population of Agency | Treated by Agency | $ Savings | Cumulative % Savings | Population of Agency | Treated by Agency | $ Savings | Cumulative % Savings |
| 10 | 5 | 46131.43 | 2.1 (0.67) | 13 | 6 | 63259.59 | 2.88 (0.49) |
| 13 | 4 | 30948.07 | 3.51 (1.00) | 15 | 12 | 29091.40 | 4.20 (0.63) |
| 15 | 11 | 18765.26 | 4.36 (1.14) | 7 | 6 | 27515.10 | 5.46 (0.97) |
| 7 | 11 | 17265.06 | 5.15 (2.02) | 10 | 4 | 26500.25 | 6.66 (1.26) |
| 3 | 2 | 16893.51 | 5.92 (2.37) | 3 | 4 | 19480.57 | 7.55 (2.05) |
| 14 | 11 | 9441.98 | 6.35 (2.52) | 14 | 12 | 16635.7 | 8.31 (2.09) |
| 8 | 4 | 8958.95 | 6.75 (3.31) | 8 | 4 | 8958.95 | 8.71 (3.67) |
| 9 | 5 | 8676.63 | 7.15 (3.35) | 11 | 12 | 6724.75 | 9.02 (3.72) |
| 5 | 11 | 3253.42 | 7.30 (3.39) | 9 | 4 | 3368.79 | 9.17 (3.82) |
| 1 | 2 | 2217.06 | 7.40 (3.69) | 1 | 2 | 2217.06 | 9.27 (3.78) |
| Total | | 162551.37 | 7.4% | | | 203752.16 | 9.27% |

Table 1: Cost reducing technology transfers, controlling for population effects

are statistically significant. If health improvement is instead based on abstinence, then the estimated cost savings from the transfers of "best practices" is 9.27%. Note that, although the ordering and patterns of transfers are different under the alternative health measures, the conclusions regarding which agencies benefit from a transfer and the magnitude of total cost savings are similar.

# Conclusion

AMR develops and applies a methodology for comparing the performance of providers of alcohol abuse treatment in Maine. The separate identification of agency "population effects" and "treatment effects" enables hypothetical comparisons of how different agencies would perform treating the same patient populations. The study concludes that Maine could improve the cost effectiveness of publicly funded treatment substantially by identifying and transferring best practices.

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