Reading Note on "Paying on the Margin for Medical Care"

Health care spending in the Unites States keep increasing and it is crucial to reduce expenditures on medical reimbursements. To save cost on medical expenditures, this paper comes up with a regime, called "top-up", which provides a middle ground between other two commonly used regimes, "no top-up" in the United Kingdom and "full coverage" in the United States. Also, the authors further compare the welfare effects of these three regimes quantitatively based on an estimated demand curve and illustrate the gains in welfare of "top-up" health insurance policy, compared with "no top-up" and "full coverage". In addition, the authors analyze the ranking of these three policies from ex ante perspective, considering their impact on risk exposure and ex ante utility. From both ex post welfare analysis and ex ante risk exposure analysis, this paper evaluates the "top-up" policy and show the quantitative welfare gains from it.

Before introducing empirical evidence in this paper, it is vital to provide definitions of these three regimes. The "top-up" policy in this paper refers to a health insurance contracts that would cover the cost of a baseline treatment, while patients could choose to pay the incremental cost of the more expensive treatments out-of-pocket. In the "no top-up" policy, only cost-effective treatments would be covered by insurance, and all treatments would be covered in the "full coverage" policy.

With the empirical evidence from breast cancer treatments in this paper, these three policies are defined accordingly. Lumpectomy (L) and mastectomy (M) are two typical breast treatments. Lumpectomies are breast-conserving surgeries and more expensive[1] because of the following radiation therapy requiring 25 treatments spread over 5 weeks, while mastectomies remove the entire cancerous breast without the radiation therapy. These two treatments of breast cancer have same health benefits (especially refer to average survival outcomes in this paper[2]). Therefore, the "top-up" insurance would cover the cost of mastectomy as the baseline cost, and patients would pay for the cost differences between lumpectomy and mastectomy, while the "no top-up" insurance would only cover the cost of mastectomy but pay nothing for lumpectomy, and "full coverage" insurance would pay for all cost of lumpectomy and mastectomy.

To evaluate three policies in the context of breast cancer, two datasets from the state of California are used in this paper: a patient-level cancer registry dataset from California Cancer Registry (CCR), and data on radiation treatment facility location from the private firm IMV. The data from CCR are collected directly from cancer patients' medical records with the time of the cancer diagnosis, the treatment choice, the exact address of residence while diagnosis, and a relatively rich set of covariates[3]. The data from IMV provides the exact street address for all institution available for radiation therapy. The authors choose over 300,000 patients[4] diagnosed between 1997 and 2009 who chose either lumpectomy or mastectomy and match these patients to her nearest radiation facility through data from IMV ranging from 1996 to 2009. Computing the distance to the nearest radiation facility, the authors use logit model with no controls, logit model with some covariates, and logit model (interacted terms and random coefficients) and find that ten minutes further distance would decrease the probability to choose lumpectomy by about 0.7 to 1.1 percentage points (while the mean lumpectomy probability in this paper is 58 percent).

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[1] Evidence is provided in Polsky et al. (2003).

[2] This result is released in 1985 (Fisher et al. 1985) and in following years (in 1989, 1995, 2002).

[3] From cancer registry dataset, there are variables measuring patient demographics (age, race, marital status, and insurance coverage) and clinical characteristics (stage and grade), also, the authors link it with the census block level, and obtain individual-level measures of covariates (income or educational attainment).

[4] Exclude cases identified through autopsy and death certificate only, age at diagnosis was less than 20, with missing data on treatment (include not choose two typical treatments) and missing data on residence.

After verifying the negative robust relationship between distance to the nearest facility for radiation therapy at diagnosis and treatment choice, the authors estimate a relative demand curve. The relative valuation (or willingness to pay) for L is $v_i \equiv v_{i,L} - v_{i,M}$ and the utility from lumpectomy is given by $u_i \equiv \alpha_i - \beta_i(\theta_i d_i + p)$[5]. When $u_i > 0$, the patient would choose lumpectomy, that is, $\Pr(L) = \Pr\,(u_i > 0)$. With assumption that price and (monetized) distance have the same effect on individual utility, the utility equation can be rewrite as $u_i \equiv \alpha_i - \beta_i' d_i$, where $\beta_i' = \theta_i d_i$ and $p = 0$ (full coverage). Through these equations, the cumulative distribution function $F(v_i)$ is obtained. Also, the welfare effects of alternative policies could be evaluated through the demand curve $F^{-1}(v_i)$ which provides a graphical framework for welfare analysis.

With the graphical framework built, the authors use it for ex post welfare and estimate treatment choices. Normalizing individual utility from mastectomy to zero, then $\Pr(L) = \Pr\,(u_i > 0) = \Pr\,(v_i = \alpha_i/\beta_i - \theta_i d_i > p = 0)$ for full coverage. Also, the authors set $\theta_i = 1150$ based on the average hourly wage and times for radiation therapy. Using values of α_i and β_i in the logit model of distance and treatment choice, \$10,000 as the incremental cost of lumpectomy and \$50,000 as the total cost of lumpectomy[6], the authors estimate the demand function of lumpectomy and the welfare effects of three policies. From the results with no controls, the "full coverage" policy raises the lumpectomy rate from 21 percent under "top-up" policy to about 58 percent, while the "no top-up" policy reduces the lumpectomy rate from about 21 percent under top-up policy to nearly zero. For associated welfare cost, the "full coverage" policy increases about \$2,00 individually relative the "top-up" policy, while the "no top-up" policy reduces it by about \$1,400 per patient[7].

Besides the ex post perspective, this paper includes brief ex ante perspective analysis. Using CARA utility $w(x) = -e^{-rx}$ with a (homogeneous) coefficient of absolute risk aversion r, and (homogeneous) annual probability of illness ρ. From the different p under three policies, this paper shows that there is no risk exposure under the "full coverage" policy, while the "no top-up" policy has the highest risk exposure. Also, the "no top-up" policy produces the inefficient treatment choices. Therefore, the "top-up" policy is more efficient than the "no top-up" policy. However, the ranking between the "top-up" policy and the "full coverage" policy is unclear. Because the "full coverage" policy produces the inefficient treatment choices with no risk exposure. For patients who have high level risk aversion, the "full coverage" policy has lower social cost than the "top-up" policy.

In all, this paper evaluates the "top-up" policy through both ex post and ex ante analyses, and finds that the "top-up" policy is ex post efficient and dominates "no top-up" policy in ex ante analysis, comparing with the "no top-up" policy and "full coverage" policy. The most important two contributions of this paper are the graphical framework to visualize welfare effects analysis and the estimation demand curve and quantify the resultant welfare effects with the distance. However, there are limitations. The IMV data are used in this paper regardless of whether the institution response to the call for survey. But some institutions may be closed and did not response to the call. Also, the increment payment in "top-up" policy is hard to define, but, this paper only considers cost differences between two surgeries based only on the same survival outcomes. There are also other perspectives on health benefits like psychology status which make the incremental cost estimation much more complicate.

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[5] where α_i and β_i are the preference parameters, d_i is the distance of patient i to the nearest radiation facility, and p is the incremental price she would need to pay for lumpectomy (relative to mastectomy).

[6] \$10,000 and \$50,000 is decided based on Polsky et al. (2003).

[7] Other results with different controls are list in Table 4, as well as Figure 3.