Supplementary Appendix

This appendix has been provided by the authors to give readers additional information about their work.

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Supplementary Appendix:
Consequences of the 340B Drug Pricing Program

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A. 340B eligibility/participation and hospital DSH percentage

Additional details on 340B eligibility and participation

Hospitals with a DSH percentage exceeding 11.75% in their last submitted annual Hospital Cost reports are 340B eligible.[1] In order to participate in the Program, hospitals must register with the Health Resources and Services Administration. Hospitals can begin 340B participation on the first day of a calendar-year quarter (January 1, April 1, July 1, and September 1). In order to continue participation, hospitals must demonstrate continued eligibility prior to the start of the next calendar year.

Hospital DSH percentages are reported in the Hospital Cost Reports.[2] DSH percentages are based on a hospital's urban/rural location status, number of beds, and DSH patient percentage (DPP) which is given by

$$\frac{Medicare\ Supplementary\ Security\ Income\ Inpatient\ Days}{Total\ Medicare\ Inpatient\ Days} + \frac{Medicaid,\ \ Non{-}Medicare\ InpatientDays}{Total\ Inpatient\ Days}.$$

The DSH percentage is capped at 12.0% for urban hospitals with less than 100 beds and rural hospitals with less than 500 beds.[3] Because this cap places a small but arbitrary set of hospitals at a DSH percentage of 12.0%, we recalculate DSH percentages for these hospitals applying the appropriate formula without the cap. Of the observations with a DSH percentage equal to 12.0%, 97% were in the categories subject to the cap, urban hospitals with less than 100 beds or rural hospitals with less than 500 beds. To verify our recalculations were accurate, we compared calculated DSH percentages for hospitals in categories not subject to the cap to their reported DSH percentages. The correlation between the calculated and reported DSH percentages among these hospitals was 0.996, supporting the accuracy of our calculations.

Clarification of DSH percentage variable specification in estimation models

In the main specification, the hospital DSH percentage variable was centered around 11.75% (specified as DSH percentage – 11.75%). Therefore, the coefficient for the adjusted discontinuity estimate can be interpreted as the effect of 340B eligibility for a hypothetical hospital with a DSH percentage equal to the eligibility threshold. This centering of the DSH percentage variable was done in all model estimations except for the sensitivity analysis with a single slope for DSH percentage in which centering is not necessary (described in Appendix section I).

B. Construction of hospital-level sample

Details of sample construction

The sample consisted of non-profit and government-owned general acute care hospitals from 2008-2012 with DSH percentages within 10% of the Disproportionate Share adjustment (DSH) percentage corresponding to the 340B eligibility threshold (11.75%). For-profit hospitals were identified in the Hospital Cost Reports and dropped. Special designation hospitals, which were also identified using Hospital Cost Reports and dropped, included critical access hospitals, sole community hospitals, pediatric hospitals, rural referral centers, and free-standing cancer centers. [4] Because many of these special designation hospitals are small hospitals (e.g., sole community hospitals have fewer than 50 beds[3], and critical access hospitals have 25 or fewer beds[5]), as an extra precaution against including hospitals that could be 340B eligible through alternate criteria, we drop all hospitals with less than 50 beds. Hospitals that were dropped because they had fewer than 50 beds constituted only 2% of fee for service Medicare hospital inpatient and 3% of

hospital outpatient spending in 2010 the midpoint of our study period. For 53 (1% of sample) hospital-year observations, hospital characteristics from the HCRIS data were missing, and these hospitals were dropped from all analyses.

Share of Medicare hospital spending attributable to sample hospitals

The regression discontinuity design employed in our analysis identifies causal effects of treatment on a marginal subject – in this case the effect on hospitals close to the 340B eligibility threshold. While marginal effects are not the average treatment effects among the full treated population, they are often of great policy relevance. Moreover, the generalizability and relevance of a marginal effect depends on how atypical the marginally affected subject is. In our study, hospitals near the Program eligibility threshold were not atypical and constituted a large share of Medicare hospital spending. For example, general acute care hospitals included in our study with DSH percentages within 10% of the eligibility threshold accounted for 56% of hospital inpatient spending in Medicare and 58% of hospital outpatient spending among public or non-profit general acute care hospitals in 2010, and public or non-profit general acute care hospitals accounted for 66% of spending among all hospital types.

Hospitals with a DSH percentage within 1% of the eligibility threshold were dropped to address misclassification and potential manipulation of DSH percentage by hospitals to select into 340B eligibility. Misclassification, which largely results from differences in HCRIS reporting periods and/or 340B participation that can begin mid-year, was vastly greater within 1% of the eligibility threshold relative to hospitals outside of that range. Specifically, 41% of observations with a DSH percentage in the previous year

between 10.75% and 11.75% were defined in the data as 340B participants and therefore, clearly subject to misclassification. In contrast, only 3.8% of observations with a reported DSH percentage between 1.75% and 10.75% in the previous year were reported as 340B participants suggesting there is substantially greater misclassification among observations within 1% of the threshold. While a number of analyses detailed in Appendix section G ruled out evidence of meaningful hospital manipulation of DSH percentage by hospitals to select into 340B eligibility, the secondary rationale for dropping these observations was a precautionary measure to exclude hospitals that were most likely to engage in such manipulation (those closest to the eligibility threshold).

C. Construction of sample for patient-level analyses on mortality rates in local communities

Hospitals that were the only study hospital in their five-digit ZIP code were identified (75% of hospitals in our sample met this criteria). All beneficiaries (continuously enrolled in fee-for-service Medicare in a given year) residing in these ZIP codes were included in the sample and assigned to the hospital in their ZIP code. Table S4 demonstrates that there were no discontinuous changes above versus below the threshold in observable sociodemographic and clinical characteristics: age, gender race/ethnicity, disability as the original reason for enrollment, ESRD as the original reason for enrollment, the number of chronic conditions from the Chronic Conditions Warehouse (Alzheimer's disease, Alzheimer's disease and related disorders or senile dementia, anemia, asthma, atrial fibrillation, benign prostatic hyperplasia, breast cancer, cataract, chronic kidney disease, chronic obstructive pulmonary disease, colorectal cancer, depression, diabetes, endometrial cancer, glaucoma, heart failure, hip or pelvic fracture, hyperlipidemia,

hypertension, hypothyroidism, ischemic heart disease, lung cancer, osteoporosis, prostate cancer, acute myocardial infarction, rheumatoid arthritis, and stroke or transient ischemic attack), Hierarchical Conditions Categories score (derived from demographic and diagnostic data in Medicare files from the previous year, with higher scores predicting higher predicted spending in the subsequent year), whether the patient was served by a safety net provider, and rates of educational attainment and poverty in beneficiaries' ZIP code tabulation area.[6] Regressions estimating eligibility-related discontinuities in patient characteristics controlled for hospital characteristics

D. Details on construction of dependent variables

Number physicians in outpatient practices/facilities owned by hospital

We determined the number of physicians practicing in hospital-owned facilities or practices in three steps. Step 1 closely follows the method used by Neprash et. al. (2015), which identifies whether physicians are financially integrated with any hospital.[7] In Step 2, we build on this measure by matching physicians to specific hospitals, so that we can measure the number of physicians practicing in a given hospital's owned practices. In Step 3, we calculate the number of physicians who are defined as being consolidated with a given hospital.

Step 1. We identify all physicians who are employed by or in a practice owned by hospitals using a 20% sample of Medicare claims. Physicians were treated as the National Provider Identifier (NPI) – Tax Identification Number (TIN) combinations, because physicians can bill under multiple TINs. About fifteen percent of physicians bill under multiple TINs. We identify all professional claims billed in a free-standing office or hospital-

owned practice from the Carrier files. To minimize inclusion of invalid claims, only claims with a positive reimbursement amount are included. Physicians who billed more than 75% of claims in a hospital-owned practice were defined as being employed by a hospital or in a practice owned by a hospital.

Step 2. We match physicians identified as practicing in a hospital-owned outpatient department to the owning hospitals. We match physician professional claims to outpatient claims which include a hospital identification number. To be a potential match, the outpatient claim had to occur in a hospital-owned practice, and the total reimbursed amount was required to be positive. We consider a professional and facility claim to match if any of the following combinations of elements of a professional and facility claim match: 1) beneficiary ID and date of service, 2) beneficiary ID, date of service ±7 days, and attending or operating NPI match, or 3) beneficiary ID, date of service ± 7 days, and first four-digits of the current procedural terminology (CPT) code for the service provided.

In a small number of cases in which a professional claim matched multiple facility claims, a facility claim designating the modal hospital was selected. Among these, if facility claims from multiple hospitals were equally present, a hospital was selected at random. Using the matched professional-facility claims, we identified the hospital with which the plurality of each physician's claims was associated. Physicians were categorized as practicing in a practice owned by that hospital. To verify the validity of this approach, online searches were conducted for a random selection of 15 physician-hospital matches, and it was confirmed that these physicians in fact worked in a practice owned by the matched hospital.

29% of hematologist-oncologists, 13% of rheumatologists, and 6% of ophthalmologists on average during our study period were categorized as practicing in a hospital-owned facility. Of these, 99.8% of hematologist-oncologists, 99.7% of rheumatologists, and 99.5% of ophthalmologists could be assigned to a specific hospital with this method.

Step 3. We count the number of physicians consolidated with a hospital. Using the hospital-physician match, we sum the number of physicians in its owned practices. We define separate measures by the specialties examined in our main analysis.

Assigning physicians to a specialty

We assign each physician (identified by their NPI) to a specialty. In the Medicare Carrier files, claims include a field for NPI indicating the billing provider as well as a Medicare Specialty Code. The Medicare Specialty Code is a taxonomy that describes the billing provider and includes physician specialty.[1]

We use the following method to assign a single specialty to each physician NPI in each year, based on the procedure used by Neprash et. al. (2015). First, we identify all claims billed by each physician NPI in a free-standing office or a hospital-owned practice. Claims billed in a physician free-standing facility are identified via place of service code equal to 11, and claims billed a hospital-owned outpatient department are identified via a place of service code equal to 22. To minimize inclusion of invalid claims in this measure,

[1] https://www.cms.gov/medicare/provider-enrollment-and-certification/medicareprovidersupenroll/downloads/jsmtdl-08515medicarprovidertypetohcptaxonomy.pdf

claims are also required to have a non-missing beneficiary identifier and a non-missing provider tax identification number.

In each year, every NPI is assigned the Medicare Specialty Code that appears most frequently in his or her claims. Using these specialty designations, physician NPIs with Medicare Specialty code of 82 (hematology), 83 (hematology-oncology), 90 (medical oncology), 98 (gynecological oncology) are defined as hematologist-oncologists. We include hematology, because many hematologists train in hematology-oncology fellowships, could treat cancer patients, and also use parenteral drugs for hematologic conditions such as iron deficiency anemia. In our main measure of hospital to hematologist-oncologist consolidation, we do not include physician NPIs designated as surgical oncologists (specialty code 91) or radiation oncologists (specialty code 92), because these physicians are less likely to administer parenteral drugs. Rheumatologists are identified with specialty code equal to 66, and ophthalmologists with specialty code equal to 88.

Number Medicare patients served per year in outpatient practices/ facilities owned by hospital

The number of patients served by hospital's owned practices in each year is defined as the number of continuously enrolled in fee-for-service Medicare beneficiaries who have Outpatient File claims occurring in a hospital's owned practices (including on-campus hospital outpatient departments (HOPDs) and off-campus practices owned by the hospital that are also eligible to bill as HOPDs and whose claims thus also appear in the Outpatient File). Claims were required to have an allowed amount exceeding zero to minimize the inclusion of rejected or invalid claims. We determine the number of beneficiaries served by

each hospital separately for each specialty by using the specialty of the attending physician on the claim to identify beneficiaries with at least one claim in the specialty of interest.

Proportion of Medicare patients served who were dually eligible for Medicaid or state assistance

Dually enrolled patients were identified using the Beneficiary Summary File and defined as patients who received Medicaid benefits or any state assistance for Medicare cost sharing. For each specialty and hospital, the variable was calculated by dividing the number of dually eligible patients served by a specialist in the hospital's owned practices by the total number of patients served by a specialist in the hospital's owned practices. Hospitals with zero patients served by a specialist were dropped from analyses on this outcome.

Number Part B drug claims billed per year by outpatient practices/ facilities owned by hospital

For each hospital and each specialty in each year, we counted all claims for Part B drug provided by the hospital to patients identified as being served by a specialist in the specialty of interest in a practice/facility owned by the hospital. Outpatient claims for Part B drugs were identified using drug CPT codes in the October 2012 Average Sales Price Drug Pricing file.

Number Medicare patients per year receiving Part B drugs from practices/outpatient facilities owned by hospitals

Any patient with an outpatient claim from a specialist in a practice owned by a given hospital and positive allowed amount attributable to Part B drug claims was identified as receiving Part B drugs from the hospital.[2]

Total hospital revenue for Part B drug spending by specialty

Drug claims for patients served by specialists in a practice owned by a hospital were identified using the aforementioned methodology. Total revenue attributable to these drug claims were measured as the sum of all payments made by Medicare, secondary payers, and the beneficiary for claims in the Outpatient files under which drugs were delivered.

Number admissions per year for beneficiaries served by safety net providers

Beneficiaries served by safety net providers were defined as beneficiaries with an inpatient, outpatient, or carrier claim for a service rendered in a federally qualified health center, community mental health center, rural health clinic ,or other safety net provider. Other safety net providers included any of the following: homeless shelter, Indian health service free-standing facility, health service provider-based facility, tribal 638 free-standing facility, tribal 638 provider-based facility, prison/correctional facility, mobile unit, intermediate care facility, residential substance abuse treatment facility, non-residential substance abuse treatment facility, or public health clinic (place of service = 50, 53, 72, 4, 5, 6, 7, 8, 9, 15, 54, 55, 57, or 71).

Number of visits to FQHCs integrated with hospital

[2] https://www.cms.gov/Medicare/Medicare-Fee-for-Service-Part-B-Drugs/McrPartBDrugAvgSalesPrice/2012ASPFiles.html

This measure was drawn from the HCRIS files and Winsorized at the 99th percentile. Without Winsorization, the discontinuity estimate at the DSH percentage for 340B eligibility is -144.4 (95% CI: -428 to 140; p=0.32).

Interpretation of coefficient estimates

Because our analysis is conducted on a 20% sample of Medicare FFS claims, for outcomes measured in units or dollars, an approximation of the full absolute effect for the hospital and the expected means for outcomes can be calculated by multiplying the coefficients and expected means by 5.

E. Specification for patient-level analyses on mortality rates in local communities

Analyses on mortality in local communities were conducted at the patient level on the sample described in Appendix section D. The specification was similar to that of the hospital-level analyses on the primary outcomes, with DSH percentage, eligibility, and hospital covariates in each observation referring to the hospital with the maximum share of admissions in the beneficiary's ZIP code. Several patient-level demographic and clinical characteristics were also included as covariates: age, gender, race/ethnicity, disability as original reason for Medicare enrollment, end-stage renal disease as original reason for Medicare enrollment, number of chronic conditions from the Chronic Conditions Warehouse, Hierarchical Conditions Category score, whether the patient was served by a safety net provider, whether the patient was dually-enrolled in Medicare and Medicaid or received state assistance, and rates of educational attainment and poverty in beneficiary's area of residence. When testing for balance in patient characteristics, specifications included hospital-level covariates but not other patient-level covariates.

F. Instrumental variables estimation

We conduct an instrumental variables analysis to remove from estimates the measurement error introduced by some misclassification of hospital eligibility based on hospital DSH percentage (particularly close to the threshold due to differences in timing of Hospital Cost Reports reporting periods, as detailed in Appendix section A and for incomplete take up of the Program (about 80% of eligible hospitals participated). The instrumental variables (IV) model was estimated in two stages. In the first stage, the probability a hospital's 340B participation was modeled controlling for eligibility and other hospital-level characteristics:

$$E(340B_{it}) = \beta_0 + \beta_1 340B\ Eligible_{it} + \beta_2 DSH_{it} + \beta_3(340B\ Eligible_{it} * DSH_{it}) + \gamma \boldsymbol{X_{it}} + \propto_t$$

Where $340B_{it}$ indicates whether hospital *i* participates in the 340B Program in year *t,* $340B\ Eligible_{it}$ indicates whether hospital *i* was 340B eligible in year *t*, DSH_{it} is hospital *i*'s DSH percentage off which 340B eligibility in year *t* is based, $\boldsymbol{X_{it}}$ is a vector of hospital characteristics, and $\propto_t$ are year fixed effects.

Hospitals' 340B participation status is then predicted using the first stage estimations and used in the second stage analysis:

$$E(Y_{it}) = \beta_0 + \beta_1 \widehat{340B}_{it} + \beta_2 DSH_{it} + \beta_3\left(340B \widehat{_{it} \times DSH_{it}}\right) + \gamma \boldsymbol{X_{it}} + \propto_{year} + \varepsilon_{it}$$

Where $\widehat{340B}_{it}$ indicates the predicted probability that hospital *i* participates in the 340B Program in year *t* and $340B \widehat{_{it} \times DSH_{it}}$ indicates the predicted interaction between 340B participation and DSH percentage, where the DSH percentage variable is centered around

the eligibility threshold. Figure S1 illustrates our first stage regression and demonstrates the large and discontinuous increase in the probability that a hospital participates in the 340B Program at the DSH percentage threshold for hospital eligibility. Since 340B Program eligibility was associated with a 68% increased probability of hospital participation based on its DSH percentage at the threshold during out study period, the IV estimates of participation effects are approximately 47% (1/0.68 x 100) greater in hospital-level analyses than estimated effects of eligibility (Table S1). In other words, since effects of program eligibility must be concentrated among hospitals that participated in the program, the eligibility-related discontinuity must be inflated to obtain the participation-related discontinuity. Therefore, IV estimates of the effects of Program participation were larger in magnitude than estimates of the effect of Program eligibility.

G. Tests of assumptions for regression discontinuity approach

We test several important assumptions underlying our approach. First, we examined the stability of hospital DSH percentages over time. Given our primary outcome of interest – hospital-physician consolidation – is likely to be a longer term hospital response rather than an immediate one upon a change in eligibility status, we would expect such a response if eligibility was stable over time. Second, we tested for evidence that hospital were manipulating their DSH percentage at the eligibility threshold. Finally, for evidence that other factors unrelated to the 340B Program were not changing discontinuously at the threshold, we tested for discontinuities in hospital and patient characteristics that should not be affected by the Program.

Stability of hospital DSH percentages

We conduct several tests that hospital DSH percentages, and in turn, 340B eligibility status, remained relatively stable over time for most hospitals. Figure S2 which plots hospital DSH percentage in 2004 against hospital DSH percentage in 2012 illustrates the relative stability of DSH percentages over the 8-year period from 2004-2012. 68% of hospitals that were 340B eligible in 2004 were eligible in 2012, and 79% of hospitals that were 340B eligible in 2012 were eligible in 2004. Among hospitals with DSH percentages >1% above the threshold in 2004, 90.0% remained eligible in 2010 (midpoint of our study period).

In any pair of consecutive years during the 2008-2012 study period, 3.8% of hospital observations moved from >1% above the threshold to below the threshold, and 4.6% moved from >1% below the threshold to above it. Among hospitals eligible for the Program in 2008, those with DSH percentages within 2 percentage points of the eligibility threshold in 2008 were eligible for 85% of the 5-year study period (Figure S3). Hospitals that were eligible in 2008 and within 10 percentage points of the threshold in 2008 were eligible for 96% of the 5-year study period. After dropping hospitals within the 1% donut, average percent of time eligible increased to 87% among hospitals within 2 percentage points of the eligibility threshold and to 96% among hospitals with DSH percentages within 10 percentage points of the eligibility threshold.

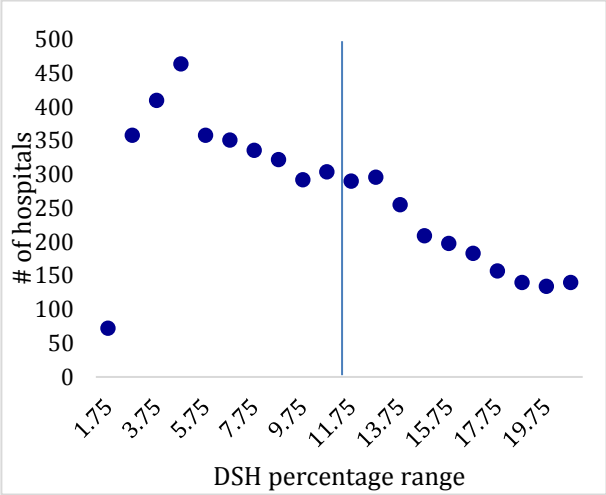
Hospital manipulation of DSH percentages

If hospitals manipulated their DSH percentages to select into 340B eligibility in a way that was related to levels of our study outcomes, a key assumption of our empirical

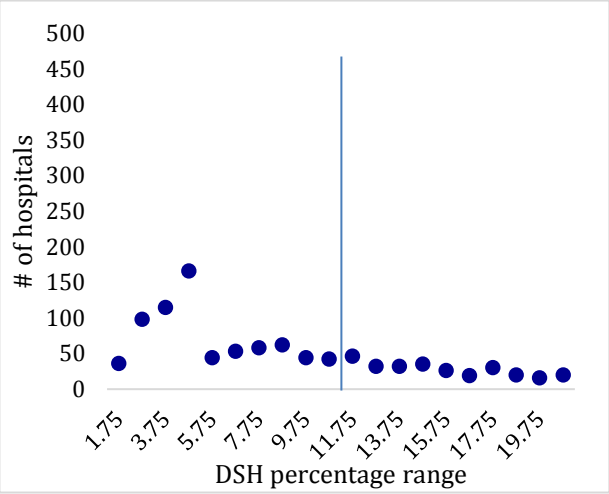
strategy would be violated. We tested for evidence that hospitals manipulate their DSH percentage to select into 340B eligibility by testing for "bunching" above the threshold. We divided DSH percentage into bins of 2% and counted the number of hospitals in each bin. Figure S6 shows the number of hospitals by DSH percentage. There was no spike in the frequency of hospitals just above the eligibility threshold, which we would expect if hospitals were manipulating their DSH percentage to become 340B eligible.

There was a small suggestion of bunching just above the threshold largely within the 1 percentage point interval we excluded from analyses. However, a similar pattern in the distribution of the number of hospitals close to the eligibility threshold in 2002 demonstrates the pattern is a natural and persistent one preceding 340B expansion, further alleviating concerns of substantial selection into 340B eligibility through manipulation of DSH percentage. The figures below plot the number of observations in each DSH percentage point bin during the study period, 2008-2012 (A) and 2002 (B). We also note that failure to account for the 12% cap in the DSH percentage calculation for urban hospitals with less than 100 beds and rural hospitals with less than 500 beds (see section A) would create the appearance of manipulation by mechanically placing a small but nontrivial number of observations just above the eligibility threshold.

A. Distribution of the number of hospitals by DSH percentage point: 2008-2012



B. Distribution of the number of hospitals by DSH percentage point: 2002



In an additional analysis for evidence of manipulation of DSH percentage to select into 340B eligibility, we test for disproportionately greater changes in DSH percentage since expansion of the 340B Program to general acute hospitals. If hospitals were selecting into 340B eligibility, we would expect that hospitals just above the threshold would experience greater increase in DSH percentage over time compared to other hospitals. We do not find evidence of such disproportionate increases, providing further support for this assumption. For example, comparing DSH percentages in 2002 (before Program expansion) to the DSH percentage for eligibility in 2010 the middle of our study period, hospitals in the 2 percentage points above the eligibility threshold in 2010 experienced slightly lower average increases in DSH percentage compared to average increases for hospitals in the 2 percentage points below the threshold and compared to the average increase among all hospitals.

As detailed in section I and Table S9, results were similar in analyses using 2002 hypothetical DSH percentages and eligibility status (before the overwhelming majority of

study hospitals became eligible), essentially ruling out selection via DSH percentage manipulation as a significant contributor to our findings and supporting the assumption underlying our empirical strategy.

We also conducted analyses excluding hospitals that had changed 340B eligibility status between 2002 and our study period, which bluntly addresses potential manipulation by removing all hospitals that could have selected into 340B. Results were similar to the analyses using 2002 DSH percentages in both magnitude and precision and did not weaken estimated effects of consolidation and drug provision.

Discontinuities in hospital and patient characteristics at the DSH percentage for 340B eligibility

We tested for discontinuities at the DSH percentage for 340B eligibility among several hospital-level characteristics that should not be affected by the 340B program: teaching status, urban/rural classification, number of beds, and Census region. We find that these hospital-level variables largely trend smoothly through the threshold.

For patient-level analyses on mortality in local communities (as well as supplementary analyses on drug provision in local communities), we also test for discontinuities in patient demographic and clinical characteristics as discussed in Appendix section F. Again, we do not find evidence of discontinuities in patient characteristics, supporting assumptions of the regression discontinuity approach.

H. Accounting for multiple correlated primary outcomes

To aid interpretation of the multiple significance tests we conducted in our primary analyses, we implement a modified Hochberg procedure described by Sankoh et al.[8] that

takes into account the magnitude of the correlation between outcomes. This was important for our analyses because our primary outcomes were so closely related conceptually and strongly correlated empirically, with each assessing a closely related aspect of the primary behavioral change we sought to assess (whether hospitals followed the Program incentives). First, we calculate the average of the Pearson correlation coefficients between each of the primary outcomes within each specialty. The average correlation coefficients in hematology-oncology, ophthalmology, and rheumatology are 0.81, 0.86, and 0.88, respectively, with 88% of the pairwise correlation coefficients exceeding 0.70 (i.e., a tight and high range). Given an average correlation coefficient between 0.8 and 0.9 with 6 end points within each specialty, we select a correction factor, c, of 2 (from Table IV in Sankoh et. al. 1997).

In this approach, the P values for each test are ordered from largest to smallest. The adjusted threshold for significance is calculated for each outcome in descending order of its p value. If the null hypothesis is rejected for any outcome, the null hypothesis is rejected for all outcomes with smaller p values and the procedure is complete. If the null hypothesis cannot be rejected for an outcome, the procedure is repeated for the next outcome. The adjusted threshold for significance is given by $c\alpha/(K-n_r+1)$ where c is the correction factor, α is the unadjusted threshold for significance or type I error (0.05), K is the number of endpoints (6 in our study), and n_r indicates the rank of the particular p value (n_r =1 indicates the largest p value). To be conservative, we restrict the adjusted threshold for significance to be 0.05 or less.

Table S3 presents the ordered p values, the adjusted threshold for significance when relevant and whether the coefficient on each outcome is deemed statistically significant.

This adjustment for multiple testing does not lead to any statistically significant results according to an unadjusted threshold to be deemed not statistically significant.

I. Sensitivity analyses

Estimating discontinuities using different bandwidths around the 340B eligibility threshold

We re-estimated discontinuity models for key outcomes across bandwidths from 2%-40%, in 0.5% increments. The models are estimated with a single slope for hospital DSH percentage in analyses using a bandwidth of 4% or greater and no slope for analyses with bandwidths smaller than 4% to avoid overfitting to data points that are insufficient to establish trends.

Discontinuities in the number of hematologist-oncologists working on hospital-owned practices, the number of patients treated by a hematologist-oncologist in a hospital-owned practice, and Part B drug spending among patients treated by a hematologist-oncologist in a hospital-owned practice remain positive across the range of bandwidths. As expected, when using increasingly narrow bandwidths around the threshold, the estimates become more variable with wider 95% confidence intervals but vary around (and are consistent with) estimates from our main analysis that used a 10 percentage point bandwidth. For significant results from our main analyses, estimates using the smallest bandwidths remain positive, similar in magnitude, and for many outcomes statistically significant (Figure S7).

We additionally present results for all outcomes using a 3% bandwidth around the eligibility threshold (Tables S5-6). Discontinuities in primary outcomes are estimated with

no slope to avoid overfitting Our results are largely consistent in magnitude and statistical significance relative to the main results with a larger bandwidth.

Estimating discontinuities using a single slope for DSH percentage on both sides of the threshold

We re-estimate our models constraining the slope to be the same for DSH percentages above and below the eligibility threshold. This approach allows us to ensure that the main results in which the slope on DSH percentage is allowed to vary on either side of the 340B eligibility threshold, is not driven by overfitting. The regression model we estimate is

$$E(Y_{it}) = \beta_0 + \beta_1 340B\ Eligible_{it} + \beta_2 DSH_{it} + \gamma \boldsymbol{X_{it}} + \propto_{year}$$

Discontinuities in hospital-level (Table S7) and patient-level (Table S8) outcomes are similar to the main results.

Estimating discontinuities using hypothetical hospital eligibility in 2002, prior to 340B Program expansion

As an additional test of hospitals' ability to manipulate their DSH percentages, we use components of the hospital DSH percentages for 2002 characteristics to calculate each hospital's hypothetical DSH percentage and eligibility status in 2002 using the current DSH percentage formula. We then estimate the discontinuities in our outcomes using these hypothetical DSH thresholds. We choose 2002 because it is before the 11.75% DSH eligibility criteria was established in 2003 and put into effect in 2004. Therefore, hospitals were unlikely to know about this eligibility threshold and manipulate their DSH percentage in response. The results can also be interpreted as better reflecting the longer term

responses of hospitals that have participated in the 340B program since 2004, because the estimation of discontinuities based on 2002 DSH percentages essentially gives greater weight to hospitals that have been 340B eligible for longer because over the 2004 to 2012 period there was net growth in 340B eligibility.

The effect sizes on the number of physicians practicing in a hospital-owned practice and number of patients served in a hospital-owned practice are greater than those in the main results (Table S9). This suggests that the effects of the 340B program on hospital-physician consolidation and number of patients treated in drug-intensive specialties are greater for hospitals eligible and participating for longer, reflecting the long-term nature of hospital strategies to acquire physician practices.

Estimating discontinuities without weighting for number of beds

In sensitivity analyses, we conduct our primary analyses without weighting for the number of beds in the hospital to provide insight into whether the main effects were driven by larger or hospital smalls. Estimates are largely consistent with the main findings. The increase in estimates in the weighted analyses relative to the unweighted indicates that the effects were more strongly concentrated in larger hospitals (Table S10).

Adjusting for state fixed effects instead of region

To examine whether our results are being driven by regional factors, we estimate our model of hospital response to the 340B program with controls for state fixed effects instead of region fixed effects (Table S11). These analyses do not alter our main conclusions.

Additional sensitivity analyses

A number of additional post hoc sensitivity analyses are conducted and results are consistent with the study conclusions.

In these sensitivity analyses, we include hospitals that were dropped from the main sample because they had fewer than 50 beds. Results after the inclusion of these hospitals support the study conclusions that the 340B Program contributed to consolidation in hematology-oncology (2.4 additional hematologist-oncologists/hospital, p = 0.02) and increased drug administration by hospitals in hematology-oncology (220 more drug claims billed/hospital, p=0.002) and ophthalmology (76 more claims/hospital, p=0.03). Analyses without weighting observations by the number of hospital beds also yield results consistent with study conclusions.

We also re-estimate primary analyses restricting the time period to before 2011 to test whether a regulatory change in 340B hospital reporting of outpatient clinics effective 2011 affected our results. Our study conclusions remain unchanged and in fact, estimates of hospital-physician consolidation associated with the Program eligibility threshold became larger, and the estimate for ophthalmologists became statistically significant. Specifically, the adjusted discontinuities at the 340B eligibility threshold were 2.7 additional hematologist-oncologists/hospital (p=0.01) and 1.6 additional ophthalmologists/hospital (p=0.03).

We conduct analyses with hospital referral region (HRR) fixed effects to examine results after controlling for finer geographic designations. Including HRR fixed effects instead of state or region effects yielded discontinuity estimates that are overall similar in

magnitude and more precise (presumably from the variance reduction achieved with smaller geographic units as predictors). For the analysis of hospital-physician consolidation, adjusted discontinuity estimates were 2.1 more hematologist-oncologists/hospital (p=0.02) and 1.1 more ophthalmologists/hospital (p=0.01).

We also examine the extent to which adding hospitals with a DSH percentage within 1% of the eligibility threshold affect our results by conducting a post hoc instrumental variables estimation including the hospitals within the "donut". Our IV estimates are similar to those from our main IV analysis (enforcing the donut) but slightly less precise; this is expected given the weaker first stage due to greater noise in 340B eligibility and participation among hospitals within 1% of the threshold.

J. Falsification tests

Testing for discontinuities among for-profit hospitals, which are not 340B-eligible

We test for discontinuities in key study outcomes among for-profit hospitals which are not eligible to participate in the 340B Program. For-profit hospitals are identified from Hospital Cost Reports. We do not find evidence of large or significant discontinuities at the eligibility threshold among for-profit hospitals, providing additional support that the main results are in fact driven by the 340B Program (Table S12).

Testing for discontinuities in 2002 hospital outcomes, prior to 340B Program expansion

We tested for discontinuities in key hospital outcomes in 2002, prior to the expansion of the 340B Program through which the overwhelming majority of hospitals in our sample became eligible. We link hospital outcomes from 2002 to hospital DSH percentages and covariates during our study period. We do not find evidence of large or

significant discontinuities at the eligibility threshold for 2002 outcomes among sample hospitals. This provides support that estimated discontinuities in the main analyses were not due to threshold-related discontinuities in fixed characteristics of hospitals or other pre-existing factors related to hospitals' DSH percentage (Table S13).

Testing for discontinuities at DSH percentages unrelated to 340B eligibility

We re-estimated our models for key outcomes using multiple alternate hypothetical thresholds above and below the true threshold for 340B eligibility when observations were restricted to one side of the true threshold. The purpose of this falsification analysis is to test whether our main results could have been due to random fluctuations associated with the 11.75% threshold. By repeating the analysis for other thresholds, we can assess what the false discovery rate is. If high, we would expect to see positive or negative discontinuities of the same magnitude and significance at multiple other thresholds. We test for discontinuities at 4.75%-8.75% and 14.75%-18.75% in 1% increments. We use a 3% bandwidth to exclude the true threshold from the sample. We constrain the slope on DSH percentage to be the same on both sides. We do not see patterns of consistent or statistically significant discontinuities in the key outcomes at any of the hypothetical thresholds, supporting the notion that discontinuities that were estimated at 11.75%, the DSH percentage corresponding to 340B eligibility, can be attributed to the 340B Program (Table S14). Removing the slope from the model, as we did in sensitivity analyses on our outcomes using bandwidths less than 4% (Table S5), produced similar estimates.

K. Supplemental analysis: Effect of hospital 340B eligibility on drug spending and provision in local communities

We examine whether the 340B Program had effects on Part B drug provision by conducting a patient-level analysis on patients who lived in the communities served by a hospital and were served by (i.e., have a claim in the Outpatient or Carrier files) a hematologist-oncologist, ophthalmologist, or rheumatologist. We focused on beneficiaries with professional claims available (a random 20% sample) who had at least one reimbursed claim for a service provided in either a hospital-owned or independent office setting by a physician in one of the three specialties (hematology-oncology, ophthalmology, and rheumatology) Communities served by hospitals are determined by patient admission flows in 2002, prior to the 340B Program expansion through which the majority of the sample became eligible. We used admissions from 2002 to identify ZIP codes served by hospitals because the Program may have affected admission flows. We included continuously enrolled fee-for-service Medicare beneficiaries living in a five-digit ZIP code in which a study hospital accounted for the maximum share of admissions, and where the hospital accounting for the maximum share accounted for at least 30% of admissions among beneficiaries living in the ZIP code. ZIP codes in which multiple hospitals account for the highest share of admissions more than 30% ZIP codes, ZIP codes with fewer than 10 admissions in claims for the 20% sample of fee-for-service Medicare beneficiaries, and ZIP codes in which the hospital with the maximum share of admissions had fewer than 5 admissions in the 20% sample were excluded.

We used this method instead of analyzing only the ZIP codes where study hospitals were located (our sample of ZIP codes for the mortality analysis among all Medicare

beneficiaries living in those ZIP codes) because we sought to examine Program effects on drug provision among the much smaller group of patients served by the 3 specialties of interest. Thus, we included more ZIP codes to achieve a larger sample of patients. We assign the DSH percentage of the hospital with the plurality of admissions in a ZIP code to all beneficiaries residing in that ZIP code. To validate this approach (that DSH percentages of plurality hospitals exceeding the 340B eligibility threshold were associated with discontinuities in 340B Program exposure), we test for discontinuities in share of admissions and share of hospital outpatient spending that is attributable to 340B hospitals.

In patient-level analyses, we then test for discontinuities in per-beneficiary drug provision by hospital-owned practices, independent physician offices, and both combined. We measure hospital drug provision in terms of total allowed amounts attributable to drug provision and number of drug claims. The sample was pooled across all patients regardless of specialty, and specialty fixed effects were included in the model.

Table S15 presents estimates for discontinuities for patient characteristics, demonstrating significant balance in characteristics between patients residing in communities served by 340B and non-340B hospitals. Moreover, we find large and statistically significant discontinuities in the share of admissions (35%, $p<0.001$) and share of hospital outpatient spending (37% $p<0.001$) attributable to 340B eligible hospitals at the DSH percentage threshold for hospital eligibility (Table S16). This indicates that Program eligibility of the hospital accounting for the plurality of admissions in a ZIP code was associated with discontinuities of exposure of beneficiaries to inpatient and outpatient care from a 340B-eligible hospital.

We find evidence of increases in spending for Part B drugs ($123, or 10.2% relative to the expected mean at the threshold for non-eligible hospitals; p =0.03) and the number of claims for Part B drugs (0.08 claims, or 10.4%; p =0.03) administered in hospital-owned practices (Table S17). We find partially offsetting decreases in drug provision in the office-setting that are not statistically significant, with a $51 decrease in drug spending (-6.0% relative to the expected mean; p=0.17) and 0.04 fewer drug claims (-2.6%, p=0.52), indicating that at least part of the increase in drug provision to local patients by hospital outpatient facilities and practices represents a shift in setting from independent practices to the hospital-owned settings. Finally, we estimated positive but statistically non-significant discontinuities in total drug provision (hospital-owned and independent office settings combined). Therefore, we cannot reject the null hypothesis that there were no changes in total drug provision.

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Appendix Tables and Figures

Table S1. Instrumental variables estimates: Hospital-physician consolidation, additional patients served in hospital-owned settings, and additional hospital drug provision associated with eligibility for the 340B Program, by specialty

	Hematology-oncology		Ophthalmology		Rheumatology	
Hospital-level measures	IV Estimate [95% CI]	P Value	IV Estimate [95% CI]	P Value	IV Estimate [95% CI]	P Value
(n=4,503 hospital-years)						
No. physicians in outpatient practices/facilities owned by hospital:	3.4 [0.5,6.4]	0.02	1.4 [-0.2,2.9]	0.08	0.1 [-1.0,1.2]	0.85
No. Medicare patients served per year in outpatient practices/facilities owned by hospital:	88.7 [-1.1,178.5]	0.05	113.6 [10.8,216.4]	0.03	14.3 [-22.6,51.1]	0.45
Proportion of Medicare patients served who were dually eligible for Medicaid or state assistance, %:	-2.3 [-4.7,0.0]	0.05	-5.5 [-9.9,-1.1]	0.01	-3.0 [-7.4,1.5]	0.20
No. Medicare patients per year receiving Part B drugs from outpatient practices/facilities owned by the hospital:	61.4 [20.8,101.9]	0.003	48.8 [4.5,93.2]	0.03	9.4 [-4.5,23.3]	0.19
No. Part B drug claims billed per year by outpatient practices/facilities owned by hospital:	328.5 [133.5,523.6]	0.001	113.1 [13.7,212.6]	0.03	30.9 [-7.4,69.1]	0.11
Hospital annual Medicare revenue for Part B drugs, $:	530,473 [180521,880426]	0.003	144,927 [-38847,328701]	0.12	50,974 [-2074,104022]	0.06

Table S2. Discontinuities in hospital characteristics at the DSH percentage threshold for 340B eligibility

		Discontinuity associated with Program eligibility		IV Estimate	
	Mean	Estimate	P Value	Estimate	P Value
Hospital-level measures		[95% CI]		[95% CI]	
(n=4,503 hospital-years)					
Teaching, %	65	-2 [-1,1]	0.80	-2 [-2,2]	0.80
Urban, %	5	-1 [-5,2]	0.37	-2 [-7,2]	0.37
No. of beds	219	13 [-21,47]	0.45	28 [-33,90]	0.37
DSH SSI %	7.3	-0.5 [-1.1,0.2]	0.18	-0.7 [-1.6,0.3]	0.18
DSH Medicaid %	19.4	0.2 [-0.6,0.9]	0.62	0.3 [-0.8,1.4]	0.64
Census Region:					
Midwest, %	28	4 [-8,16]	0.53	6 [-12,24]	0.53
South, %	44	-9 [-23,5]	0.22	-13 [-33,8]	0.22
West, %	11	-2 [-10,5]	0.54	-3 [-14,7]	0.53
Northeast, %	18	7 [-4,18]	0.21	11 [-6,27]	0.21

Table S3. Statistical significance after accounting for multiple correlated primary outcomes using a modified Hochberg procedure

		Modified Hochberg Approach	
	P value	Adjusted Significance Threshold	Significant or Not
Hematology-oncology			
No. Medicare patients served per year in outpatient practices/facilities owned by hospital	0.053	0.050	Not Significant
Proportion of Medicare patients served who were dually eligible for Medicaid or state assistance, %	0.048	0.050	Significant
No. physicians in outpatient practices/facilities owned by hospital	0.02	N/A	Significant
No. Medicare patients per year receiving Part B drugs from outpatient practices/facilities owned by the hospital	0.003	N/A	Significant
Hospital annual Medicare revenue for Part B drugs, $	0.003	N/A	Significant
No. Part B drug claims billed per year by outpatient practices/facilities owned by hospital	0.001	N/A	Significant
Ophthalmology			
Hospital annual Medicare revenue for Part B drugs, $	0.12	0.050	Not Significant
No. physicians in outpatient practices/facilities owned by hospital	0.08	0.050	Not Significant
No. Part B drug claims billed per year by outpatient practices/facilities owned by hospital	0.03	0.033	Significant
No. Medicare patients served per year in outpatient practices/facilities owned by hospital	0.03	N/A	Significant
No. Medicare patients per year receiving Part B drugs from outpatient practices/facilities owned by the hospital	0.03	N/A	Significant
Proportion of Medicare patients served who were dually eligible for Medicaid or state assistance, %	0.01	N/A	Significant
Rheumatology			
No. physicians in outpatient practices/facilities owned by hospital	0.84	0.050	Not Significant
No. Medicare patients served per year in outpatient practices/facilities owned by hospital	0.45	0.050	Not Significant
Proportion of Medicare patients served who were dually eligible for Medicaid or state assistance, %	0.19	0.033	Not Significant
No. Medicare patients per year receiving Part B drugs from outpatient practices/facilities owned by the hospital	0.19	0.025	Not Significant
No. Part B drug claims billed per year by outpatient practices/facilities owned by hospital	0.12	0.020	Not Significant
Hospital annual Medicare revenue for Part B drugs, $	0.06	0.017	Not Significant

Table S4. Discontinuities in patient characteristics at the DSH percentage threshold for 340B eligibility among patients in a hospital's ZIP code

	Mean	Discontinuity associated with Program eligibility	
		Estimate [95% CI]	P-Value
Patient-level analyses of Medicare beneficiaries in hospital ZIP codes (n=1,989,633)			
Mortality, %	5.1	0.1 [-0.1,0.3]	0.27
Mortality (Unadjusted for patient characteristics), %		0.1 [-0.1,0.3]	0.49
Age	72.0	0.2 [-0.4,0.7]	0.61
Female, %	57.7	-0.1 [-0.8,0.5]	0.69
Race/Ethnicity			
Black, %	11.6	1.9 [-2.4,6.2]	0.38
Hispanic, %	1.6	-0.3 [-1.0,0.3]	0.34
White, %	83.8	-1.171 [-5.7,3.4]	0.61
Disability, %	27.7	-0.4 [-2.6,1.8]	0.71
ESRD, %	0.8	0.0 [-0.1,0.1]	0.89
# Chronic conditions from CCW	3.8	0.0 [-0.1,0.1]	0.66
HCC score	0.8	0.0 [-0.0,0.0]	0.71
Patient served by safety net provider, %	3.2	0.1 [-1.7,1.9]	0.91
Dually enrolled in Medicare and Medicaid, %	22.2	0.0 [-2.4,2.3]	0.97
ZCTA-level characteristics			
% elderly population with a high school degree	73.7	0.4 [-2.1,3.0]	0.76
% elderly population with income below the Federal Poverty Level	9.5	0.2 [-0.8,1.2]	0.71

Table S5. Using a narrow (±3 percentage point) bandwidth: Hospital-physician consolidation, additional patients served in hospital-owned settings, and additional hospital drug provision associated with eligibility for the 340B Program, by specialty

	Hematology-oncology		Ophthalmology		Rheumatology	
	Adjusted discontinuity associated with Program eligibility [95% CI]	P Value	Adjusted discontinuity associated with Program eligibility [95% CI]	P Value	Adjusted discontinuity associated with Program eligibility [95% CI]	P Value
Hospital-level analyses (n=1,124 hospital-years)						
No. physicians in outpatient practices/facilities owned by hospital:	1.8 [0.2,3.5]	0.03	0.4 [-0.1,0.9]	0.15	0.0 [-0.3,0.4]	0.94
No. Medicare patients served per year in outpatient practices/facilities owned by hospital:	39.8 [-16.6,96.1]	0.17	33.1 [3.4,62.7]	0.03	1.2 [-11.2,13.6]	0.85
No. Medicare patients per year receiving Part B drugs from outpatient practices/facilities owned by the hospital:	24.6 [1.3,48.0]	0.04	17.7 [2.2,33.2]	0.03	1.2 [-3.5,5.9]	0.62
No. Part B drug claims billed per year by outpatient practices/facilities owned by hospital:	154.0 [33.3,274.6]	0.01	39.3 [6.8,71.7]	0.02	5.5 [-7.4,18.5]	0.40
Hospital annual Medicare revenue for Part B drugs, $:	298374 [89424,507324]	0.01	77979 [24587,131370]	0.004	15429 [-3953,34810]	0.12

Table S6. Using a narrow (±3 percentage point) bandwidth: Discontinuities in hospital care for low-income groups and mortality in local communities associated with eligibility for 340B Program

	Adjusted discontinuity associated with Program eligibility [95% CI]	P Value
Hospital-level analyses (n=1,124 hospital-years)		
Hospital provision of safety net care:		
No. visits to FQHCs owned by hospital	-269 [-809,272]	0.33
Medicare spending for care at FQHCs owned by hospital, $	-836 [-4386,2714]	0.64
No. health care professionals employed in FQHCs owned by hospital, FTEs	-0.1 [-0.3,0.1]	0.40
Hospital provision of inpatient care to Medicare patients:		
No. admissions per year	54.0 [-140.4,248.4]	0.59
No. admissions per year for dual-eligible beneficiaries	24.8 [-22.6,72.1]	0.31
No. admissions per year for beneficiaries in low-income areas	8.6 [-22.3,39.6]	0.58
No. admissions per year for beneficiaries in low-income areas	37.1 [-28.8,121.6]	0.23
Patient-level analyses of Medicare beneficiaries in hospital ZIP codes (N=487,311 beneficiaries)		
Share of admissions in ZIP code attributable to 340B-eligible hospitals, %	46.4 [46.2,51.7]	<0.001
Share of hospital outpatient spending in ZIP code attributable to 340B-eligible hospitals, %	48.5 [45.4,51.6]	<0.001
Annual mortality, %:		
All beneficiaries living in hospital ZIP code	0.1 [-0.1,0.2]	0.30
Dual-eligible beneficiaries	0.0 [-0.4,0.3]	0.82
Beneficiaries served by safety net providers	-0.1 [-0.9,0.6]	0.72
Beneficiaries in low income areas	0.2 [0.0,0.5]	0.04

Table S7. Model with a single DSH percentage slope: Hospital-physician consolidation, additional patients served in hospital-owned settings, and additional hospital drug provision associated with eligibility for the 340B Program, by specialty

	Hematology-oncology		Ophthalmology		Rheumatology	
	Adjusted discontinuity associated with Program eligibility		Adjusted discontinuity associated with Program eligibility		Adjusted discontinuity associated with Program eligibility	
	[95% CI]	P Value	[95% CI]	P Value	[95% CI]	P Value
Hospital-level measures (n=4,503 hospital-years)						
No. physicians in outpatient practices/facilities owned by hospital:	2.3 [0.3,4.3]	0.02	0.9 [-0.1,2.0]	0.08	0.1 [-0.6,0.8]	0.85
No. Medicare patients served per year in outpatient practices/facilities owned by hospital:	60.4 [-0.7,121.4]	0.05	76.6 [7.3,145.9]	0.03	9.5 [-15.3,34.3]	0.45
No. Medicare patients per year receiving Part B drugs from outpatient practices/facilities owned by the hospital:	41.8 [14.0,69.6]	0.003	32.9 [2.9,62.9]	0.03	6.3 [-3.0,15.7]	0.19
No. Part B drug claims billed per year by outpatient practices/facilities owned by hospital:	223.5 [88.3,358.7]	0.001	76.3 [9.1,143.6]	0.03	20.8 [-4.9,46.6]	0.11
Hospital annual Medicare revenue for Part B drugs, $:	360,574 [118887,602261]	0.003	97,129 [-28912,223169]	0.13	34,482 [-1373,70337]	0.06

Table S8. Model with a single DSH percentage slope: Discontinuities in hospital care for low-income groups and mortality in local communities associated with eligibility for 340B Program

	Adjusted discontinuity associated with Program eligibility [95% CI]	P Value
Hospital-level analyses (n=4,503 hospital-years)		
Hospital provision of safety net care:		
No. visits to FQHCs owned by hospital	2.4 [-144.4,149.1]	0.97
Medicare spending for care at FQHCs owned by hospital, $	-1479 [-5209,2251]	0.44
No. health care professionals employed in FQHCs owned by hospital, FTEs	0.0 [-0.1,0.0]	0.29
Hospital provision of inpatient care to Medicare patients:		
No. admissions per year	147.1 [-95.3,389.4]	0.23
No. admissions per year for dual-eligible beneficiaries	8.3 [-59.2,75.8]	0.81
No. admissions per year for beneficiaries in low-income areas	13.9 [-24.9,52.7]	0.48
No. admissions per year for beneficiaries in low-income areas	24.9 [-79.5,129.4]	0.64
Patient-level analyses of Medicare beneficiaries in hospital ZIP codes (N=1,989,633 beneficiaries)		
Share of admissions in ZIP code attributable to 340B-eligible hospitals, %	48.2 [44.8,51.6]	<0.001
Share of hospital outpatient spending in ZIP code attributable to 340B-eligible hospitals, %	47.6 [43.7,51.6]	<0.001
Annual mortality, %:		
All beneficiaries living in hospital ZIP code	0.1 [-0.1,0.3]	0.28
Dual-eligible beneficiaries	0.0 [-0.4,0.4]	0.97
Beneficiaries served by safety net providers	-0.2 [-1.0,0.7]	0.70
Beneficiaries in low income areas	0.3 [-0.1,0.6]	0.14

Table S9. Using hospitals' hypothetical 340B eligibility in 2002, prior to 340B Program expansion: Hospital-physician consolidation, additional patients served in hospital-owned settings, and additional hospital drug provision associated with eligibility for the 340B Program, by specialty

	Hematology-oncology			Ophthalmology			Rheumatology		
	Effect of 340B Eligibility		IV Estimate	Effect of 340B Eligibility		IV Estimate	Effect of 340B Eligibility		IV Estimate
	Estimate [95% CI]	P Value	Estimate [95% CI]	Estimate [95% CI]	P Value	Estimate [95% CI]	Estimate [95% CI]	P Value	Estimate [95% CI]	P Value	Estimate [95% CI]	P Value
Hospital-level measures (n=4,202 hospital-years)												
No. physicians in outpatient practices/facilities owned by hospital:												
	3.8 [0.5,7.1]	0.03	12.5 [1.7,23.2]	0.02	2.7 [0.0,5.4]	0.05	8.5 [-0.4,17.4]	0.06	0.8 [-0.5,2.0]	0.22	2.5 [-1.3,6.4]	0.20
No. Medicare patients served per year in outpatient practices/facilities owned by hospital:												
	80.2 [11.6,148.7]	0.02	263.7 [55.6,471.7]	0.01	166.6 [14.3,318.8]	0.03	525.3 [33.3,1017.2]	0.04	27.8 [-6.4,62.0]	0.11	86.6 [-12.3,185.5]	0.09
No. Medicare patients per year receiving Part B drugs from outpatient practices/facilities owned by the hospital:												
	42.9 [7.4,78.5]	0.02	141.3 [33.0,249.6]	0.01	56.8 [3.8,109.9]	0.04	177.2 [12.3,342.0]	0.04	11.7 [-2.2,25.6]	0.10	36.6 [-3.7,76.9]	0.08
No. Part B drug claims billed per year by outpatient practices/facilities owned by hospital:												
	216.9 [25.5,408.4]	0.03	713.5 [124.3,1302.7]	0.02	130.1 [-5.3,265.5]	0.06	407.0 [-18.8,832.8]	0.06	35.7 [-4.9,76.3]	0.09	112.6 [-7.1,232.3]	0.07
Hospital annual Medicare revenue for Part B drugs, $:												
	318829 [-1758,639416]	0.05	1059831 [89351,2030312]	0.03	194834 [3705,385962]	0.05	591407 [-12425,1195239]	0.06	57685 [1608,113762]	0.04	183833 [14886,352780]	0.03

Table S10. Unweighted analyses: Hospital-physician consolidation, additional patients served in hospital-owned settings, and additional hospital drug provision associated with eligibility for the 340B Program, by specialty

Hematology-oncology				Ophthalmology				Rheumatology			
Effect of 340B Eligibility		IV Estimate		Effect of 340B Eligibility		IV Estimate		Effect of 340B Eligibility		IV Estimate	
Estimate [95% CI]	P Value	Estimate [95% CI]	P Value	Estimate [95% CI]	P Value	Estimate [95% CI]	P Value	Estimate [95% CI]	P Value	Estimate [95% CI]	P Value
Hospital-level measures (n=4,503 hospital-years)											
No. physicians in outpatient practices/facilities owned by hospital											
1.3 [0.2,2.3]	0.02	2.3 [0.4,4.1]	0.02	0.5 [-0.1,1.1]	0.08	0.9 [-0.1,1.9]	0.08	0.0 [-0.3,0.3]	0.80	0.1 [-0.4,0.6]	0.79
No. Medicare patients served per year in outpatient practices/facilities owned by hospital											
34 [4.4,63.7]	0.02	60.8 [8.6,112.9]	0.02	35.7 [2.3,69.1]	0.04	64.5 [5.0,123.9]	0.03	4.2 [-7.0,15.4]	0.46	7.9 [-12.1,27.9]	0.44
No. Medicare patients per year receiving Part B drugs from outpatient practices/facilities owned by the hospital											
20.9 [6.5,35.3]	0.01	37.2 [11.9,62.5]	0.004	13.0 [-1.1,27.1]	0.07	23.5 [-1.5,48.5]	0.07	3.1 [-1.2,7.4]	0.16	5.6 [-2.1,13.2]	0.15
No. Part B drug claims billed per year by outpatient practices/facilities owned by hospital											
114.5 [37.6,191.3]	0.003	204 [70.2,337.7]	0.003	30.1 [-2.3,62.6]	0.07	54.3 [-3.2,111.7]	0.06	9.6 [-2.7,21.9]	0.13	17.3 [-4.6,39.2]	0.12
Hospital annual Medicare revenue for Part B drugs, $											
204958 [66800,343116]	0.004	365764 [124767,606761]	0.003	50287 [-6944,107518]	0.09	91246 [-9651,192144]	0.08	17075 [-394,34545]	0.06	30721 [-251,61693]	0.05

Table S11. Model with state fixed effects in lieu of region fixed effects: Hospital-physician consolidation, additional patients served in hospital-owned settings, and additional hospital drug provision associated with eligibility for the 340B Program, by specialty

	Hematology-oncology		Ophthalmology		Rheumatology	
	Adjusted discontinuity associated with Program eligibility		Adjusted discontinuity associated with Program eligibility		Adjusted discontinuity associated with Program eligibility	
Hospital-level measures (n=4,503 hospital-years)	[95% CI]	P Value	[95% CI]	P Value	[95% CI]	P Value
No. physicians in outpatient practices/facilities owned by hospital	2.0 [0.1,4.0]	0.04	0.9 [-0.1,1.8]	0.09	0.2 [-0.5,0.9]	0.56
No. Medicare patients served per year in outpatient practices/facilities owned by hospital	57.1 [10.3,103.9]	0.02	68.2 [-5.1,141.5]	0.07	8.6 [-16.6,33.8]	0.50
No. Medicare patients per year receiving Part B drugs from outpatient practices/facilities owned by the hospital	35.9 [13.0,58.8]	0.002	27.7 [-3.4,58.8]	0.08	5.5 [-4.4,15.5]	0.28
No. Part B drug claims billed per year by outpatient practices/facilities owned by hospital	181.7 [67.7,295.7]	0.002	65.7 [-5.0,136.4]	0.07	18.0 [-9.9,45.8]	0.21
Hospital annual Medicare revenue for Part B drugs, $	314186 [100388,527985]	0.004	90125 [-21911,202160]	0.12	27018 [-9167,63204]	0.14

Table S12. Discontinuities among for-profit hospitals which are not 340B-eligible: Hospital-physician consolidation, additional patients served in hospital-owned settings, and additional hospital drug provision associated with eligibility for the 340B Program, by specialty

	Hematology-oncology		Ophthalmology		Rheumatology	
Hospital-level measures	Adjusted discontinuity associated with Program eligibility* [95% CI]	P Value	Adjusted discontinuity associated with Program eligibility* [95% CI]	P Value	Adjusted discontinuity associated with Program eligibility* [95% CI]	P Value
(n=963 hospital-years)						
No. physicians in outpatient practices/facilities owned by hospital	-0.4 [-0.9,0.1]	0.15	0.0 [-0.0,0.0]	0.98	0.0 [-0.0,0.0]	0.21
No. Medicare patients served per year in outpatient practices/facilities owned by hospital	-23.3 [-53.6,7.0]	0.13	-6.6 [-19.2,6.0]	0.31	0.0 [-7.9,7.9]	0.99
No. Medicare patients per year receiving Part B drugs from outpatient practices/facilities owned by the hospital	-11.6 [-28.6,5.3]	0.18	-2.2 [-12.9,8.5]	0.69	-0.8 [-3.1,1.5]	0.51
No. Part B drug claims billed per year by outpatient practices/facilities owned by hospital	-27 [-80.2,26.2]	0.32	-2.0 [-18.1,14.0]	0.81	-3.2 [-8.9,2.6]	0.28
Hospital annual Medicare revenue for Part B drugs, $	-40995 [-122366,40376]	0.32	-5568 [-35192,24056]	0.71	-2158 [-14404,10088]	0.73

Table S13. Using hospital outcomes in 2002 prior to 340B Program expansion: Discontinuities in additional patients served in hospital-owned settings and additional hospital drug provision

	Hematology-oncology		Ophthalmology		Rheumatology	
	Adjusted discontinuity associated with Program eligibility* [95% CI]	P Value	Adjusted discontinuity associated with Program eligibility* [95% CI]	P Value	Adjusted discontinuity associated with Program eligibility* [95% CI]	P Value
No. Medicare patients served per year in outpatient practices/facilities owned by hospital	-0.1 [-1.6,1.4]	0.94	-0.1 [-2.5,2.3]	0.95	0.5 [-0.2,1.2]	0.19
No. Medicare patients per year receiving Part B drugs from outpatient practices/facilities owned by the hospital	0.3 [-0.7,1.3]	0.58	-0.3 [-1.0,0.4]	0.37	0.1 [-0.1,0.3]	0.41
No. Part B drug claims billed per year by outpatient practices/facilities owned by hospital	0.4 [-1.2,2.00]	0.62	-0.4 [-1.420.6]	0.45	0.1 [-0.2,0.5]	0.42
Hospital annual Medicare revenue for Part B drugs, $	135 [-1005,1274]	0.82	2 [-1599,1603]	1.00	174 [-98,446]	0.21

Table S14. Discontinuities in key variables at DSH percentages unrelated to 340B eligibility with observations restricted to one side of the threshold

	Discontinuities in key variables at alternative DSH percentages with observations restricted to one side of the 340B eligibility threshold																			
	4.75		5.75		6.75		7.75		8.75		14.75		15.75		16.75		17.75		18.75	
	Adjusted discontinuity associated with Program eligibility*		Adjusted discontinuity associated with Program eligibility*		Adjusted discontinuity associated with Program eligibility*		Adjusted discontinuity associated with Program eligibility*		Adjusted discontinuity associated with Program eligibility*		Adjusted discontinuity associated with Program eligibility*		Adjusted discontinuity associated with Program eligibility*		Adjusted discontinuity associated with Program eligibility*		Adjusted discontinuity associated with Program eligibility*	
Hospital-level m	[95% CI]	P Value	[95% CI]	P Value	[95% CI]	P Value	[95% CI]	P Value	[95% CI]	P Value	[95% CI]	P Value	[95% CI]	P Value	[95% CI]	P Value	[95% CI]	P Value	[95% CI]	P Value
Hematology-oncology:																				
No. physicians in outpatient practices/facilities owned by hospital:																				
	-0.3	0.73	0.5	0.67	-0.9	0.55	-0.1	0.91	0.4	0.49	-1.6	0.32	-0.4	0.76	0.4	0.79	1.5	0.47	-1.6	0.57
	[-2.2,1.6]		[-1.8,2.8]		[-3.8,2.0]		[-1.3,1.1]		[-0.7,1.5]		[-4.8,1.6]		[-2.9,2.1]		[-2.4,3.1]		[-2.6,5.7]		[-7.2,4.0]	
No. Medicare patients served per year in outpatient practices/facilities owned by hospital:																				
	-14.1	0.48	18.4	0.49	-32.2	0.31	-16.6	0.33	19.1	0.49	-32.6	0.34	-26.8	0.46	-32.3	0.36	27.5	0.60	-45.7	0.49
	[-52.7,24.6]		[-34.3,71.0]		[-94.9,30.4]		[-49.9,16.7]		[-34.8,73.1]		[-99.9,34.7]		[-98.1,44.4]		[-101.8,37.2]		[-74.2,129.1]		[-176.6,85.1]	
No. Medicare patients per year receiving Part B drugs from outpatient practices/facilities owned by the hospital:																				
	-5.4	0.58	5.6	0.68	-15.5	0.31	-11.5	0.20	5	0.64	-3.8	0.82	-17.8	0.47	-33.7	0.12	20.3	0.42	-15.2	0.63
	[-24.5,13.8]		[-20.8,32.0]		[-45.3,14.2]		[-29.0,6.0]		[-15.9,25.8]		[-36.8,29.3]		[-65.9,30.2]		[-76.4,9.0]		[-29.3,69.9]		[-76.5,46.2]	
No. Part B drug claims billed per year by outpatient practices/facilities owned by hospital:																				
	8	0.86	12.1	0.83	-91.4	0.18	-29.1	0.46	38.2	0.35	-29	0.75	-48.4	0.60	-149.4	0.11	69.1	0.56	-28.6	0.85
	[-83.8,99.9]		[-101.0,125.2]		[-224.3,41.6]		[-106.2,48.1]		[-42.4,118.8]		[-204.5,146.5]		[-228.4,131.6]		[-333.3,34.5]		[-161.2,299.4]		[-333.3,276.2]	
Hospital annual Medicare revenue for Part B drugs, $:																				
	932.6	0.99	14730.6	0.92	-195456.8	0.23	-32514.4	0.68	45164.3	0.59	-127572.3	0.45	-134215.2	0.38	-261633.1	0.10	50490.7	0.82	-19481	0.95
	[-173916.3,175781.5]		[-263484.7,292946.0]		[-517242.4,126328.8]		[-185759.4,120730.7]		[-120688.2,211016.7]		[-459070.1,203925.5]		[-433386.6,164956.1]		[-573762.8,50496.7]		[-375675.1,476656.5]		[-622536.5,583574.4]	
Ophthalmology:																				
No. physicians in outpatient practices/facilities owned by hospital:																				
	-0.3	0.27	-0.4	0.54	0.3	0.42	0.3	0.36	0.1	0.51	0.7	0.49	-0.2	0.80	0.1	0.94	0.4	0.56	0.2	0.88
	[-0.9,0.3]		[-1.5,0.8]		[-0.4,1.1]		[-0.4,1.1]		[-0.2,0.5]		[-1.3,2.6]		[-1.8,1.4]		[-1.7,1.8]		[-1.0,1.9]		[-2.1,2.5]	
No. Medicare patients served per year in outpatient practices/facilities owned by hospital:																				
	-25.7	0.30	-36.6	0.45	15.4	0.57	26.5	0.41	16	0.22	53.1	0.39	-22.9	0.62	3.8	0.93	65.7	0.34	-13.5	0.89
	[-74.1,22.8]		[-131.9,58.8]		[-37.4,68.2]		[-37.0,90.1]		[-9.7,41.7]		[-67.5,173.7]		[-114.1,68.2]		[-79.6,87.3]		[-69.2,200.5]		[-205.4,178.4]	
No. Medicare patients per year receiving Part B drugs from outpatient practices/facilities owned by the hospital:																				
	-24.8	0.42	-39.7	0.41	4.3	0.84	29.2	0.33	14.7	0.19	45.4	0.37	-10.4	0.80	-30.6	0.43	57	0.28	19	0.81
	[-85.3,35.6]		[-133.3,53.9]		[-36.3,44.9]		[-28.9,87.3]		[-7.4,36.7]		[-54.5,145.3]		[-89.3,68.5]		[-107.1,45.8]		[-45.9,160.0]		[-139.1,177.1]	
No. Part B drug claims billed per year by outpatient practices/facilities owned by hospital:																				
	-8.7	0.52	-14.5	0.44	-3.9	0.68	14.1	0.27	7.4	0.24	15.8	0.41	-4.5	0.81	-12.1	0.50	31.5	0.24	-2.7	0.94
	[-35.3,17.9]		[-51.4,22.5]		[-22.1,14.4]		[-11.0,39.2]		[-5.0,19.7]		[-21.4,53.1]		[-40.5,31.6]		[-47.2,22.9]		[-20.7,83.7]		[-76.2,70.8]	
Hospital annual Medicare revenue for Part B drugs, $:																				
	-27698.2	0.56	-55098.2	0.41	-1380.5	0.96	47040.2	0.27	13906	0.49	22247.2	0.72	17.3	1.00	-87091.7	0.27	81820.4	0.43	74509.8	0.69
	[-120039.1,64642.8]		[-187309.1,77112.8]		[-61236.5,58475.5]		[-36547.6,130628.0]		[-25768.2,53580.3]		[-98458.4,142952.7]		[-130096.7,130131.4]		[-241224.0,67040.5]		[-120433.3,284074.1]		[-295375.8,444395.4]	
Rheumatology:																				
No. physicians in outpatient practices/facilities owned by hospital:																				
	-0.4	0.31	-0.3	0.49	0.4	0.48	-0.1	0.87	-0.2	0.62	0.2	0.63	0.2	0.58	-0.3	0.49	0	1.00	0.1	0.81
	[-1.3,0.4]		[-1.3,0.6]		[-0.7,1.5]		[-0.7,0.6]		[-1.2,0.7]		[-0.6,1.1]		[-0.5,0.8]		[-1.2,0.6]		[-0.7,0.7]		[-0.8,1.1]	
No. Medicare patients served per year in outpatient practices/facilities owned by hospital:																				
	-20.8	0.20	-11.2	0.45	13.1	0.42	-2.8	0.81	-6	0.69	11.5	0.29	7.2	0.43	-27.8	0.04	5	0.71	-4.4	0.78
	[-52.4,10.8]		[-40.4,18.0]		[-18.5,44.6]		[-25.1,19.6]		[-36.0,24.0]		[-9.7,32.7]		[-10.6,25.0]		[-54.7,-0.9]		[-21.6,31.5]		[-34.9,26.1]	
No. Medicare patients per year receiving Part B drugs from outpatient practices/facilities owned by the hospital:																				
	-19.2	0.16	-22.3	0.30	12.8	0.36	3.9	0.80	-5.7	0.63	19.3	0.21	15.4	0.23	-30.7	0.09	1.5	0.93	3.2	0.87
	[-45.9,7.4]		[-64.5,20.0]		[-14.5,40.1]		[-25.6,33.3]		[-28.8,17.5]		[-10.6,49.2]		[-9.8,40.6]		[-66.4,5.0]		[-30.6,33.6]		[-33.9,40.4]	
No. Part B drug claims billed per year by outpatient practices/facilities owned by hospital:																				
	-7	0.18	-6.4	0.37	4.3	0.40	0.3	0.96	-1.7	0.71	5.7	0.26	4.7	0.24	-11.6	0.07	1	0.85	0.8	0.90
	[-17.2,3.2]		[-20.4,7.5]		[-5.7,14.3]		[-9.6,10.2]		[-10.4,7.1]		[-4.1,15.5]		[-3.1,12.5]		[-24.0,0.8]		[-9.2,11.1]		[-10.4,11.9]	
Hospital annual Medicare revenue for Part B drugs, $:																				
	-25802.4	0.17	-22996.8	0.37	17168.3	0.42	178.5	0.99	-8808.6	0.62	17816.9	0.36	42453.9	0.05	-53612.6	0.09	-17985.5	0.51	918.2	0.98
	[-62777.0,11172.1]		[-73128.3,27134.8]		[-24410.1,58746.8]		[-38149.7,38506.7]		[-44015.4,26398.2]		[-19998.7,55632.5]		[-296.3,85204.2]		[-114738.7,7513.5]		[-71068.5,35097.6]		[-63149.0,64985.5]	

Table S15. Discontinuities in patient characteristics in local communities associated with eligibility for the 340B Program

	Mean	Adjusted discontinuity associated with Program eligibility [95% CI]	P Value
Patient-level analyses of Medicare beneficiaries in communities served by hospitals (n=4,089,011)			
Age	75.2	0.2 [-0.1,0.5]	0.19
Female, %	63.3	-0.1 [-0.7,0.5]	0.75
Race/ethnicity			
Black, %	7.8	-0.2 [-3.0,2.6]	0.90
Hispanic, %	0.9	-0.3 [-0.8,0.2]	0.26
White, %	89.2	1.5 [-1.6,4.5]	0.34
Disability, %	16.9	-0.8 [-2.1,0.5]	0.22
ESRD, %	0.6	0.0 [-0.1,0.1]	0.50
# Chronic conditions from CCW	4.7	-0.1 [-0.2,0.1]	0.28
HCC Score	1.0	0.0 [-0.1,0.0]	0.19
Safety net user, %	3.3	-0.2 [-1.7,1.3]	0.76
Dually enrolled in Medicare and Medicaid, %	12.6	-1.0 [-2.5,0.4]	0.16
ZCTA-level characteristics			
% elderly population with a high school degree	76.0	2.2 [0.1,4.3]	0.04
% elderly population with income below the Federal Poverty Level	8.3	-0.5 [-1.1,0.1]	0.13

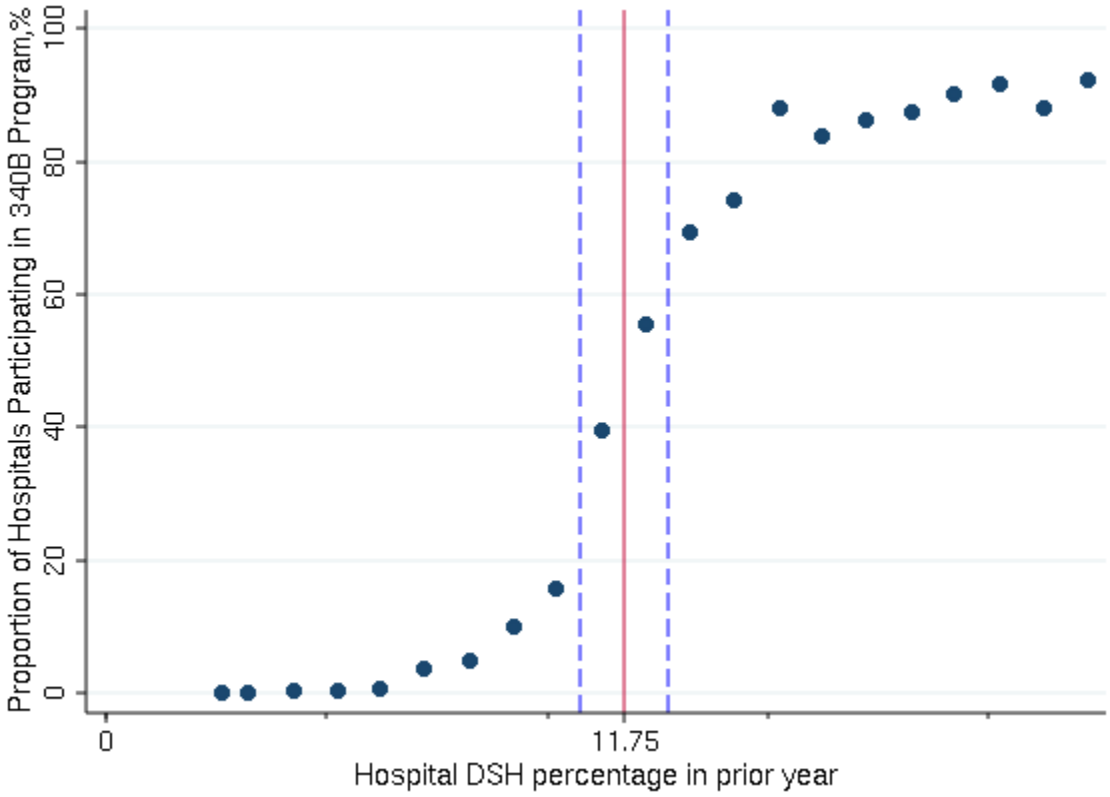
Table S16. Discontinuities in share of admissions and outpatient spending associated with eligibility for the 340B Program

	Mean	Adjusted discontinuity associated with Program eligibility [95% CI]	P Value
Patient-level analyses of Medicare beneficiaries in communities served by hospitals (n=4,089,011)			
Exposure to 340B Program:			
Share of admissions in ZIP code attributable to 340B-eligible hospitals, %	16.7	34.5 [29.8,39.2]	<0.001
Share of hospital outpatient spending in ZIP code attributable to 340B-eligible hospitals, %	21.6	36.8 [31.4,42.2]	<0.001

Table S17. Discontinuities in drug provision in local communities associated with eligibility for the 340B Program

		Adjusted for patient characteristics		Not adjusted for patient characteristics	
	Mean	Adjusted discontinuity associated with Program eligibility [95% CI]	P Value	Adjusted discontinuity associated with Program eligibility [95% CI]	P Value
Patient-level analyses of Medicare beneficiaries in communities served by hospitals (n=4,089,011)					
Annual Drug Provision					
Drug spending, $					
Hospital-owned setting	1205.0	123.2 [11.3,235.2]	0.03	96.3 [-14.5,207.1]	0.09
Independent practice setting	850.9	-51.3 [-147.6,44.9]	0.30	-53.6 [-152.9,45.8]	0.29
Hospital-owned and independent settings	2055.8	71.9 [-31.4,175.3]	0.17	42.7 [-60.8,146.2]	0.42
No. Drug Claims					
Hospital-owned setting	0.77	0.08 [0.01,0.16]	0.03	0.06 [-0.01,0.14]	0.11
Independent practice setting	1.55	-0.04 [-0.17,0.08]	0.52	-0.06 [-0.19,0.07]	0.37
Hospital-owned and independent settings	2.25	0.05 [-0.06,0.16]	0.35	0.01 [-0.10,0.13]	0.81

Figure S1. Hospital 340B participation rate by DSH adjustment percentage



This figure plots the relationship between hospital participation in the 340B Program and hospital DSH percentage in the prior year. Hospitals were categorized based on their DSH percentage in 1 percentage point bins with no bins overlapping the 340B eligibility threshold of 11.75%. Each plotted point represents the proportion of hospital-years in a given bin in which the hospital was participating in the 340B Program in that year (the 340B participation rate). The red vertical line denotes the threshold for 340B Program eligibility at a DSH percentage of 11.75%. Dotted blue lines are plotted at 10.75% and 12.75%, to indicate the range in which hospital-years were excluded from the analytic sample due to expected misclassification of hospital eligibility and participation close to the threshold. A DSH percentage above 11.75% was strongly predictive of hospital 340B participation. For hospital-years in which the hospital had a DSH percentage more than one percentage point above the threshold, the 340B participation rate was 82.4%. Of hospital-years with DSH percentages more than one percentage point below the eligibility, the participation rate was only 3.8%.

Figure S2. Scatter plot of hospital DSH percentages in 2004 vs. 2012 across all hospitals

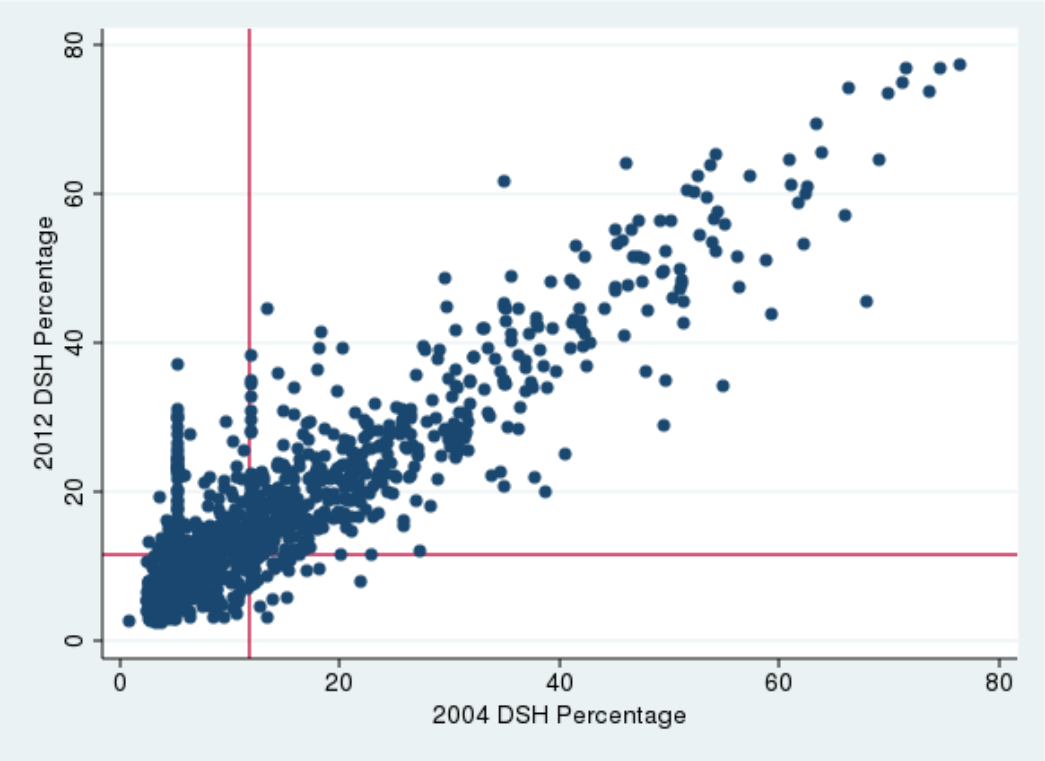


Figure legend. This figure plots the relationship between each hospital's DSH percentage in 2004 and its DSH percentage in 2012. The red lines denote the threshold for 340B Program eligibility at a DSH percentage of 11.75%.

Figure S3. Proportion of study period hospitals were 340B eligible among hospitals that were eligible in 2008, by distance from DSH percentage threshold for eligibility

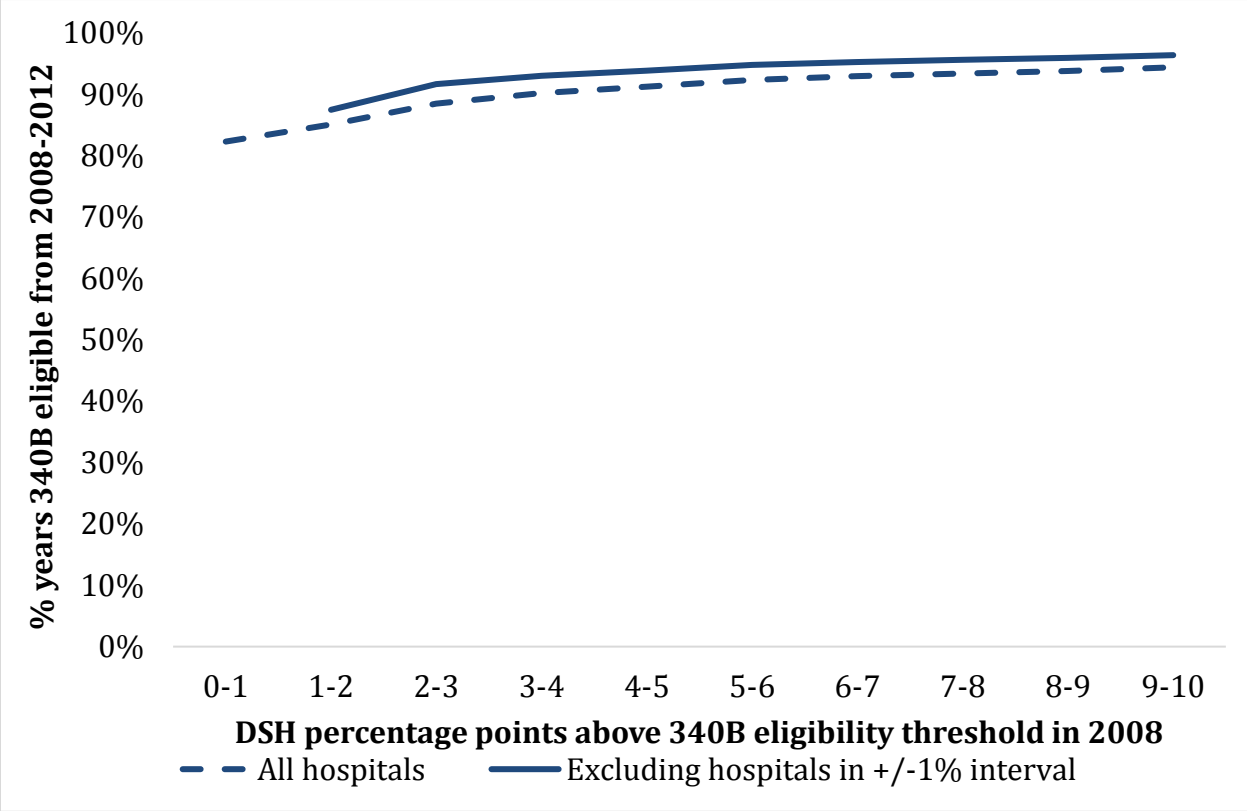


Figure legend. This figure plots the average percent of the 5-year study period from 2008 to 2012 hospitals were 340B eligible, among hospitals that were 340B-eligible in 2008. Hospitals were categorized by bandwidth, or distance from the 340B eligibility threshold. The percent of hospitals with an eligibility status change in the following year is plotted. The dotted line includes all hospitals, and the solid line excludes hospitals with DSH percentage within 1% of the 340B eligibility threshold (the "donut").

Figure S4. 340B Program-related discontinuities in number of patients served in hospital-owned practices and proportion of patients served who were dual eligible, by specialty

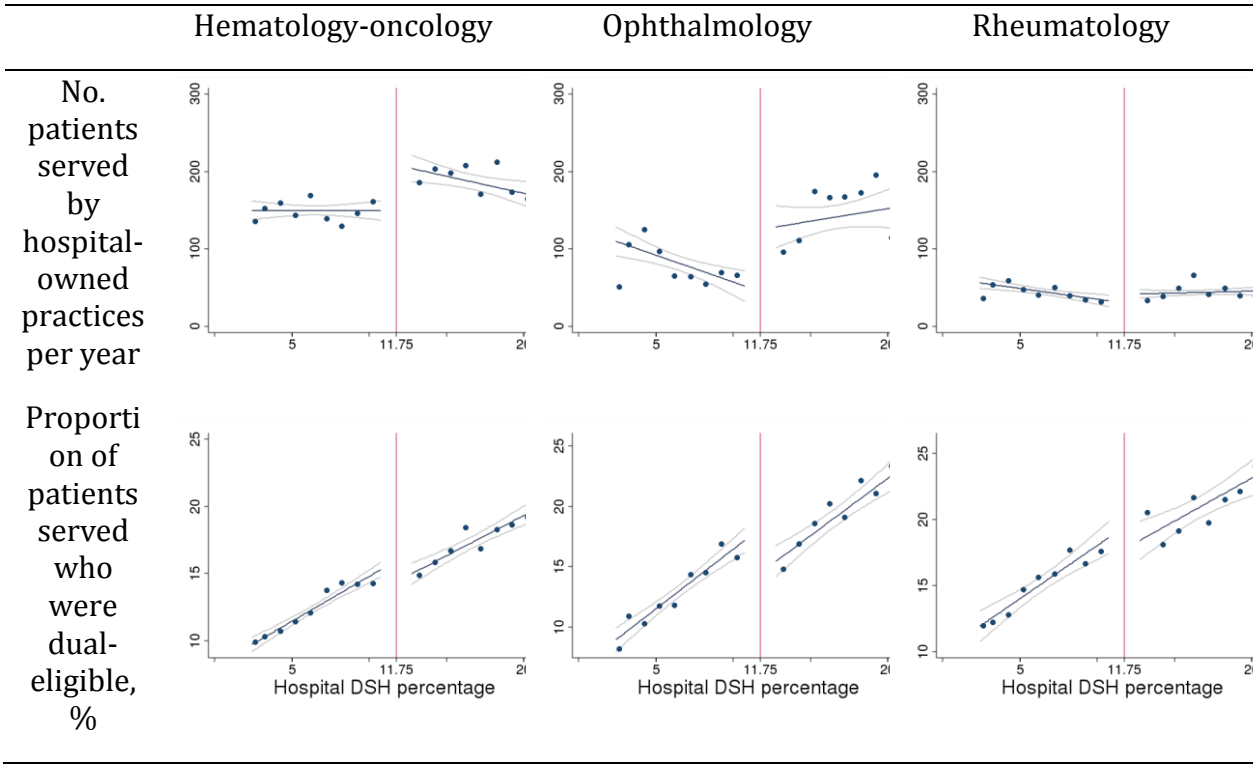
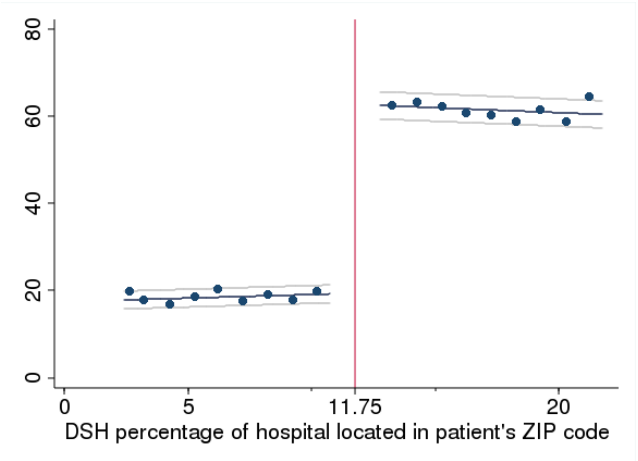


Figure legend. For each specialty, the number of patients served in hospital-owned practices and the proportion of patients served who were dual eligible by specialty are plotted by hospital DSH percentage in the prior year, which determines 340B Program eligibility. Hospitals were categorized based on their DSH percentage into one percentage point bins, excluding hospitals within 1 percentage point of the eligibility threshold of 11.75%. Unadjusted bin means were calculated and plotted, using hospital size (in beds) to weight hospital contributions to the mean. For illustrative purposes, a line of best fit to the bin means is displayed to either side of the threshold, with 95% confidence intervals. The red vertical line denotes the threshold for 340B Program eligibility at a DSH percentage of 11.75%.

Figure S5. 340B Program-related discontinuities in hospitals' local communities: proportion of hospital care provided by 340B-eligible hospitals and annual mortality

Proportion of Medicare inpatient and outpatient spending in hospital ZIP code attributable to 340B-eligible hospitals, %	Annual mortality among Medicare beneficiaries in hospital's ZIP code, %



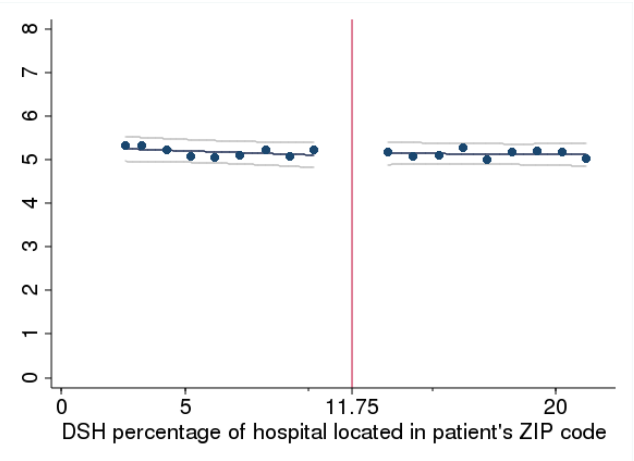


Figure legend. Among hospitals that were the only hospital located in their ZIP code, hospitals were categorized based on their DSH percentage into one percentage point bins, excluding hospitals within 1 percentage point of the 340B Program eligibility threshold of 11.75%. Among Medicare beneficiaries living in these hospitals' ZIP codes, an unadjusted mean was calculated for each bin for the (A) the proportion of Medicare spending for patients' inpatient and outpatient hospital care that was provided by 340-eligible hospitals, and (B) an annual indicator of death. The figure displays the bin means with a line of best fit to either side of the threshold and 95% confidence intervals for each line. The red vertical line denotes the threshold for 340B Program eligibility at a DSH percentage of 11.75%.

Figure S6. Test for selection into 340B eligibility: Number of hospitals by DSH percentage

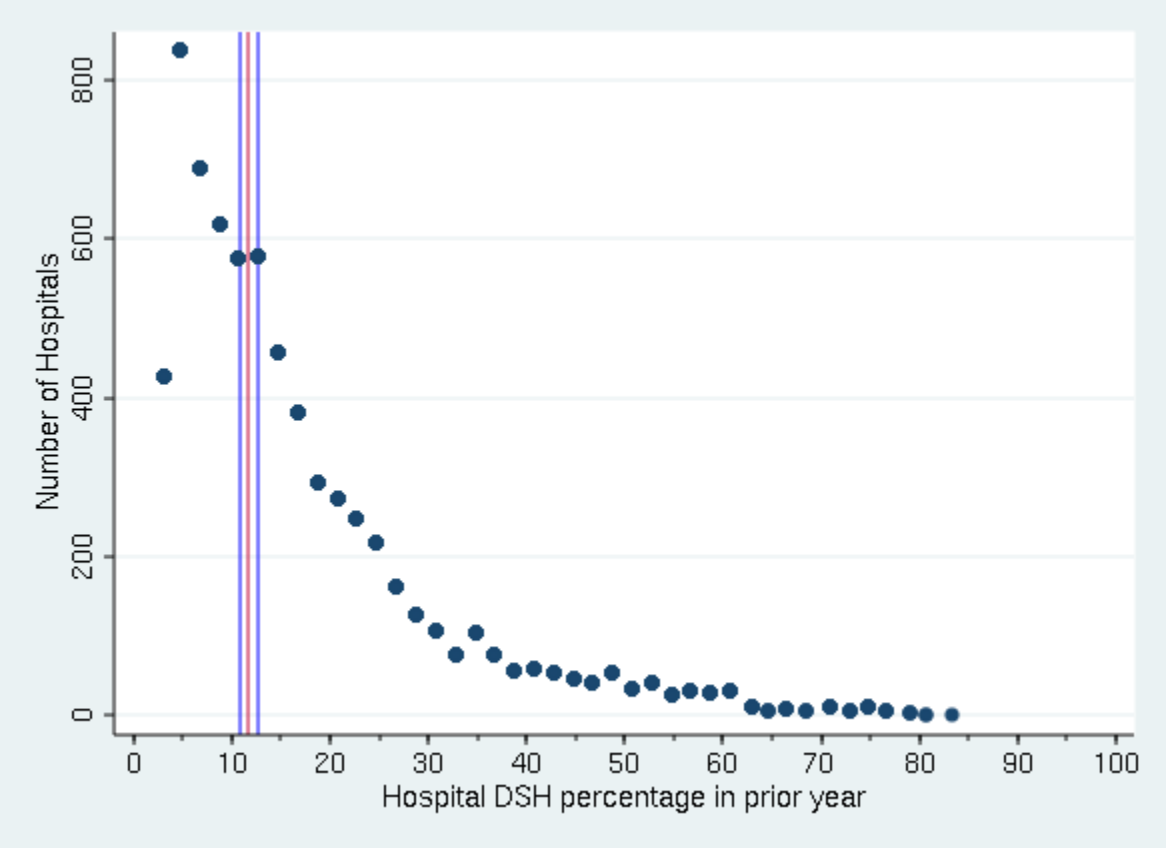


Figure legend. This figure plots the number of hospitals in the sample by DSH percentage to test for evidence that hospital's manipulated their DSH percentage to become 340B eligible. Hospitals were categorized based on their DSH percentage in 2 percentage point bins with no bins overlapping the 340B eligibility threshold of 11.75%. Each plotted point represents the number of hospitals in a given bin. The red vertical line denotes the threshold for 340B Program eligibility at a DSH percentage of 11.75%. Blue lines denote the 10.75% to 12.75% interval in which we excluded hospitals from our main analysis.

Figure S7. Discontinuity estimates on the effect of 340B eligibility on key outcomes using hospitals with DSH percentages that are successively closer to 11.75%, the DSH percentage corresponding to the 340B eligibility threshold

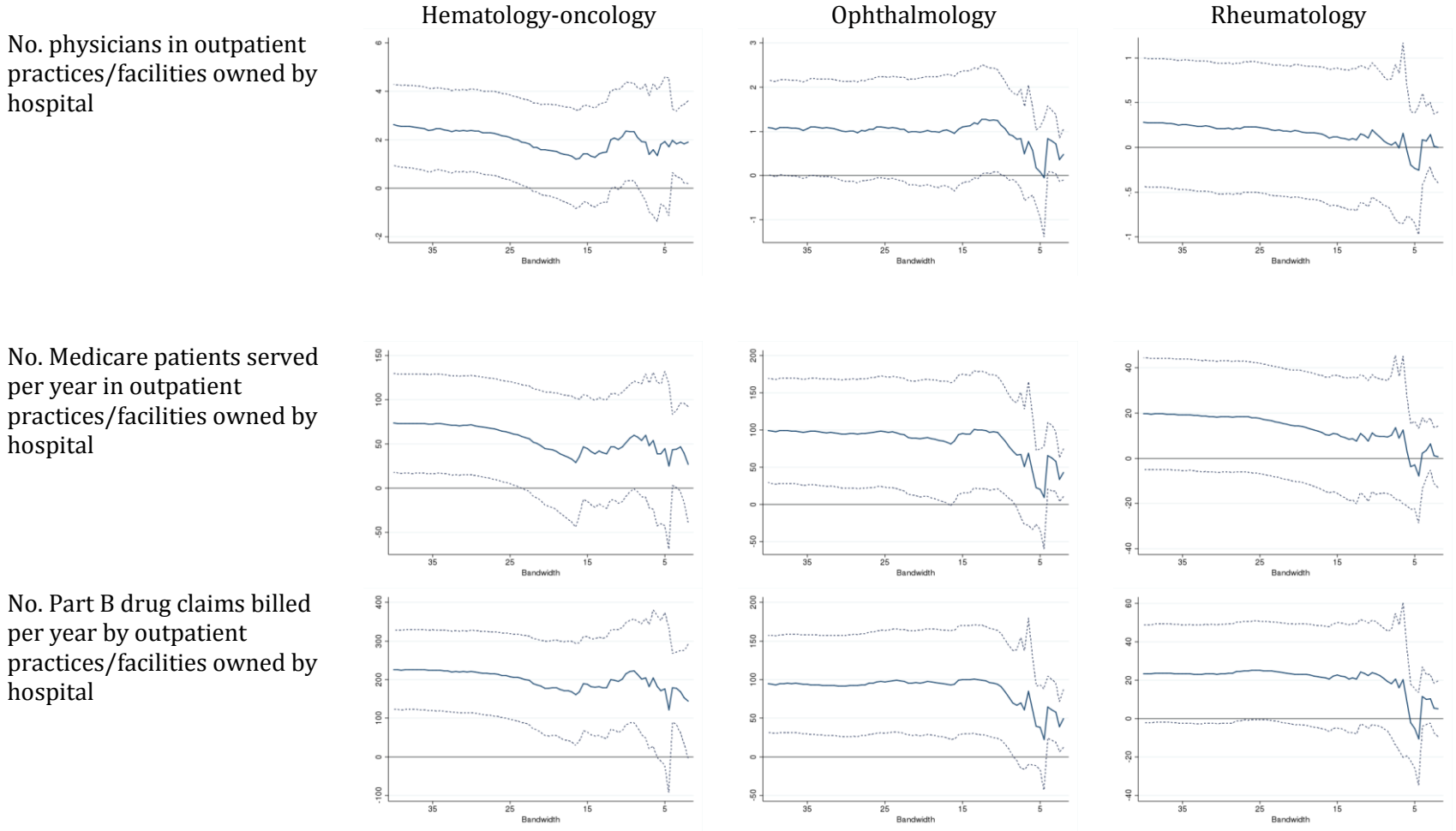


Figure legend. This figure plots adjusted regression discontinuity coefficients and 95% confidence intervals for key outcomes using bandwidths around the 340B eligibility threshold that are successively narrower in 0.5 percentage point increments. The x-axis in each

panel indicates the bandwidth used, or the maximum percentage point distance between hospitals in the sample and 11.75%, the 340B eligibility threshold. The y-axis indicates the magnitude of the coefficient. The models are estimated with a single slope for hospital DSH percentage in analyses using a bandwidth of 4% or greater and no slope for analyses with bandwidths smaller than 4% to avoid overfitting to data points that are insufficient to establish trends. In addition, hospital-level regression discontinuity analyses control for the hospital's urban/rural status, census region, teaching status, and observation year fixed effects. Analyses on Part B drug spending additionally control for patient-level characteristics including age, gender, race (black, Hispanic, Non-Hispanic white), disability, ESRD,27 chronic conditions from the Medicare Chronic Conditions Data Warehouse, HCC score, Medicare-Medicaid dually enrolled, and area-level education and income, 95% confidence intervals were generated from robust standard errors that account for clustering at the hospital-level.

Figure S8. Discontinuity estimates on the percent of area-level admissions and HOPD spending attributable to 340B eligible hospitals for the analysis on area-level drug provision

% Admissions in ZIP code going to 340B eligible hospitals	% HOPD spending attributable to 340B eligible hospitals

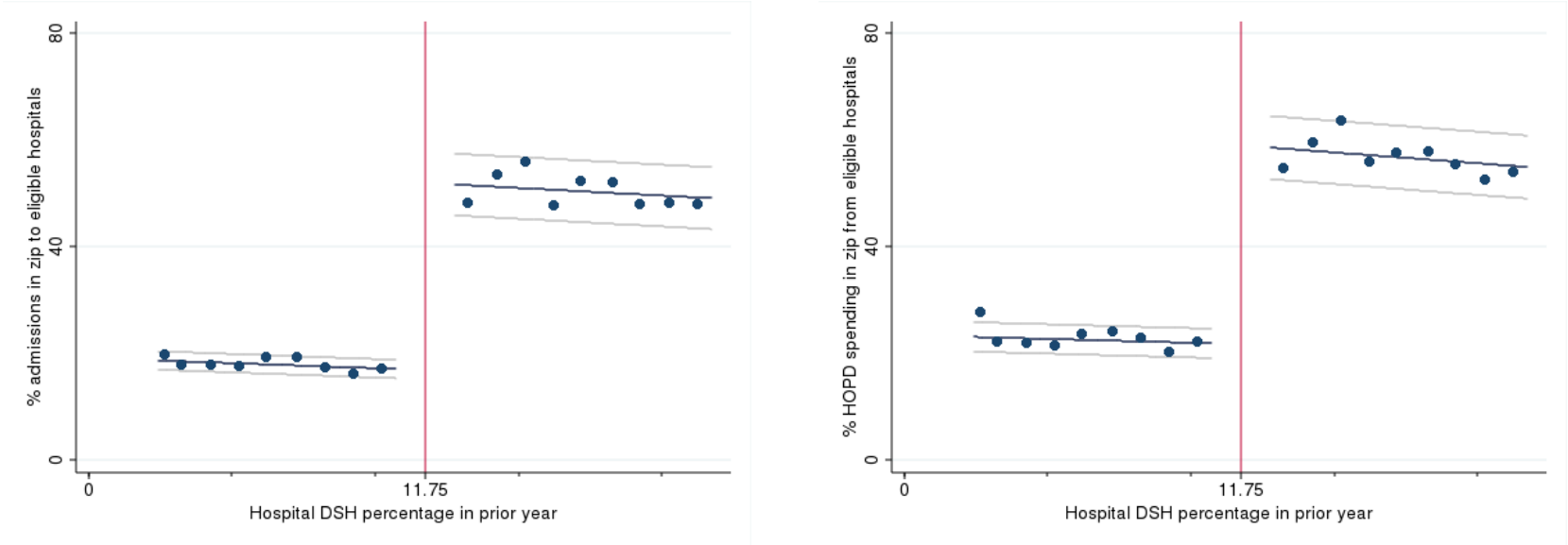


Figure legend: These figures plot the relationship between hospital DSH percentage and the percent of admissions and outpatient spending in a hospital's community that are attributable to 340B hospitals for the area-level sample. DSH percentages are divided into bins of size one percent. Each blue point represents the average outcome for observations in a given bin. The plots demonstrate significant discontinuities in the unadjusted proportion of admissions and hospital outpatient spending attributable to 340B eligible hospitals.