

**AN ECONOMIC ANALYSIS OF THE PROPOSED MERGER BETWEEN WELLMONT
HEALTH SYSTEM AND MOUNTAIN STATES HEALTH ALLIANCE**

Michael Doane
Luke Froeb

Competition Economics LLC

January, 2015

The views expressed herein are solely those of the authors and do not necessarily reflect the views of Competition Economics LLC, Vanderbilt University, Anthem VA, or BCBS-Tennessee.

I. Introduction and Summary

We have been asked by America's Health Insurance Plans ("AHIP") to evaluate the likely competitive effects of the proposed merger between Wellmont Health System ("Wellmont") and Mountain States Health Alliance ("Mountain States"). Wellmont and Mountain States have agreed to exclusively explore the creation of a new, combined system and the proposed merger was recently approved by the boards of directors of both systems.¹ Following Tenn. Code Ann. § 68-11-1303 (2014), we analyzed the likely competitive effects of the proposed merger on "[t]he ability of ... health care payors to negotiate optimal payment and service arrangements with hospitals."²

Specifically, we analyzed the competitive impact of combining the acute care hospital facilities of each system. To do this, we performed three empirical studies that show (1) how the proposed merger changes the structure of the market for inpatient services provided by hospitals in relevant geographic markets, (2) the extent to which the merging hospitals are close substitutes for each other (using the tool of diversion analysis), and (3) the extent to which the merger affects bargaining between health plans and hospitals and, ultimately, hospital prices (using bargaining models employed by the U.S. Federal Trade Commission to evaluate hospital mergers).

We found:

¹ See Letter of Notice to the Southwest Virginia Health Authority of the intent of Mountain States and Wellmont to file an application for the issuance of a Certificate of Public Advantage ("COPA") with respect to a cooperative agreement among the parties (dated September 16, 2015) and Letter of Notice to the Tennessee Department of Health of the intent of Mountain States and Wellmont to file an application for the issuance of COPA with respect to cooperative agreement among the parties (dated September 15, 2015).

² See House Bill 2316 Southwest Virginia Health Authority (offered January 22, 2015).

- In the Southwest Virginia and Northeast Tennessee areas that comprise the 90 percent inpatient draw area of the merged hospitals, the proposed merger creates a firm with over a 77 percent share. Concentration would increase well beyond the thresholds presumed to be anticompetitive by competition agencies.
- An analysis of inpatients' hospital choices shows that the merged hospitals are each other's closest competitors. If Wellmont were to close, 75 percent of its patients would go to a Mountain States hospital. Similarly, if Mountain States were to close, 72 percent of its patients would go to a Wellmont facility.
- The modeling framework routinely used by competition agencies to evaluate hospital mergers predicts huge post-merger price increases.

All three of these findings point to the same conclusion -- this merger is likely to significantly reduce competition and raise prices for consumers. This finding is consistent with the hospital merger retrospectives performed by economists at the U.S. Federal Trade Commission ("FTC") suggesting that reductions in competition of this magnitude have significant anticompetitive effects.³

We have not analyzed any potential efficiencies or quality improvements of the merger. However, given the magnitude of the loss in competition, any merger-specific efficiencies and quality improvement would need to be significant to offset the loss of competition. In this regard, we note that economic analyses of past hospital mergers have not found projected efficiencies to be large enough to offset anticompetitive effects.

II. Overview of the Merging Hospital Systems

The proposed merger would combine two large hospital systems serving communities in Northeast Tennessee and Southwest Virginia. Wellmont operates four hospitals in Tennessee

³ For a summary, see Farrell, Joseph, David Balan, Keith Brand, and Brett Wendling, (2011), "Economics at the FTC: Hospital Mergers, Authorized Generic Drugs, and Consumer Credit Markets," *Review of Industrial Organization*, Vol. 39, No. 4. pp. 271-296.

and two hospitals in Virginia as well as numerous outpatient care sites. Mountain States operates eight hospitals in Tennessee and five hospitals in Virginia and, like Wellmont, numerous outpatient care facilities located throughout the region.

Table 1 lists the hospital facilities operated by the merging systems and describes their characteristics, including type of facility (acute care, critical access, children's, rehabilitation, and psychiatric care), teaching status, number of Medicare certified beds, and the names of the two closest hospitals. As the table highlights, for sixteen of the twenty merging hospitals, the closest competing hospital (and in many cases, both the closest and second-closest competing hospital), is owned by the merging partner. The close proximity of the merger hospitals is further depicted in Figure 1. For example, the closest acute care hospital to Wellmont's Mountain View hospital (118 beds) is Mountain States' Norton hospital (129 beds) with an estimated driving time between them of six minutes. The closest acute care hospital to Wellmont's Holston Valley hospital (519 beds) is Mountain States' Indian Path hospital (300 beds) with an estimated driving time between them of nine minutes. The two closest hospitals to Wellmont's Bristol Regional hospital (282 beds) are Mountain States' Indian Path and Johnston Memorial (116 beds) hospitals with estimated driving times of 22 minutes and 24 minutes, respectively.

III. Economic Analysis of Proposed Merger

Patients are the ultimate consumers of hospital-based acute care inpatient services. In order to attract employers, health plans seek to offer access to hospitals that are attractive to their covered subscribers. To attract hospitals to their networks, health plans offer access to subscribed employees and individuals, and negotiate rates that the hospitals are willing to accept. A health plan with few subscribers will typically be less attractive to a hospital (all else equal),

and a health plan with few hospitals, far away from subscribers, in its network will typically be less attractive to subscribers (again, all else equal). More generally, third-party payors (e.g., private providers of health insurance) are responsible for negotiating the rates paid to hospitals and making payments for enrollees in accordance with these rates. Typically, patients do not pay the entire bill for the services they consume, but pay a portion of the negotiated rates as “deductibles” or “co-payments.” They can also receive balance bills directly from “out-of-network” providers.

Health insurance plans create a network of preferred hospitals and other health-care providers for their subscribers, while providing access to potential customers (i.e., their subscribers) to the health-care providers in their network. That is, health plans provide each side of the market (i.e., health-care providers and patients) with access to suitable alternatives on the other side of the market. The rates at which hospitals are reimbursed are typically determined by negotiation between a health plan and the hospital. Consumers’ preferences affect these negotiations. Payers try to put together a network with a large number of high quality and conveniently located hospitals, which increases demand for their plans, which in turn makes payers more willing to pay higher prices to include attractive hospitals in their networks. By quality, we mean the attributes of a hospital that appeal to consumers.

The largest public payors are Medicare, which provides health insurance for the elderly, and Medicaid, which provides coverage for low-income persons.⁴ Private insurance companies such as Blue Cross/Blue Shield of Tennessee (“BCBS-TN”) and Anthem VA sell health

⁴ In 1983, Medicare adopted the Inpatient Prospective Payment System (“IPPS”). IPPS defined diagnostic-related groups (“DRGs”), and paid hospitals on the basis of the average cost of treating all patients in that DRG and certain other factors, regardless of the actual cost incurred in the specific case for which reimbursement was sought.

insurance to individuals directly and indirectly, through group policies sold to employers. Rates (and other contractual terms and conditions) are determined in negotiations between health insurers and health care providers. Economic models of bargaining provide a useful framework for analyzing price determination in this economic setting.

A. The Role of Bargaining in Evaluating Hospital Mergers

A commonly used economic framework for analyzing bargaining was developed by John Nash, and begins by listing the properties that a reasonable bargaining outcome should have.⁵ From these properties, it follows that the parties split the gains from trade, where the gains are measured relative to the total surplus *both* parties gain from reaching an agreement relative to their outside alternatives if no agreement is reached. An interesting feature of this analytical framework is the role that the alternatives to agreement play in determining the terms of agreement. A good outside alternative will improve a party's bargaining position, and allow it to capture a bigger share of the proverbial pie.

To improve its bargaining position, a party must either increase the other party's gain for reaching agreement or reduce its own gain reaching agreement. Increasing the other party's gain from agreement makes the other more willing to compromise to reach an agreement, which leads to a bigger share of the joint profit. Likewise, by reducing its own gain from reaching agreement, a party becomes less willing to compromise, improving its bargaining position, and increasing its share of the joint profit.

Mergers or acquisitions can weaken the other party's bargaining position by making them more eager to reach agreement. To illustrate this, suppose a health plan puts together a network

⁵ John Nash, (1950) "The Bargaining Problem," *Econometrica*, Volume 18, pp. 155-162. See also Froeb, Luke and Brian T. McCann, *Managerial Economics: A Problem Solving Approach*, Thomson South-Western, 2008, Chapter 14.

of hospitals to serve its client base. The health plan bargains with individual hospitals over whether to include them in the network and what price it will charge if included in the network. To make this concrete, one can imagine that the health plan plays the hospitals off against each other by threatening to include only one of them in the network. But whether or not the threat is explicit, it is clear that the alternative to reaching agreement with one hospital is agreement with the other. If the hospitals are close substitutes, then the health insurer has a good alternative to reaching agreement with one of the hospitals — it can reach agreement with the other. But if the two hospitals merge and bargain jointly, the health insurer's alternatives become much worse. The loss in competition due to merger is big if the merging hospitals are close substitutes and the non-merging hospitals are worse substitutes.

When there is only one hospital that is easily accessible by patients, negotiated rates are likely to be higher than they would otherwise be. Thus, a critical determinant of the hospital rates negotiated by a health plan is the availability of multiple hospitals that the health plan's subscribers would consider reasonably close substitutes for one another. For example, in Hot Springs, Arkansas the only two acute care hospitals abandoned their plans to merge when the FTC indicated it would challenge the merger. The next closest hospitals were in Little Rock, more than 30 miles away. Presumably the FTC was worried that the merger would increase the bargaining power of the two Hot Springs hospitals because payors who wanted to sell policies in Hot Springs would have had to contract with the merged hospital.

B. Structural Analysis of Proposed Merger

As noted in the Horizontal Merger Guidelines, market concentration is often a useful “structural” indicator of likely competitive effects of a merger.⁶ In evaluating market concentration, the Guidelines consider both the post-merger level of market concentration and the change in concentration resulting from a merger. Market concentration is measured using the Herfindahl-Hirschman Index (“HHI”) which is calculated by summing the squares of the individual market shares.⁷ The HHI ranges from 10,000 (equivalent to a single firm) to a number approaching zero (equivalent to many infinitesimally small firms). In a horizontal context, an acquisition is presumed likely to create or enhance market power when the post-merger HHI exceeds 2,500 (equivalent to four independent firms) points and the acquisition increases the HHI by more than 200 points.⁸

A structural analysis of a proposed merger begins with market delineation. Antitrust market delineation is a tool for identifying markets in which firms have the ability to exercise market power.⁹ Thus, when delineating a market, one should be mindful of the reason for undertaking the exercise. Since our focus is on assessing the competitive effect of a merger among competing acute care hospital systems, and because there are few viable substitutes for acute care delivered at a hospital, we define the *relevant product market* to be the cluster of acute care services for inpatient hospital care. This definition is consistent with the economic literature

⁶ U.S. Department of Justice and Federal Trade Commission, *Horizontal Merger Guidelines* (issued August 19, 2010), (hereinafter “Guidelines”), Section 5.3.

⁷ For example, a market consisting of four firms with market shares of 30 percent, 30 percent, 20 percent, and 20 percent has an HHI of 2,600 ($30^2 + 30^2 + 20^2 + 20^2$).

⁸ Merger Guidelines, Section 1.51.

⁹ See, for example, G. J. Werden (1992), “Four Suggestions on Market Delineation,” *Antitrust Bulletin*, vol. 37, pp. 107-121.

on hospital mergers and with prior court rulings.¹⁰ Although acute care hospitals offer a large number of differentiated services, basic services available at most acute care hospitals include normal childbirth, pediatrics, gynecology, general medicine, and general surgical services.

When prices are negotiated, as in the present case, *geographic markets* are defined by asking whether a hypothetical monopolist of all the acute-care hospitals in a candidate market could profitably negotiate price increases of 5 percent, the usual threshold used in delineating an antitrust market. Thus, we seek to quantify the extent to which consumers consider various alternatives to be close substitutes for one another.

The extent to which consumers are willing to substitute one hospital for another can be inferred from past choices that consumers have made. To analyze these choices, we utilized calendar year 2014 data on commercially-insured inpatients covered by Anthem VA and BCBS-TN, the largest commercial payors in Virginia and Tennessee, respectively. Anthem VA has

¹⁰ See, for example, Gowrisankaran, Gautam, Aviv Nevo, and Robert Town (2015), "Mergers When Prices Are Negotiated: Evidence from the Hospital Industry." *American Economic Review*, Vol. 105 No. 1; pp. 172-203; Capps, Cory, David Dranove, and Mark Satterwaite, (2003) "Competition and Market Power on Option Demand Markets," *RAND Journal of Economics*, Vol. 34, No. 4, pp. 737–763; *FTC v. Butterworth Health Corp* (1996). *Hospital Corp. of Am.*, 807 F.2d 1381 (7th Cir. 1986); *United States v. Mercy Health Services*, 902 F. Supp. 968 (N.D. Iowa 1995), *vacated as moot* 107 F.3d 632 (8th Cir. 1997); and *ProMedica Health Sys., Inc. v. Fed. Trade Comm’n*, 749 F.3d 559, 562 (6th Cir. 2014). Some of the court rulings define the product market somewhat more narrowly than the cluster of acute inpatient hospital care, excluding, for example, tertiary services. Such definitions are likely to lead higher market shares for the parties than the cluster of all acute inpatient hospital care used here. Therefore, the approach used here likely understates the market shares of the parties that would be found using the narrower product market definition used by some courts.

negotiated contracts with hospitals located in Virginia and Sullivan County, TN (a county contiguous to Virginia) and BCBS-TN has negotiated contracts with hospitals in Tennessee.¹¹

To understand how consumers are willing to substitute one hospital for another, for each merging acute care hospital shown in Table 1, we first determined the ZIP codes that comprised the hospital's 90 percent inpatient draw area.¹² We then determined the other (non-merging) hospitals serving inpatients from those ZIP codes. Specifically, we included all non-merging acute care hospitals that discharged inpatients to any of the 127 ZIP codes comprising the combined draw areas of the merging hospitals as long as the non-merging hospital's share of total discharges equal or exceed one percent of the combined discharges from all merging hospitals. Fourteen non-merging hospitals met this criterion; their ownership and other characteristics are shown in Table 2. As shown in Figure 2, the competitive alternatives to the merging hospitals are generally located to the southwest and northeast of the merging hospitals. Our resulting database contained 15,244 inpatient discharges residing in 127 ZIP codes.¹³

¹¹ Data on inpatient discharges from Virginia hospitals were obtained from Virginia Health Information ("VHI"). VHI's patient level database system includes patient demographic, administrative, clinical, and financial information on every discharge that occurs in Virginia licensed hospitals (see <http://www.vhi.org/pld.asp>). We use discharges designated as Anthem – BCBS. Since the VHI inpatient discharge database includes discharges from Virginia hospitals only, we use internal Anthem VA data for its covered discharges from the Wellmont and Mountain States hospitals under contract with Anthem VA located in Sullivan County, Tennessee. Because inpatient discharge data were not readily available from the State of Tennessee, internal BCBS-TN data were used to identify BCBS-TN covered inpatients discharged from hospitals in Tennessee. Other data sources used in our study include Centers for Medicare and Medicaid Services ("CMS") Healthcare Provider Reporting Information System ("HCIS") and Provider of Services files (for hospital characteristics); American Hospital Directory (for hospital location, ownership, facility type, and Medicare discharges), and Google Maps (for travel times).

¹² Specifically, the ZIP codes to which each hospital discharged inpatients were sorted from largest to smallest in terms of total inpatient discharges. Starting with the ZIP code with the largest number of discharges, other ZIP codes were added until the limit of 90 percent of total discharges was reached.

Figure 3 depicts the share of discharges by ZIP code for Wellmont, Mountain States, and all competing hospitals combined. The relative size of the circles shown in the figure reflect differences in the number of inpatient discharges across ZIP codes. For each ZIP code, the shares of the merging systems are denoted in red for Wellmont, blue for Mountain States, and yellow for non-merging, competing hospitals. Figure 3 shows that the merging systems are the two most frequently chosen alternatives for Anthem VA and BCBS-TN covered inpatients in most of the ZIP codes contained in the combined draw areas of the merging hospitals. To illustrate this point further, in Figure 4 the combined share of the merging firm is shown in black. As shown in the figure, the merged firm has a dominant share in many of the ZIP codes that comprise Northeast Tennessee and Southwest Virginia. Using each hospital's share of inpatient discharges, and accounting for common ownership, the pre-merger and post-merger HHIs are 3,436 and 5,987, respectively (see Table 3). Another way to measure the magnitude of the merger is to look at the combined share of the merging firm. The share of the combined firm is 77 percent. In sum, the merger creates what looks like a “must have” hospital system, in that it would be difficult for a payor to put together a viable provider network in the draw area that did not include the merged hospital. Table 3 also reports the pre-merger and post-merger HHIs for the 90 percent draw area of each merging hospital. The post-merger HHI for the individual hospital draw areas all exceed 2,500 points and increases in the HHI range from 1,313 to 4,387.

Since both Anthem-VA and BCBS-TN may incur additional costs when customers go to an out-of-state hospital, each generally prefers that patients choose facilities with whom they

¹³ Each DRG may be a separate relevant product market, but we aggregate all DRGs for convenience. To the extent that the merging parties may not offer all of the included services, we are likely under-reporting their shares and the increase in concentration following merger.

contract in their respective states.¹⁴ (Specifically, these costs include an “access charge” paid to the health plan (e.g., Anthem VA or BCBS-TN) that processes the claim and a potentially higher reimbursement rate.) For this reason, we also calculated pre-merger and post- merger HHIs separately for the inpatients covered by Anthem VA and the inpatients covered by BCBS-TN. Using data describing the hospital choices made by Anthem VA covered inpatients, the pre-merger and post-merger HHIs are 2,989 and 4,768, respectively. The hospitals chosen by the inpatients covered by Anthem VA are shown in Table 4. Figures 5 and 6 show the location of the hospitals and their shares by ZIP code. Figure 7 highlights the combined share of the merged system.

Using data describing the hospital choices made by BCBS-TN covered inpatients, the pre-merger and post-merger HHIs are 3,780 and 6,674, respectively (see Table 6). The hospitals chosen by the inpatients covered by BCBS-TN are shown in Table 7. Figures 8 and 9 show the location of the hospitals and their shares by ZIP code, and Figure 7 highlights the combined share of the merged system

The above analysis excludes hospitals located in Kentucky and North Carolina as potential alternatives for inpatients residing in the draw areas of the merging hospitals. We understand, from conversations with market participants, that few inpatients located in Virginia and Tennessee travel to Kentucky and North Carolina for hospital care. To check this, we utilized data available from American Hospital Directory (“AHD”), which reports Medicare discharges from all hospitals by ZIP code. Using the Medicare discharges reported by AHD, we identified the ZIP codes to which the merging hospitals discharged Medicare inpatients. For

¹⁴ As a licensee of the BCBS association, each plan has restrictions with respect to contracting with hospitals for Blue-branded business in counties that are not within its licensed service area (which in this case is defined by state boundaries) or which are not contiguous to the service area.

each of these ZIP codes (128 in total), we identified all other hospitals that discharged Medicare inpatients to those ZIP codes, including hospitals located in Virginia, Tennessee, Kentucky, and North Carolina. We found that only 3 percent of the Medicare inpatients in the combined draw area of the merging systems chose hospitals in Kentucky and only 3 percent chose hospitals located in North Carolina. Using each hospital's share of Medicare inpatient discharges, and accounting for common ownership, the pre-merger and post-merger HHIs become 2,967 and 5,701, respectively in the combined draw area of the merging systems (see Table 8). The share of the combined system is 75 percent. Thus, concentration estimates reported using the Medicare data are consistent with those calculated using Anthem VA and BCBS-TN covered inpatients, and the omission of discharges from Kentucky and North Carolina hospitals would be unlikely to change conclusions drawn from our analysis of the Anthem VA and BCBS-TN data.

An important factor in assessing the competitive implications of the structural indicators described above is ease of entry into the relevant market. As noted in the Guidelines, if entry is easy and sufficiently rapid, a firm's high prices will return to competitive levels as entrants, enticed by above-competitive profits, enter the market. Because of the need to plan, obtain zoning, licensing, and certificate of need regulatory permits to construct a new hospital, we do not consider ease of entry as a deterrent to any competitive concerns raised in this context. Moreover, the profitability of entry is likely lower in lower density areas (such as in rural Tennessee and Virginia) relative to other locations.

In sum, the structural analysis suggests that the proposed merger would eliminate substantial competition between the merged hospitals.

C. Diversion Analysis to Determine Substitutability between the Merging Hospitals

Diversion analysis is commonly used in antitrust economics to analyze mergers involving differentiated products. In this case, hospitals are differentiated by a number of factors, including the type and quality of services offered, as well as location. The diversion ratio between two products, A and B, measures the extent to which the products are close substitutes for each other. In the context of hospital mergers, the diversion ratio attempts to estimate the share of inpatients that each merging hospital would lose to its merging partner and to alternate competing hospitals, if the first hospital were no longer available to inpatients as an option.¹⁵ Stated differently, in evaluating a merger between hospitals A and B, hospital B would be considered a close substitute to hospital A if a high share of inpatients would switch to B if hospital A were no longer available. Merging firms that are close substitutes to each other present a greater likelihood that post-merger price would increase as a result of the increase in bargaining power. That is, in a scenario where the hospitals bargain with a health insurer, a merger between two such hospitals has the potential to increase the bargaining power of the merged hospital relative to the health insurer, given that the merger eliminates competition between the merging systems.

Since the diversion analysis is based on patient choice, to implement the diversion analysis we first estimated a model of individual hospital choices to understand how inpatients select the hospital they use.¹⁶ In doing so, we examined how the choices among available hospitals are influenced by the characteristics of the patient (e.g., age and gender), of the hospital (e.g., bed capacity, teaching status, and measures of quality), the driving time to each hospital (expressed in

¹⁵ See, for example, Farrell, Joseph, David Balan, Keith Brand, and Brett Wendling, (2011), “Economics at the FTC: Hospital Mergers, Authorized Generic Drugs, and Consumer Credit Markets,” *Review of Industrial Organization*, Vol. 39, No. 4. pp. 271-296.

¹⁶ We adopt a standard conditional logit specification based on the random utility model (see Appendix B). The specification allows the disutility of travel time to vary by the characteristics of the inpatient, including the clinical condition of the inpatient (see Table 9 and the model’s variable glossary in Appendix A).

minutes), the clinical treatment sought by the inpatients (e.g., the Diagnosis-Related Group (“DRG”)), and the match between the service sought by the inpatient and the services provided by the hospital. The information obtained from the estimated choice model is then used to predict how inpatient choices would change if a hospital involved in the proposed merger were no longer available. That is, by excluding a merging hospital as an option, the model is used to determine the proportion of inpatients that would switch to other competing hospitals, including those of the proposed merging partner.¹⁷

We estimated our choice model using data describing the hospital choices of 15,244 Anthem VA and BCBS-TN inpatients that reside in the ZIP codes that comprise the 90 percent draw areas of the merging hospitals. The set of hospital alternatives include the merging Wellmont and Mountain State acute-care hospitals and the fourteen competing acute care hospitals shown in Table 2 above. The estimated choice model of hospital choice is presented in Table 9. We used the parameter estimates from the choice model to calculate the diversion ratios shown in Tables 10-13. Using the covered inpatients of Anthem VA and BCBS-TN, the left panel of Table 10 reports diversion from Wellmont to Mountain States when the Wellmont hospitals are hypothetically excluded from the choice set. The hospital names shown in red font are those of Wellmont’s merging partner, Mountain States. From the table, it is apparent the Mountain States hospitals are close substitutes to the Wellmont hospitals. The five largest diversion ratios are all associated with a Mountain States hospital and combined they account for 70 percent of the diversion from Wellmont. Overall, the diversion from to Mountain States from Wellmont is 75 percent. Similarly, as shown in the right panel of Table 10, the overall diversion from Mountain States to Wellmont is significant (72

¹⁷ The diversion ratio between two hospitals, A and B, when A is hypothetically removed from the choice set, is calculated as follows: $Diversion\ Ratio_{A \rightarrow B} = \frac{(Share\ of\ Hospital\ B,\ on\ exclusion\ of\ Hospital\ A - Share\ of\ Hospital\ B)}{(Share\ of\ Hospital\ A)}$.

percent). The two largest diversion ratios are associated with Wellmont hospitals and combined they account for 66 percent of the diversion from Mountain States.

We also used the estimated choice model to examine how our diversion analysis would change if we included six Kentucky acute care hospitals that appear in our analysis of Medicare data. As noted above, few (less than 3 percent) Medicare inpatients residing in the combined draw areas of the merged hospitals chose to travel to a Kentucky for hospital care. As shown in Table 11, the diversion results discussed above are only slightly changed when the Kentucky hospitals are considered a competitive alternative and included in the diversion analysis.

Tables 12 reports diversion ratios using the inpatients covered by Anthem-VA and the set of hospitals (merging and non-merging) chosen by them. Table 13 reports diversion ratios using the inpatients covered by BCBS-TN and the set of hospitals they selected. The diversion ratios shown in these tables tell a similar story: the Wellmont and Mountain States systems are each other's closest competitors.

D. Willingness to Pay ("WTP") Analysis

The FTC uses WTP analysis as a tool to evaluate the competitive effects of hospital mergers.¹⁸ The approach is based on a model of "two-stage hospital competition" characterizing the interaction among hospitals, health insurers, and health plan enrollees. In the first stage of the two-stage model, hospitals negotiate with health insurers to be included in their networks. Negotiations over the rates a health insurer pays for services occur between each hospital or hospital system and the outcome of the bargaining process are prices that reflect the relative

¹⁸ See, for example, Opinion of the Commission, *In the Matter of ProMedica Health System, Inc.*, Docket No. 9346; Complaint Counsel's Pre-Trial Brief, *In the Matter of the OSF Healthcare System and Rockford Health System*, Docket No. 9349, and Farrell, Joseph, David Balan, Keith Brand, and Brett Wendling, (2011), "Economics at the FTC: Hospital Mergers, Authorized Generic Drugs, and Consumer Credit Markets," *Review of Industrial Organization*, Vol. 39, No. 4. pp. 271-296.

value added to the health insurer's network by each hospital. In the second stage, hospitals compete among themselves to provide care to a health plan's members. Since a patient who becomes sick generally has strong financial incentives to choose among hospitals available in the network of its previously chosen health plan, the model assumes that there are no payment differences among hospitals in the network and non-price factors (such as the hospitals location and other attributes) determine which hospitals are chosen.

In this framework, health plans construct networks that take into account the preferences of their prospective enrollees, and a hospital is added to a payer network if the incremental benefit of having the additional hospital as an option to subscribers exceeds the incremental cost to enrollees. The incremental cost to enrollees is represented by the insurance premium which is assumed to reflect the rates expected to be paid to the hospital. The incremental benefit of adding a new hospital to the network is measured as the additional benefit of each of its enrollees from using that new hospital in its network. An enrollee located far from a particular hospital, or who considers the hospital relatively unattractive, would have a low probability of actually using the hospital, and would place a low value on its inclusion in the network. Thus, each hospital's negotiating position (bargaining power) reflects the incremental value it offers to enrollees for being in the network. That incremental value is determined by the availability of and attractiveness of substitute hospitals for health plan members. The better are the substitute hospitals (location, quality), the less incremental value another hospital adds. The value to the enrollees of having the additional hospital as an option is referred to as the "willingness to pay" for that hospital (or for the network of hospitals included in a system).

The logic of this framework suggests that when the merging hospitals are close substitutes to each other, each hospital's pre-merger bargaining power is attenuated by the ability

of a health plan to move patients to its rival. A merger among two substitute hospitals would increase the combined hospital's bargaining power because it eliminates this ability.

The change in price related to the merger is a function of the incremental value of the merged entity being in the network relative to the incremental value of either hospital separately being in the network. In this context, price refers to the amount a health plan pays hospitals for services provided to its plan members. Prior research has examined the relationship between hospital prices and the incremental value of adding a hospital to a network. For example, in their study of hospital merger cases, Fourier and Gai (2007) found the overall (across all DRGs) elasticity of price with respect to WTP to be in the range of 0.63 to 0.68. This means that a hospital merger that increases WTP by 10% would raise post-merger prices by 6.3%.

Using the estimated model of hospital choice presented above, the predicted change in WTP resulting from the combination of the Wellmont and Mountain States hospital systems is shown in Table 14 for a range of assumptions regarding the elasticity of price with respect to WTP¹⁹ The WTP estimates were calculated using the inpatient discharges for Anthem VA and BCBS-TN combined, and separately using inpatient discharges for Anthem VA and BCBS-TN.

The WTP analysis shows the merger significantly increases the bargaining position of the merged hospitals because inpatients in the draw areas of the merging hospitals view the merging hospitals as very close substitutes, confirmed by the estimated diversion ratios presented above. As shown in the table, for a range of assumptions regarding the elasticity of price with respect to WTP (including conservative values significantly below those in the published literature), large post-merger price increases are predicted (see Table 14).

¹⁹ See Appendix B for a detailed description of the WTP formulas derived from the hospital choice model.

In sum, the large predicted price increase (12 percent at the low end and ranging to 130 percent at the high end) resulting from the WTP approach illustrates that the bargaining position of the merged hospital system is substantially improved because it would be difficult for payers to turn to a desirable alternative hospital network that excluded the two merging hospitals systems.

It is important to note that this analysis, as is true with any such analysis, has its limitations. The WTP analysis and the other tools to evaluate the competitive effects of the proposed merger are not without criticism. The benefit of the diversion ratio and WTP analysis is they attempt to estimate the effect of the merger on prices negotiated between health insurers and hospitals without the need to explicitly define geographic markets. Critics have noted that errors in the WTP framework include the reliability of the hospital choice model (including its strong reliance on travel time as a determinant of hospital choice) and the measurement of the relationship between WTP and hospital prices. While such criticisms may affect the magnitude of precise price predictions, because this merger is so big, they do not change the conclusion that the merger would lead to large hospital price increases for consumers in the Southwest Virginia-Northeast Tennessee markets affected.

III. Conclusion

To evaluate the likely competitive effects of the proposed merger between Wellmont and Mountain States, we have performed three different empirical analyses that show (1) how the proposed merger changes the structure of the market for inpatient services provided by hospitals in relevant geographic markets, (2) the extent to which the merging hospitals are close

substitutes for each other, and (3) the extent to which the merger affects bargaining between health plans and hospitals and, ultimately, hospital prices.

The results all three analyses say the same thing: this merger is anticompetitive. Concentration would increase well beyond the thresholds considered anticompetitive by competition agencies. The observed hospital choices of inpatients residing in Northeastern Tennessee and Southeast Virginia show the merging systems are close substitutes and a merger of the combined systems would give the merged system significant bargaining power that would likely lead to significantly higher post-merger prices.

TABLES AND FIGURES

TABLE 1
MERGING HOSPITALS AND THEIR CHARACTERISTICS

Hospital	System	County	State	Type of Facility	Teaching Status	Medicare Certified Beds	For-Profit Status	Nearest Competing Hospital	Travel Minutes to Nearest Competing Hospital	Second-Nearest Competing Hospital	Travel Minutes to Second-Nearest Competing Hospital
Sycamore Shoals	MSHA	Carter	TN	Acute Care	N	109	N	Holston Valley	36	Bristol Regional	37
Johnson County	MSHA	Johnson	TN	Critical Access	N	2	N	Bristol Regional	59	Wythe County	78
Indian Path	MSHA	Sullivan	TN	Acute Care	Y	300	N	Holston Valley	8	Bristol Regional	22
Unicoi County	MSHA	Unicoi	TN	Acute Care	N	48	N	Laughlin Memorial	43	Holston Valley	46
Johnson City	MSHA	Washington	TN	Acute Care	Y	480	N	Holston Valley	31	Bristol Regional	36
Franklin Woods	MSHA	Washington	TN	Acute Care	N	139	N	Holston Valley	27	Bristol Regional	32
Niswonger	MSHA	Washington	TN	Childrens	Y	N/A	N	Holston Valley	31	Bristol Regional	36
Quillen	MSHA	Washington	TN	Rehab.	Y	N/A	N	Holston Valley	27	Bristol Regional	32
Woodridge	MSHA	Washington	TN	Psych.	Y	N/A	N	Holston Valley	33	Bristol Regional	38
Dickenson	MSHA	Dickenson	VA	Critical Access	N	25	N	Mountain View	36	Lonesome Pine	47
Norton	MSHA	Norton	VA	Acute Care	Y	129	N	Mountain View	6	Lonesome Pine	14
Russell County	MSHA	Russell	VA	Acute Care	N	78	N	Clinch Valley	34	Bristol Regional	45
Smyth County	MSHA	Smyth	VA	Acute Care	N	170	N	Wythe County	31	Bristol Regional	51
Johnston Memorial	MSHA	Washington	VA	Acute Care	N	116	N	Bristol Regional	24	Holston Valley	46

TABLE 1 (CONT.)
MERGING HOSPITALS AND THEIR CHARACTERISTICS

Hospital	System	County	State	Type of Facility	Teaching Status	Medicare Certified Beds	For-Profit Status	Name of Nearest Hospital	Travel Minutes to Nearest Hospital	Name of Second Nearest Hospital	Travel Minutes to Second Nearest Hospital
Hancock County	Wellmont	Hancock	TN	Critical Access	N	25	N	Lakeway Regional	46	Morristown-Hamblen	46
Hawkins County	Wellmont	Hawkins	TN	Acute Care	N	50	N	Lakeway Regional	37	Morristown-Hamblen	37
Bristol Regional	Wellmont	Sullivan	TN	Acute Care	Y	282	N	Indian Path	23	Johnston Memorial	25
Holston Valley	Wellmont	Sullivan	TN	Acute Care	Y	519	N	Indian Path	8	Franklin Woods	28
Mountain View	Wellmont	Norton	VA	Acute Care	N	118	N	Norton	6	Russell County	50
Lonesome Pine	Wellmont	Wise	VA	Acute Care	Y	60	N	Norton	14	Indian Path	48
Sources: American Hospital Directory (Hospital, System, County, State, Type of Facility); CMS HCRIS data (Teaching Status); CMS POS data (Medicare Certified Beds, For-Profit Status); Google Maps (Travel Minutes). Note: Bold red font indicates hospitals that belong to a merging party.											

FIGURE 1
LOCATION OF MERGING HOSPITALS



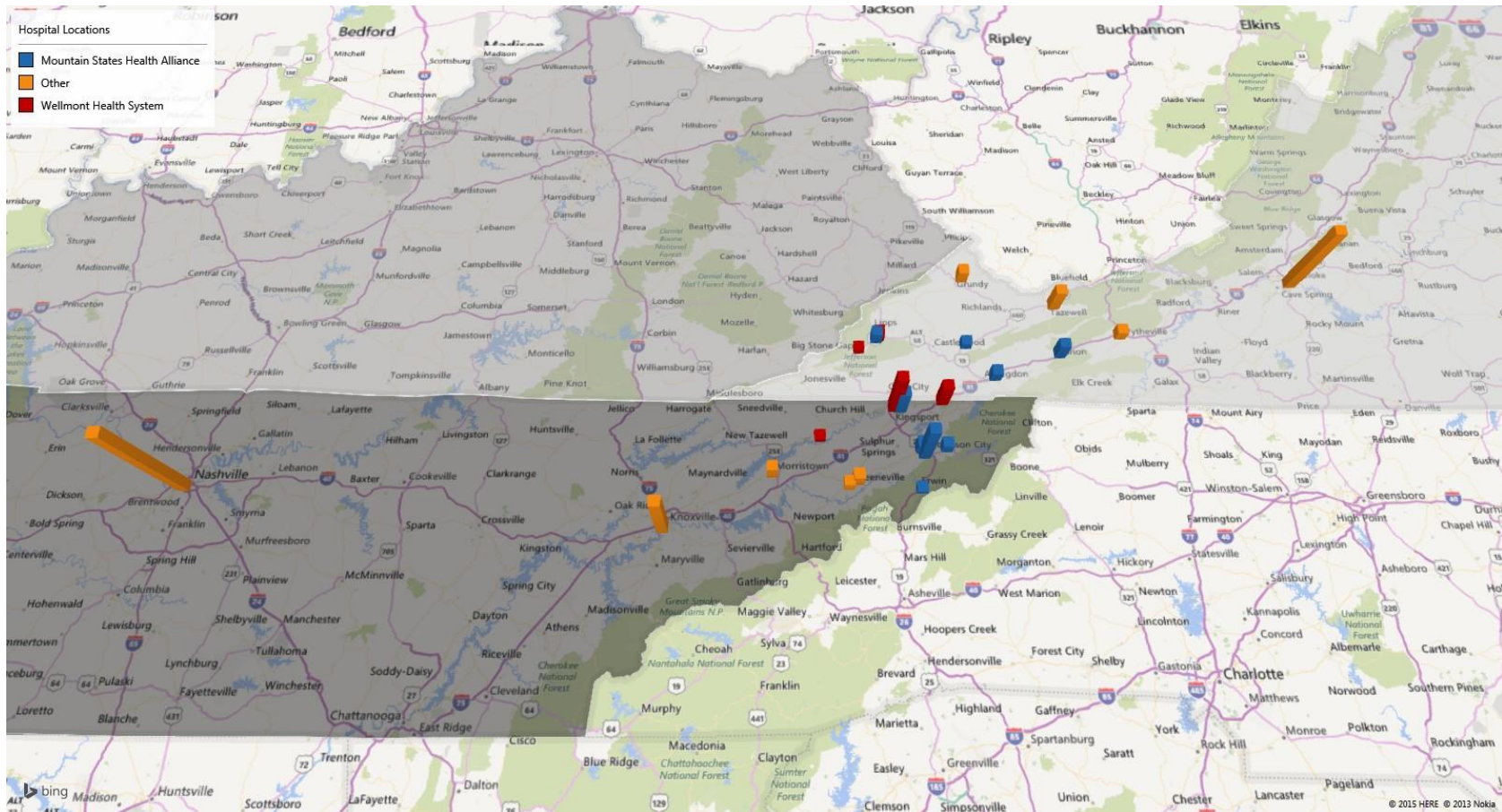
Source: AHD

Note: Names with "*" depict non-short term acute care hospitals.

TABLE 2
CHARACTERISTICS OF COMPETING HOSPITALS IN 90% COMBINED DRAW AREA OF MERGING HOSPITALS
BASED ON INPATIENTS COVERED BY ANTHEM-VA AND BCBS-TN

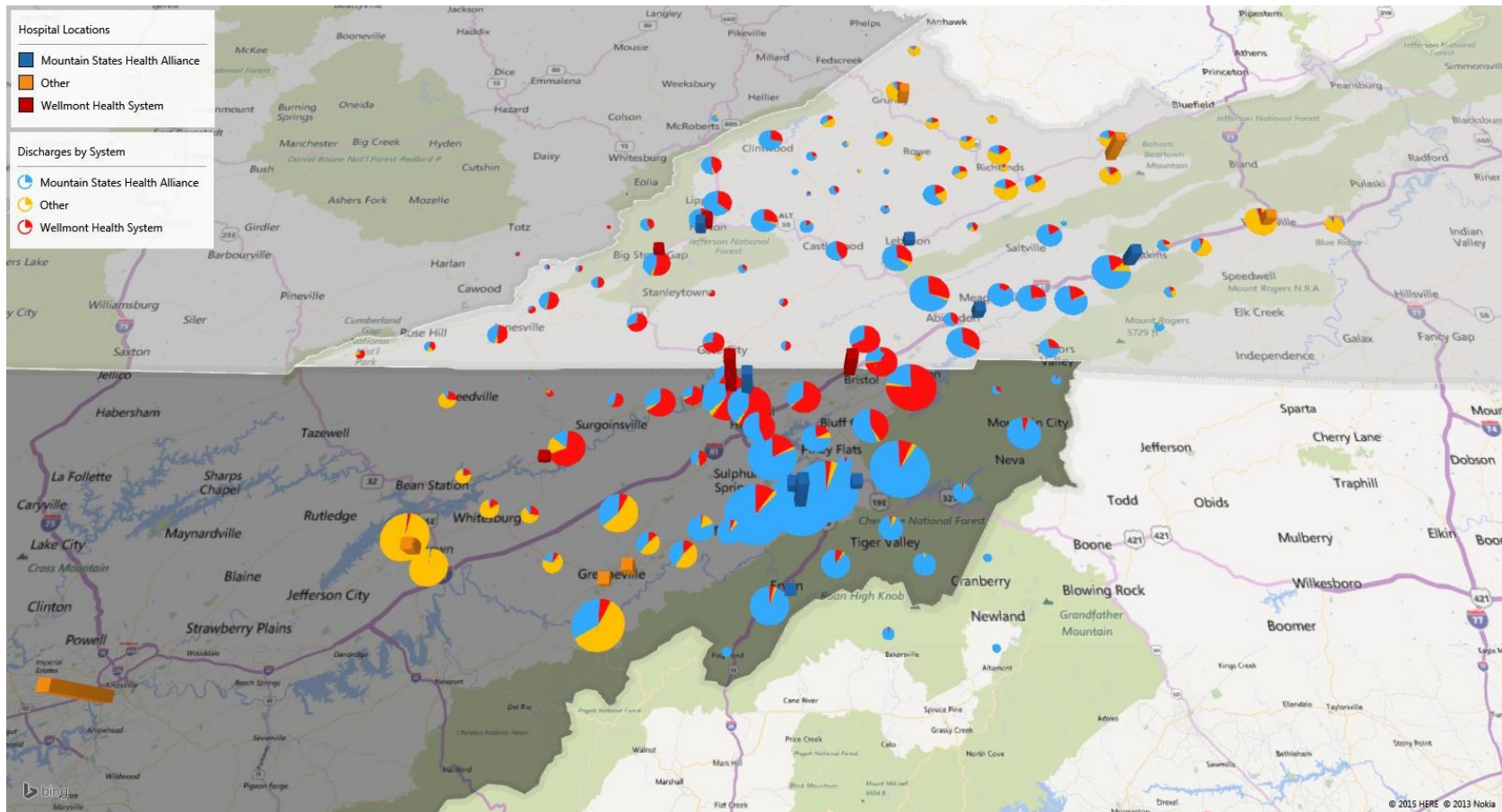
Hospital	System	County	State	Type of Facility	Teaching Status	Medicare Certified Beds	For-Profit Status
Roanoke Memorial	Carilion	Roanoke	VA	Acute Care	Y	703	N
Tazewell Community	Carilion	Tazewell	VA	Acute Care	N	238	N
Lakeway Regional	CHS	Hamblen	TN	Acute Care	N	135	Y
Morristown-Hamblen	Covenant	Hamblen	TN	Acute Care	N	155	N
Clinch Valley	LifePoint	Tazewell	VA	Acute Care	N	175	Y
Wythe County	LifePoint	Wythe	VA	Acute Care	N	100	N
Vanderbilt University	Vanderbilt University	Davidson	TN	Acute Care	Y	985	N
Laughlin Memorial	N/A	Greene	TN	Acute Care	N	140	N
Takoma Regional	N/A	Greene	TN	Acute Care	N	94	N
University of Tennessee	N/A	Knox	TN	Acute Care	Y	581	N
Buchanan General	N/A	Buchanan	VA	Acute Care	N	134	N
Sources: American Hospital Directory (Hospital, System, County, State, Type of Facility); CMS HCRIS data (Teaching Status); CMS POS data (Medicare Certified Beds, For-Profit Status).							

FIGURE 2
LOCATION OF MERGING AND COMPETING HOSPITALS IN 90% COMBINED DRAW AREA OF MERGING HOSPITALS
BASED ON INPATIENTS COVERED BY ANTHEM-VA AND BCBS-TN



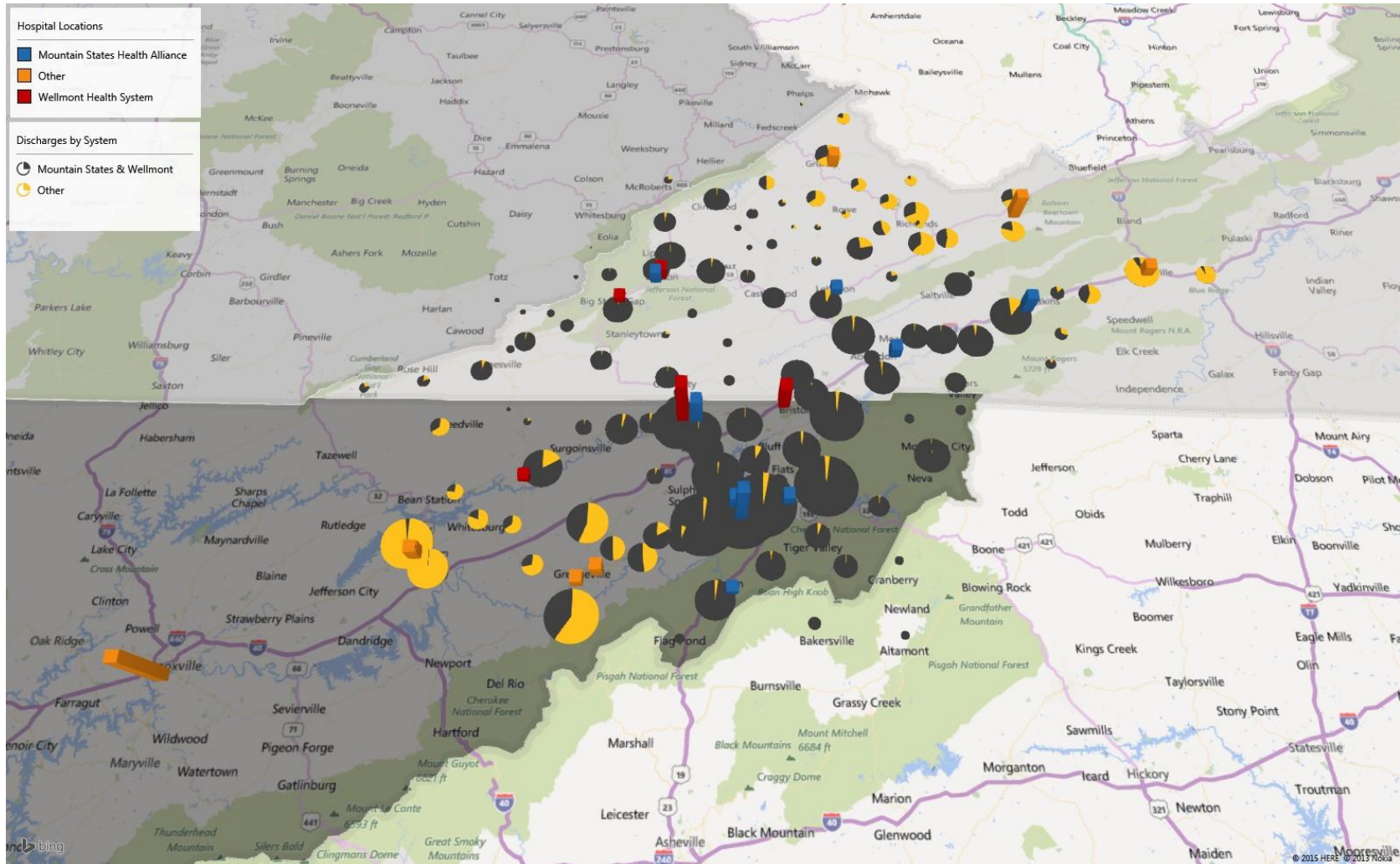
Sources: AHD; CMS Provider of Services File (June 2015); Virginia Health Information PLD (2014); BCBS internal data; Anthem internal data.
 Note: Short term acute care hospital locations only. Height of bars indicate the relative number of hospital beds.

FIGURE 3
MERGING AND COMPETING HOSPITAL DISCHARGES IN 90% COMBINED DRAW AREA OF MERGING HOSPITALS
BASED ON INPATIENTS COVERED BY ANTHEM-VA AND BCBS-TN



Sources: AHD; CMS Provider of Services File (June 2015); Virginia Health Information PLD (2014); BCBS internal data; Anthem internal data.
 Note: Short term acute care hospital locations only. Height of bars indicate the relative number of hospital beds.

FIGURE 4
MERGING AND COMPETING HOSPITAL DISCHARGES IN 90% COMBINED DRAW AREA OF MERGING HOSPITALS
BASED ON INPATIENTS COVERED BY ANTHEM-VA AND BCBS-TN



Sources: AHD; CMS Provider of Services File (June 2015); Virginia Health Information PLD (2014); BCBS internal data; Anthem internal data.
Note: Short term acute care hospital locations only. Height of bars indicate the relative number of hospital beds.

TABLE 3
STRUCTURAL CONCENTRATION IN 90% COMBINED DRAW AREA OF MERGING HOSPITALS
BASED ON INPATIENTS COVERED BY ANTHEM-VA AND BCBS-TN

Geographic Market	Pre-Merger HHI	Post- Merger HHI	Change in HHI	Combined Firm Share (%)
90% Draw Area:				
Johnson City	4,607	7,834	3,227	88.4
Holston Valley	3,822	6,978	3,157	83.3
Bristol Regional	4,117	7,348	3,231	85.4
Franklin Woods	5,097	7,963	2,866	89.1
Indian Path	4,483	8,519	4,037	92.3
Russell County	3,475	6,500	3,024	79.7
Johnston Memorial	3,825	7,117	3,292	83.8
Sycamore Shoals	7,788	9,101	1,313	95.4
Unicoi County	7,166	9,205	2,039	95.9
Hawkins County	2,680	4,494	1,814	64.3
Lonesome Pine	4,351	8,635	4,284	92.9
Norton Community	4,490	8,662	4,172	93.0
Mountain View	4,574	8,961	4,387	94.6
Smyth County	4,990	6,893	1,903	82.4
Combined	3,436	5,987	2,551	77.0
Source: AHD; BCBS internal data; Virginia Health Information PLD (2014); Anthem internal data.				

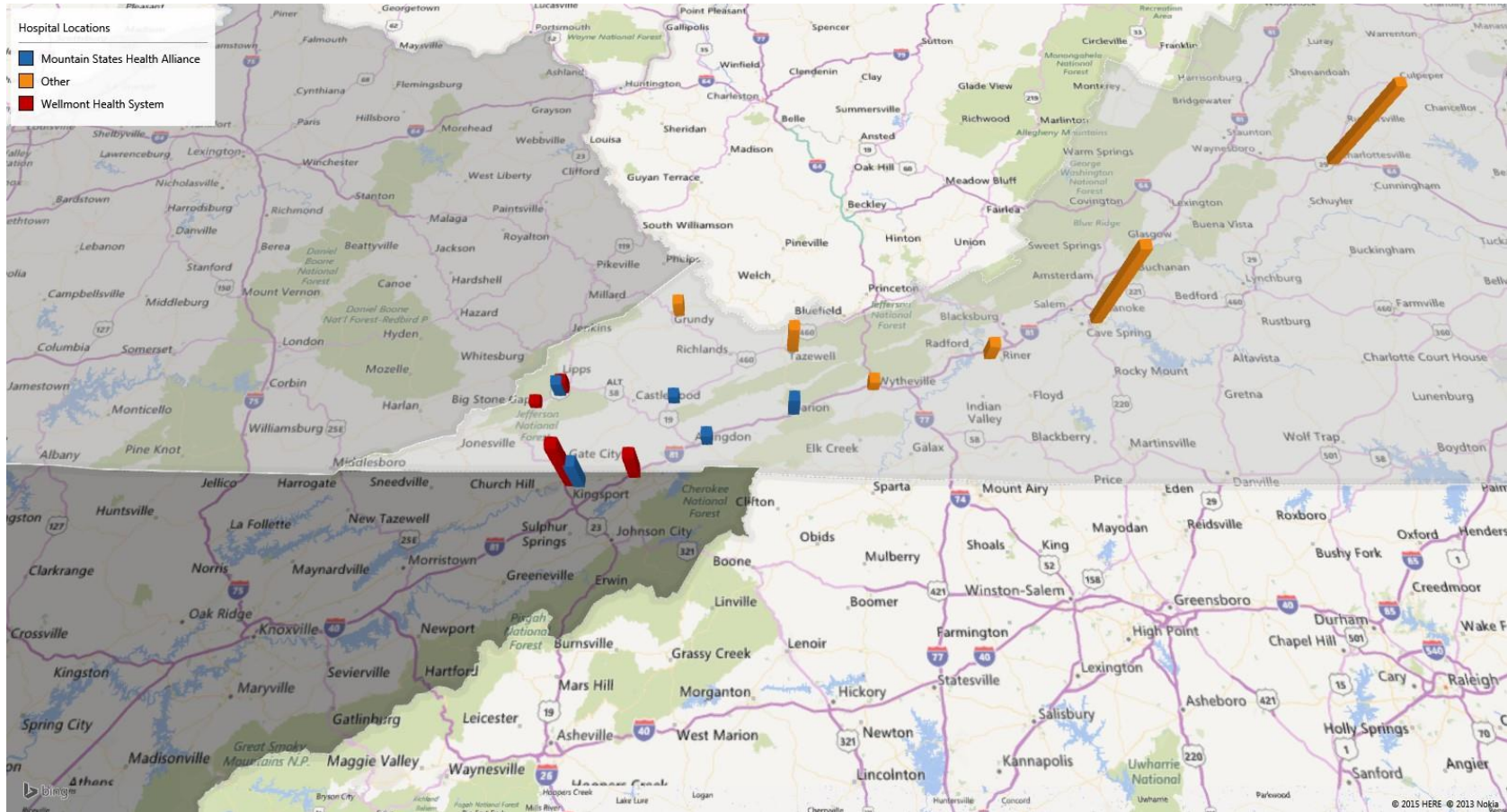
TABLE 4
STRUCTURAL CONCENTRATION IN 90% COMBINED DRAW AREA OF MERGING HOSPITALS
BASED ON INPATIENTS COVERED BY ANTHEM-VA

Geographic Market	Pre-Merger HHI	Post- Merger HHI	Change in HHI	Combined Firm Share (%)
90% Draw Area:				
Bristol Regional	3,111	4,853	1,743	66.8
Russell County	3,244	4,851	1,607	66.4
Johnston Memorial	4,044	6,014	1,969	76.1
Holston Valley	3,263	6,068	2,804	76.7
Indian Path	4,026	7,864	3,838	88.5
Norton Community	4,400	8,441	4,041	91.8
Lonesome Pine	4,275	8,462	4,187	91.9
Mountain View	4,642	8,954	4,311	94.6
Smyth County	5,260	6,245	985	77.9
Combined	2,989	4,768	1,779	66.0
Source: AHD; Virginia Health Information PLD (2014); Anthem internal data.				

TABLE 5
CHARACTERISTICS OF MERGING AND COMPETING HOSPITALS IN 90% DRAW AREA OF MERGING HOSPITALS
BASED ON INPATIENTS COVERED BY ANTHEM-VA

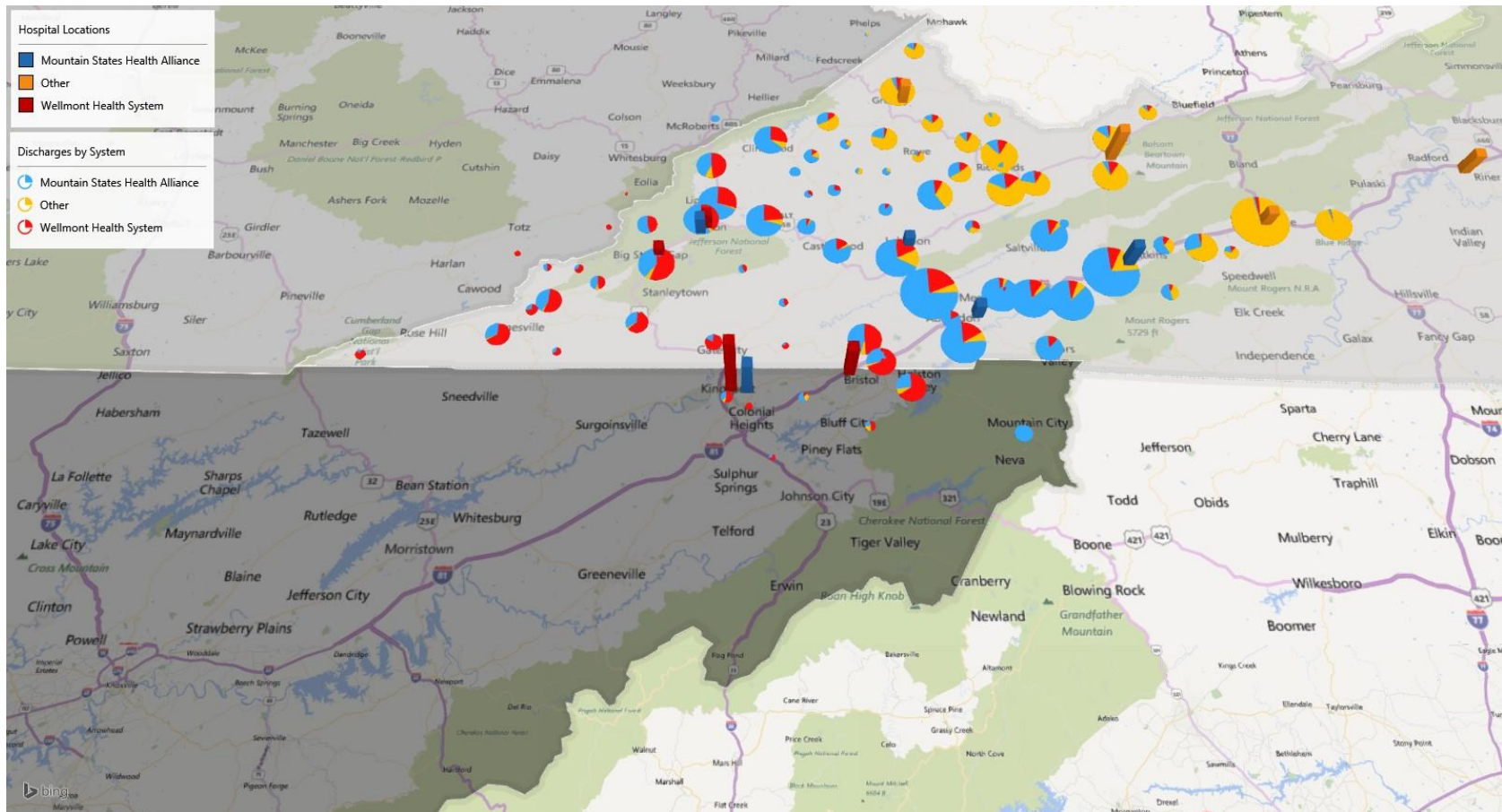
Hospital	System	County	State	Type of Facility	Teaching Status	Medicare Certified Beds	For-Profit Status
Indian Path	MSHA	Sullivan	TN	Acute Care	Y	300	N
Norton	MSHA	Norton	VA	Acute Care	Y	129	N
Russell County	MSHA	Russell	VA	Acute Care	N	78	N
Smyth County	MSHA	Smyth	VA	Acute Care	N	170	N
Johnston	MSHA	Washington	VA	Acute Care	N	116	N
Bristol Regional	Wellmont	Sullivan	TN	Acute Care	Y	282	N
Holston Valley	Wellmont	Sullivan	TN	Acute Care	Y	519	N
Mountain View Regional	Wellmont	Norton	VA	Acute Care	N	118	N
Lonesome Pine	Wellmont	Wise	VA	Acute Care	Y	60	N
New River Valley	Carilion	Montgomery	VA	Acute Care	N	146	N
Roanoke	Carilion	Roanoke	VA	Acute Care	Y	703	N
Tazewell	Carilion	Tazewell	VA	Acute Care	N	238	N
Clinch Valley	LifePoint	Tazewell	VA	Acute Care	N	175	Y
Wythe County	LifePoint	Wythe	VA	Acute Care	N	100	N
University of Virginia	University of Virginia	Charlottesville	VA	Acute Care	Y	622	N
Buchanan	N/A	Buchanan	VA	Acute Care	N	134	N
Sources: American Hospital Directory (Hospital, System, County, State, Type of Facility); CMS HCRIS data (Teaching Status); CMS POS data (Medicare Certified Beds, For-Profit Status); Virginia Health Information PLD (2014); Anthem internal data.							

FIGURE 5
LOCATION OF MERGING AND COMPETING HOSPITALS IN 90% DRAW AREA OF MERGING HOSPITALS
BASED ON INPATIENTS COVERED BY ANTHEM-VA



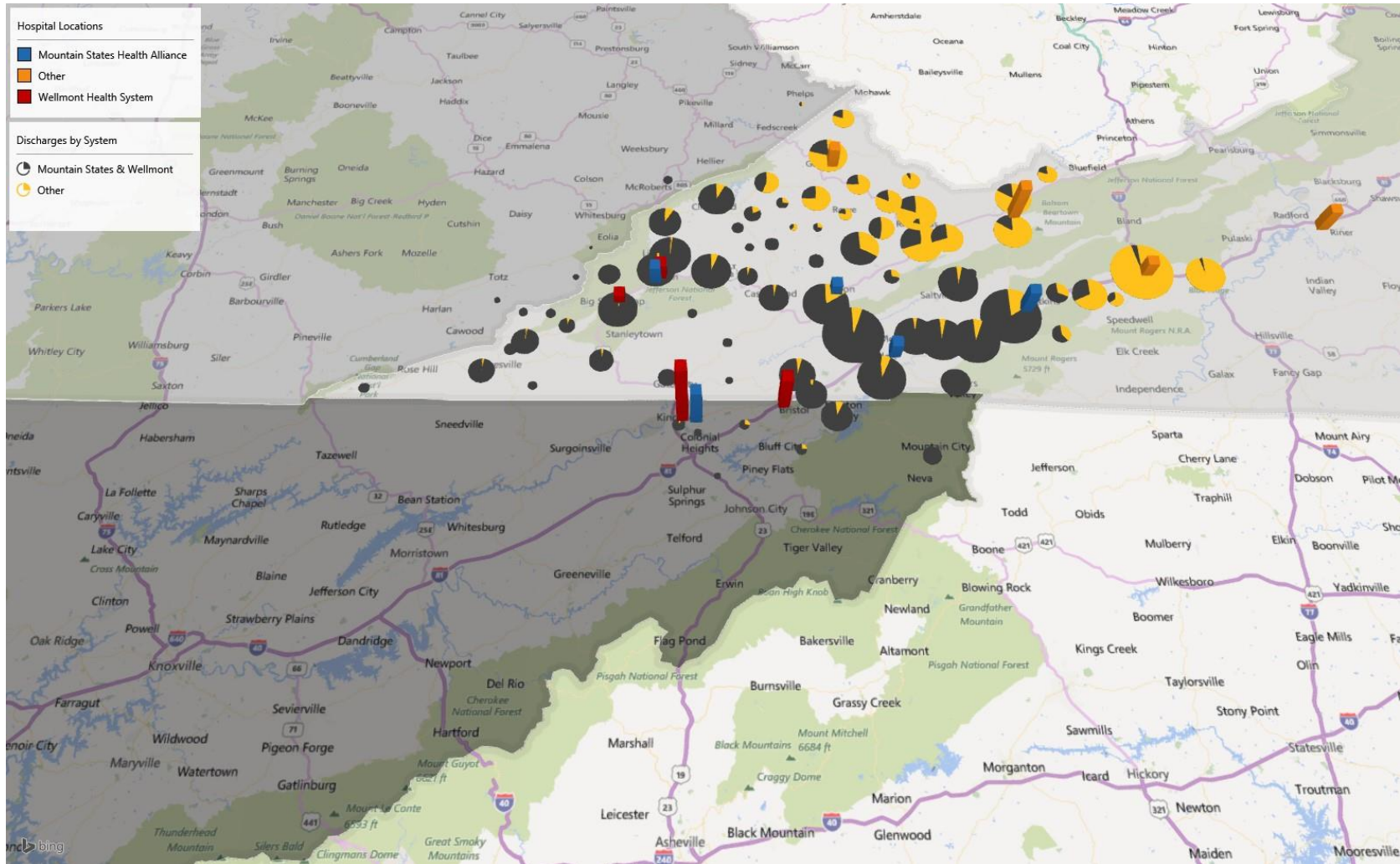
Sources: AHD; CMS Provider of Services File (June 2015); Virginia Health Information PLD (2014); Anthem internal data.
Note: Short term acute care hospital locations only. Height of bars indicate the relative number of hospital beds.

FIGURE 6
MERGING AND COMPETING HOSPITAL DISCHARGES IN 90% COMBINED DRAW AREA OF MERGING HOSPITALS
BASED ON INPATIENTS COVERED BY ANTHEM-VA



Sources: AHD; CMS Provider of Services File (June 2015); Virginia Health Information PLD (2014); Anthem internal data.
 Note: Short term acute care hospital locations only. Height of bars indicate the relative number of hospital beds.

FIGURE 7
MERGING AND COMPETING HOSPITAL DISCHARGES IN 90% COMBINED DRAW AREA OF MERGING HOSPITALS
BASED ON INPATIENTS COVERED BY ANTHEM-VA



Sources: AHD; CMS Provider of Services File (June 2015); Virginia Health Information PLD (2014); Anthem internal data.
Note: Short term acute care hospital locations only. Height of bars indicate the relative number of hospital beds.

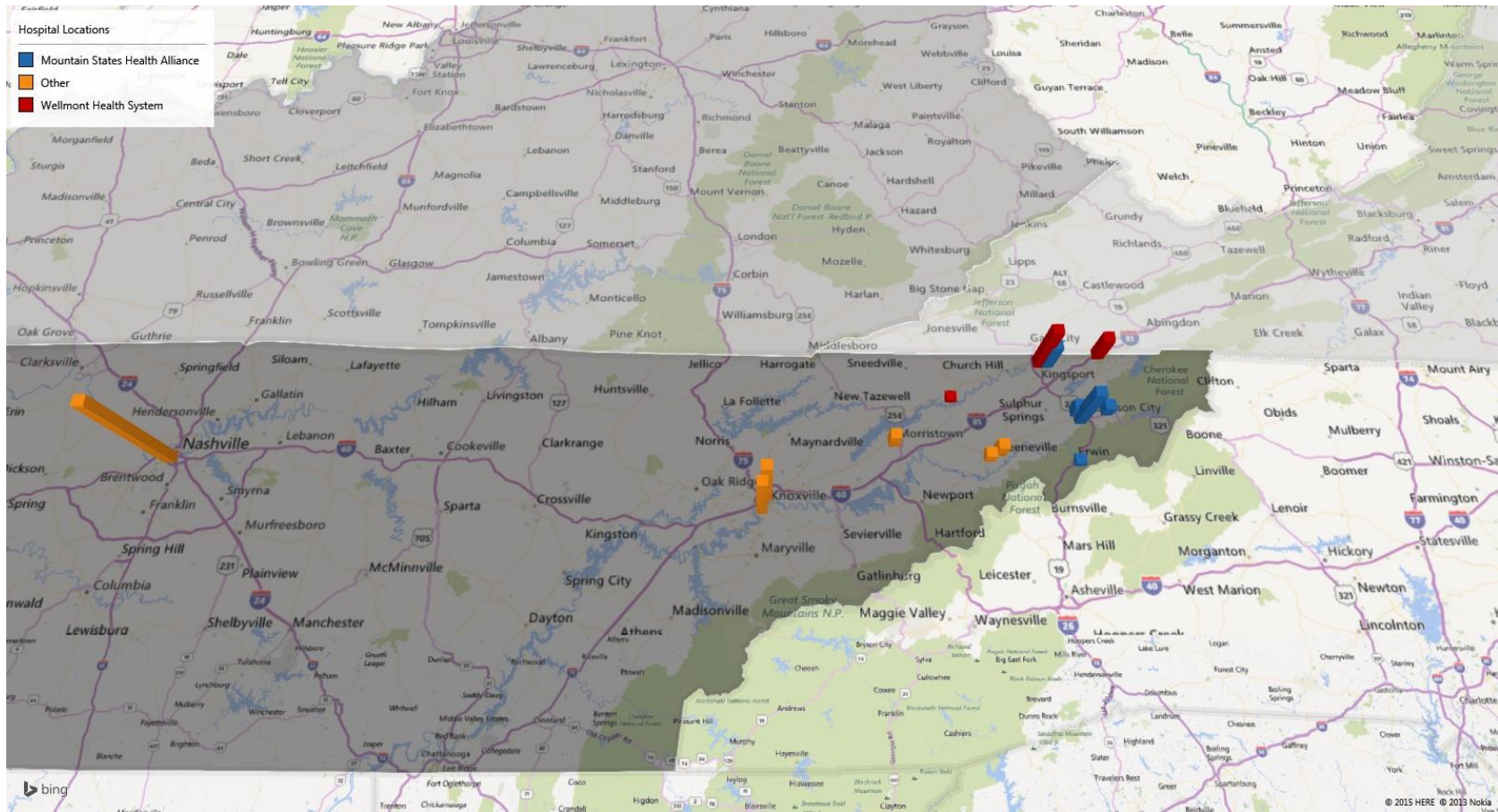
TABLE 6
STRUCTURAL CONCENTRATION IN 90% COMBINED DRAW AREA OF MERGING HOSPITALS
BASED ON INPATIENTS COVERED BY BCBS-TN

Geographic Market	Pre-Merger HHI	Post-Merger HHI	Change in HHI	Combined Firm Share (%)
90% Draw Area:				
Johnson City	4,661	8,017	3,356	89.4
Holston Valley	3,852	6,818	2,966	82.2
Franklin Woods	5,158	7,987	2,829	89.2
Indian Path	4,547	8,510	3,963	92.2
Bristol Regional	5,007	9,241	4,233	96.1
Sycamore Shoals	7,845	9,151	1,306	95.6
Unicoi County	7,241	9,260	2,020	96.2
Hawkins County	2,632	4,383	1,751	63.3
Combined	3,780	6,674	2,894	81.3
Source: AHD; BCBS internal data.				

TABLE 7
CHARACTERISTICS OF MERGING AND COMPETING HOSPITALS IN 90% DRAW AREA OF MERGING HOSPITALS
BASED ON INPATIENTS COVERED BY BCBS-TN

Hospital	System	County	State	Type of Facility	Teaching Status	Medicare Certified Beds	For-Profit Status
Sycamore Shoals	MSHA	Carter	TN	Acute Care	N	109	N
Indian Path	MSHA	Sullivan	TN	Acute Care	Y	300	N
Unicoi County	MSHA	Unicoi	TN	Acute Care	N	48	N
Franklin Woods	MSHA	Washington	TN	Acute Care	N	139	N
Johnson City	MSHA	Washington	TN	Acute Care	Y	480	N
Hawkins County	Wellmont	Hawkins	TN	Acute Care	N	50	N
Bristol Regional	Wellmont	Sullivan	TN	Acute Care	Y	282	N
Holston Valley	Wellmont	Sullivan	TN	Acute Care	Y	519	N
Lakeway	CHS	Hamblen	TN	Acute Care	N	135	Y
Physicians Regional	CHS	Knox	TN	Acute Care	N	610	Y
Morristown-Hamblen	Covenant	Hamblen	TN	Acute Care	N	155	N
Vanderbilt University	Vanderbilt University	Davidson	TN	Acute Care	Y	985	N
Laughlin	N/A	Greene	TN	Acute Care	N	140	N
Takoma	N/A	Greene	TN	Acute Care	N	94	N
University of Tennessee	N/A	Knox	TN	Acute Care	Y	581	N
Sources: American Hospital Directory (Hospital, System, County, State, Type of Facility); CMS HCRIS data (Teaching Status); CMS POS data (Medicare Certified Beds, For-Profit Status); BCBS internal data.							

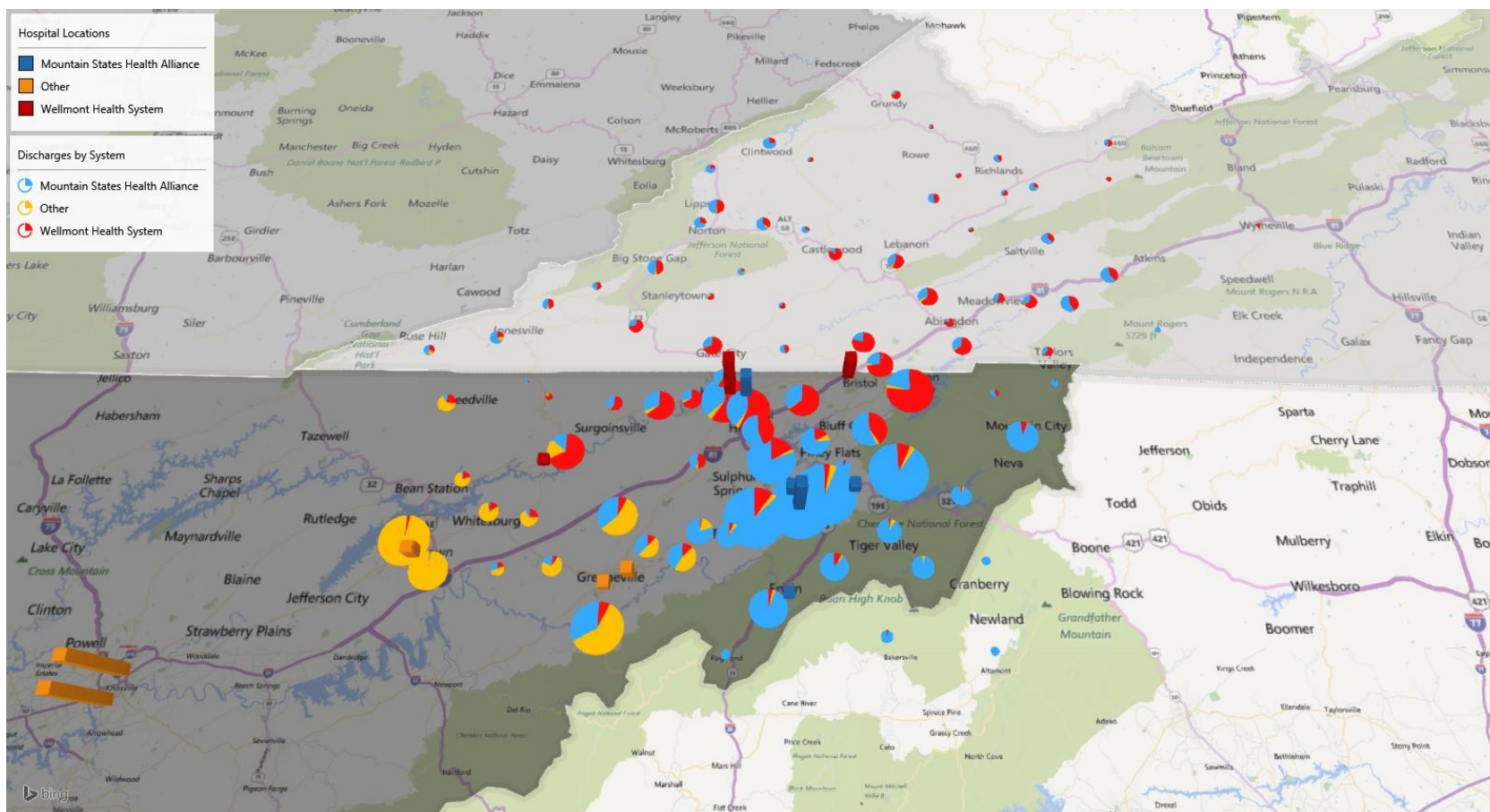
FIGURE 8
LOCATION OF MERGING AND COMPETING HOSPITALS IN 90% DRAW AREA OF MERGING HOSPITALS
BASED ON INPATIENTS COVERED BY BCBS-TN



Sources: AHD; CMS Provider of Services File (June 2015); BCBS internal data.

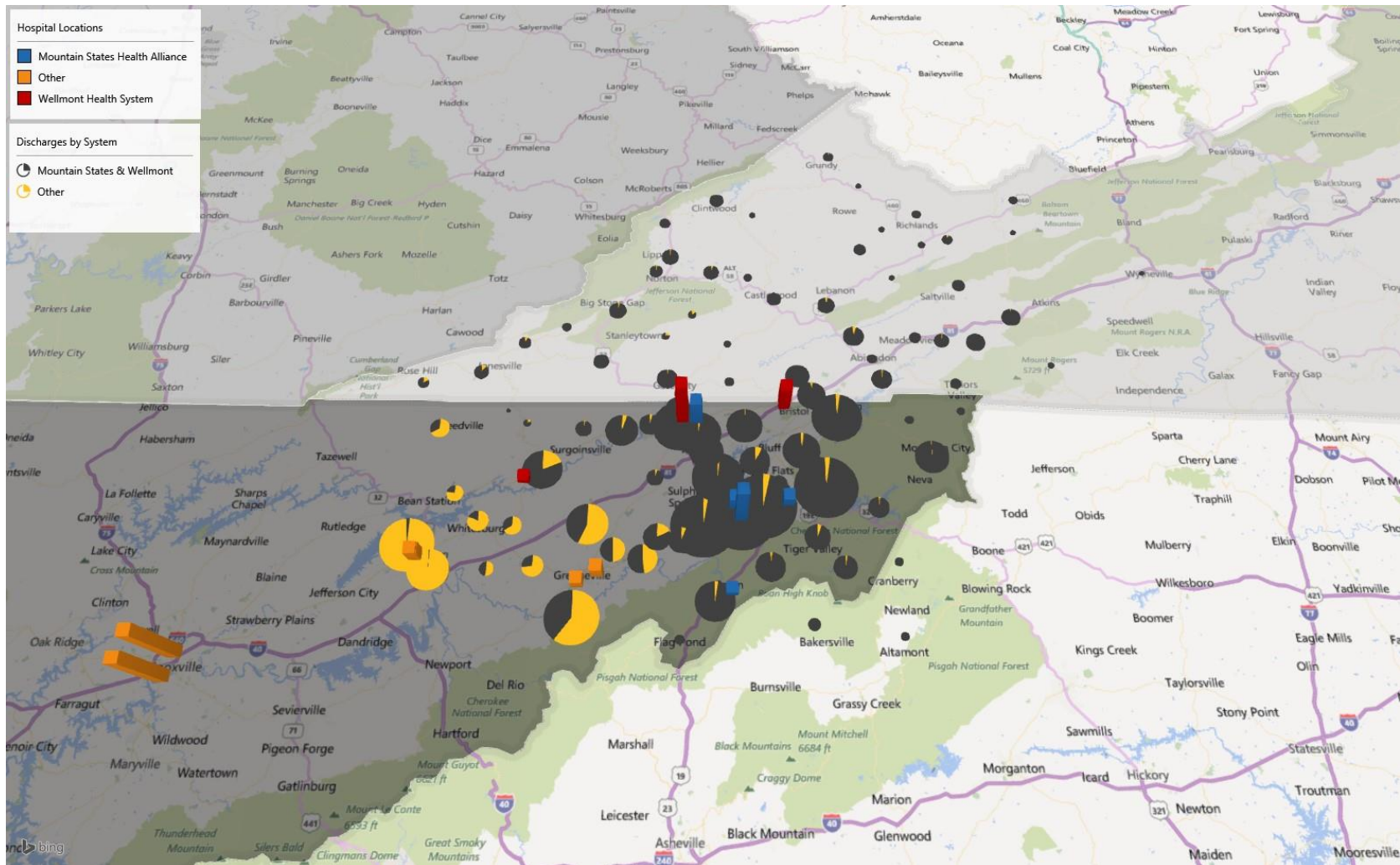
Note: Short term acute care hospital locations only. Height of bars indicate the relative number of hospital beds.

FIGURE 9
MERGING AND COMPETING HOSPITAL DISCHARGES IN 90% COMBINED DRAW AREA OF MERGING HOSPITALS
BASED ON INPATIENTS COVERED BY BCBS-TN



Sources: AHD; CMS Provider of Services File (June 2015); BCBS internal data.
 Note: Short term acute care hospital locations only. Height of bars indicate the relative number of hospital beds.

FIGURE 10
MERGING AND COMPETING HOSPITAL DISCHARGES IN 90% COMBINED DRAW AREA OF MERGING HOSPITALS
BASED ON INPATIENTS COVERED BY BCBS-TN



Sources: AHD; CMS Provider of Services File (June 2015); BCBS internal data.

Note: Short term acute care hospital locations only. Height of bars indicate the relative number of hospital beds.

TABLE 8
STRUCTURAL CONCENTRATION IN COMBINED DRAW AREA OF MERGING HOSPITALS
BASED ON INPATIENTS COVERED BY MEDICARE

Geographic Market	Pre-Merger HHI	Post-Merger HHI	Change in HHI	Combined Firm Share (%)
Draw Area:				
Johnson City	3,582	6,830	3,248	82.3
Holston Valley	3,634	7,106	3,471	84.1
Bristol Regional	3,784	7,490	3,706	86.2
Indian Path	4,551	8,833	4,283	93.9
Franklin Woods	5,107	8,258	3,151	90.7
Sycamore Shoals	5,640	9,705	4,065	98.5
Johnston Memorial	4,085	8,085	4,000	89.7
Norton Community	4,691	9,357	4,667	96.7
Russell County	4,707	7,861	3,154	88.1
Lonesome Pine	4,964	9,718	4,754	98.6
Smyth County	3,590	5,150	1,560	69.2
Unicoi County	8,967	9,842	875	99.2
Hawkins County	4,813	6,216	1,403	78.0
Combined	2,967	5,701	2,734	75.0
Source: AHD; CMS Provider of Services data (June 2015).				

TABLE 9
HOSPITAL CHOICE MODEL

Variable	Parameter
Driving Time (minutes)	-0.0922958
Driving Time Squared	0.0000577
Teaching Hospital	-0.533981
Teaching*Male	-0.0092189 *
Teaching*Length of Stay (days)	-0.0095582 *
Teaching*Patient Older than 61 Years of Age	0.2046083
Teaching*Patient Younger than 18 Years of Age	-0.2726483
Number of Beds	0.0006906
Beds*Male	0.0007159
Beds*Length of Stay (days)	0.000199
Beds*Patient Older than 61 Years of Age	0.0009057
Beds*Patient Younger than 18 Years of Age	0.0009665
For-Profit Hospital (FP)	-1.859845
FP*Male	0.370776
FP*Length of Stay (days)	-0.0394727 *
FP*Patient Older than 61 Years of Age	0.1848587 *
FP*Patient Younger than 18 Years of Age	-0.425434
Nursing Intensity (N)	-73.05278
N*Male	19.10245
N*Length of Stay (days)	-1.871556
N*Patient Older than 61 Years of Age	8.783048
N*Patient Younger than 18 Years of Age	-58.61092
Capital Intensity (C)	0.0304038
C*Male	0.0232912
C*Length of Stay (days)	-0.01496
C*Patient Older than 61 Years of Age	0.0943971
C*Patient Younger than 18 Years of Age	-0.0923083
Hospital Services:	
Cardiology	0.5679328
Labor & Delivery	1.346332
Nervous System	0.4686566
Psychiatric	-0.3506205
Transplant	0.2762136
Hospital Services Interacted with Corresponding Patient Treatment Category Based on MDC:	
Cardiology	0.6475583

TABLE 9 (CONT.)
HOSPITAL CHOICE MODEL

Variable	Parameter
Labor & Delivery	19.22139 *
Nervous System	0.8572154
Psychiatric	5.670516
Driving Time Interacted with Hospital Characteristics:	
Teaching Hospital	-0.0013858 *
Number of Beds	0.0000578
For-Profit Hospital	0.0114433
Nursing Intensity	-0.2429945
Capital Intensity	0.0005666
Driving Time Interacted with Patient Characteristics:	
Male	0.000098 *
Length of Stay (days)	-0.0000908 *
Patient Older than 61 Years of Age	-0.0089102
Patient Younger than 18 Years of Age	0.0012455 *
Driving Time Interacted with Patient Treatment Category Based on MDC:	
Circulatory	-0.0035003
Obstetrics	-0.0155155
Respiratory	-0.0246734
Digestive	-0.0066864
Musculoskeletal	-0.0011332 *
Nervous	-0.004803
Kidney	-0.0060736
Reproductive	-0.0102048
Psychiatric	-0.0182139
Hepatobiliary	-0.0040826
Endocrine	-0.0111445
Infection	-0.010393
Skin	-0.0253741
Myeloproliferative	0.0181401
Injury	-0.0021937 *
ENT	-0.0021012 *
Other	-0.0010147 *
Notes: All parameters are statistically significant at the 5% level except those marked by an asterisk. Variable glossary contained in Appendix B.	

TABLE 10
DIVERSION RATIO IN 90% COMBINED DRAW AREA OF MERGING HOSPITALS
BASED ON INPATIENTS COVERED BY ANTHEM-VA AND BCBS-TN

Diversion from Wellmont to Mountain States	
Hospital	Diversion Ratio
Johnson City	0.32
Johnston	0.13
Franklin Woods	0.12
Indian Path	0.07
Norton	0.06
Clinch Valley	0.05
Morristown-Hamblen	0.04
Sycamore Shoals	0.04
Laughlin	0.03
UT Medical Center	0.03
Wythe County	0.02
Carilion Roanoke	0.01
Vanderbilt	0.01
Buchanan	0.01
Takoma	0.01
Smyth County	0.01
Carilion Tazewell	0.01
Lakeway	0.00
Russell County	0.00
Unicoi County	0.00
Note: Diversion ratio equals fraction of Wellmont's inpatients that would choose hospital if Wellmont hospitals were not available.	

Diversion from Mountain States to Wellmont	
Hospital	Diversion Ratio
Holston Valley	0.38
Bristol	0.28
Laughlin	0.06
Clinch Valley	0.05
Morristown-Hamblen	0.04
Lonesome Pine	0.04
UT Medical Center	0.03
Wythe County	0.03
Carilion Roanoke	0.02
Takoma	0.02
Vanderbilt	0.02
Mountain View	0.02
Buchanan	0.01
Carilion Tazewell	0.01
Lakeway	0.00
Hawkins County	0.00
Note: Diversion ratio equals fraction of Mountain States' inpatients that would choose hospital if Mountain States hospitals were not available.	

TABLE 11
DIVERSION RATIO IN 90% COMBINED DRAW AREA OF MERGING HOSPITALS
BASED ON INPATIENTS COVERED BY ANTHEM-VA AND BCBS-TN (INCLUDING KENTUCKY HOSPITALS)

Diversion from Wellmont to Mountain States	
Hospital	Diversion Ratio
Johnson City	0.32
Johnston Memorial	0.13
Franklin Woods	0.12
Indian Path	0.07
Clinch Valley	0.04
Norton	0.04
Morristown-Hamblen	0.04
Sycamore Shoals	0.04
Laughlin Memorial	0.03
University of Tennessee	0.02
Wythe County	0.02
Pikeville	0.02
Carilion Roanoke	0.01
Whitesburg ARH	0.01
Takoma Regional	0.01
Smyth County	0.01
Vanderbilt	0.01
Buchanan General	0.01
Carilion Tazewell	0.01
Lakeway Regional	0.00
Harlan ARH	0.00
Russell County	0.00
Middlesboro ARH	0.00
Unicoi County	0.00
UK Chandler	0.00
Hazard ARH	0.00
Note: Diversion ratio equals fraction of Wellmont's inpatients that would choose hospital if Wellmont hospitals were not available. ARH hospitals, Pikeville, and UK Chandler are located in Kentucky.	

Diversion from Mountain States to Wellmont	
Hospital	Diversion Ratio
Holston Valley	0.37
Bristol Regional	0.28
Laughlin Memorial	0.06
Clinch Valley	0.05
Morristown-Hamblen	0.04
University of Tennessee	0.03
Wythe County	0.03
Lonesome Pine	0.03
Carilion Roanoke	0.02
Pikeville	0.02
Takoma Regional	0.02
Vanderbilt	0.01
Whitesburg ARH	0.01
Buchanan General	0.01
Mountain View	0.01
Carilion Tazewell	0.01
Lakeway Regional	0.00
Middlesboro ARH	0.00
Harlan ARH	0.00
UK Chandler	0.00
Hawkins County	0.00
Hazard ARH	0.00
Note: Diversion ratio equals fraction of Mountain States' inpatients that would choose hospital if Mountain States hospitals were not available. ARH hospitals, Pikeville, and UK Chandler are located in Kentucky.	

TABLE 12
DIVERSION RATIO IN 90% COMBINED DRAW AREA OF MERGING HOSPITALS
BASED ON INPATIENTS COVERED BY ANTHEM-VA

Diversion From Wellmont to Mountain States	
Hospital	Diversion Ratio
Johnston	0.34
Indian Path	0.20
Norton	0.14
Clinch Valley	0.12
Wythe County	0.05
Carilion Roanoke	0.04
Buchanan	0.03
Smyth County	0.03
Carilion Tazewell	0.02
Carilion New River Valley	0.02
Russell County	0.01
University of Virginia	0.00
Note: Diversion ratio equals fraction of Wellmont's inpatients that would choose hospital if Wellmont hospitals were not available.	

Diversion From Mountain States to Wellmont	
Hospital	Diversion Ratio
Bristol	0.31
Holston Valley	0.28
Clinch Valley	0.12
Lonesome Pine	0.08
Wythe County	0.07
Carilion Roanoke	0.04
Mountain View Regional	0.03
Buchanan	0.03
Carilion Tazewell	0.02
Carilion New River	0.02
University of Virginia	0.00
Note: Diversion ratio equals fraction of Mountain States' inpatients that would choose hospital if Mountain States hospitals were not available.	

TABLE 13
DIVERSION RATIO IN 90% COMBINED DRAW AREA OF MERGING HOSPITALS
BASED ON INPATIENTS COVERED BY BCBS-TN

Diversion from Wellmont to Mountain States	
Hospital	Diversion Ratio
Johnson City	0.46
Franklin Woods	0.17
Indian Path	0.11
Sycamore Shoals	0.05
Morristown-Hamblen	0.05
Laughlin	0.04
Physicians Regional	0.04
University of Tennessee	0.03
Vanderbilt University	0.02
Takoma	0.02
Lakeway	0.01
Unicoi County	0.00
Note: Diversion ratio equals fraction of Wellmont's inpatients that would choose hospital if Wellmont hospitals were not available.	

Diversion from Mountain States to Wellmont	
Hospital	Diversion Ratio
Holston Valley	0.46
Bristol	0.29
Laughlin	0.07
Morristown-Hamblen	0.05
Physicians Regional	0.04
University of Tennessee	0.04
Vanderbilt University	0.02
Takoma	0.02
Lakeway	0.01
Hawkins County	0.00
Note: Diversion ratio equals fraction of Mountain States' inpatients that would choose hospital if Mountain States hospitals were not available.	

TABLE 14
WILLINGNESS-TO-PAY ANALYSIS

Change in WTP (%) [1]	Elasticity of Price with Respect to WTP [2]	Predicted Price Increase (%) [3] = [1] x [2]
<i>Based on Inpatients Covered by Anthem-VA:</i>		
200	0.1	20
200	0.2	40
200	0.5	100
200	0.65	130
<i>Based on Inpatients Covered by BCBS-TN:</i>		
122	0.1	12
122	0.2	24
122	0.5	61
122	0.65	79
<i>Based on Inpatients Covered by Anthem-VA and BCBS-TN:</i>		
138	0.1	14
138	0.2	28
138	0.5	69
138	0.65	90

APPENDIX A
VARIABLE GLOSSARY

Variable	Type	Description	Sources
Driving Time	Continuous	Driving time in minutes from patient's ZIP code to hospital address	Google Maps
<i>Hospital Characteristics:</i>			
Teaching Hospital	Binary	Equal to 1 if hospital is a teaching hospital, 0 otherwise	CMS
Number of Beds	Continuous	Medicare certified beds	CMS
For-Profit Hospital	Binary	Equal to 1 if hospital is a for-profit hospital, 0 otherwise	CMS
Nursing Intensity	Continuous	Full-time equivalent nursing hours divided by total patient days	CMS
Capital Intensity	Continuous	Total assets divided by total patient days	CMS
<i>Hospital Services:</i>			
Cardiology	Binary	Equal to 1 if hospital provides cardiac catheterization lab services, cardiac thoracic surgery services, or coronary care unit services; 0 otherwise	CMS
Labor & Delivery	Binary	Equal to 1 if hospital provides neonatal intensive care unit services, neonatal nursery services, or obstetrics services; 0 otherwise	CMS
Nervous System	Binary	Equal to 1 if hospital provides neurosurgical services, 0 otherwise	CMS
Psychiatric	Binary	Equal to 1 if hospital provides adult inpatient psychiatric services, emergency psychiatric services, forensic psychiatric services, geriatric psychiatric services, or child and/or adolescent psychiatric services; 0 otherwise	CMS
Transplant	Binary	Equal to 1 if hospital provides Medicare certified transplant center services or non-Medicare certified organ transplant services; 0 otherwise	CMS
<i>Patient Characteristics:</i>			
Male	Binary	Equal to 1 if patient's sex is male, 0 otherwise	Claims/discharge data
Length of Stay	Continuous	Number of days patient was an inpatient at a hospital as indicated by admission and discharge dates	Claims/discharge data
Patient Older than 61 Years of Age	Binary	Equal to 1 if patient's age at the time of discharge was greater than or equal to 62 years; 0 otherwise	Claims/discharge data

APPENDIX A (CONT.)
VARIABLE GLOSSARY

Variable	Type	Description	Sources
Patient Younger than 18 Years of Age	Binary	Equal to 1 if patient's age at the time of discharge was less than 18 years; 0 otherwise	Claims/discharge data
<i>Patient Treatment Category Based on MDC:</i>			
Circulatory	Binary	Equal to 1 if patient's Major Diagnostic Category (MDC) was classified as MDC 5; 0 otherwise	Claims/discharge data
Obstetrics	Binary	Equal to 1 if patient's MDC was classified as MDC 14 or MDC 15; 0 otherwise	Claims/discharge data
Respiratory	Binary	Equal to 1 if patient's MDC was classified as MDC 4; 0 otherwise	Claims/discharge data
Digestive	Binary	Equal to 1 if patient's MDC was classified as MDC 6; 0 otherwise	Claims/discharge data
Musculoskeletal	Binary	Equal to 1 if patient's MDC was classified as MDC 8; 0 otherwise	Claims/discharge data
Nervous	Binary	Equal to 1 if patient's MDC was classified as MDC 1; 0 otherwise	Claims/discharge data
Kidney	Binary	Equal to 1 if patient's MDC was classified as MDC 11; 0 otherwise	Claims/discharge data
Reproductive	Binary	Equal to 1 if patient's MDC was classified as MDC 12 or MDC 13; 0 otherwise	Claims/discharge data
Psychiatric	Binary	Equal to 1 if patient's MDC was classified as MDC 19; 0 otherwise	Claims/discharge data
Hepatobiliary	Binary	Equal to 1 if patient's MDC was classified as MDC 7; 0 otherwise	Claims/discharge data
Endocrine	Binary	Equal to 1 if patient's MDC was classified as MDC 10; 0 otherwise	Claims/discharge data
Infection	Binary	Equal to 1 if patient's MDC was classified as MDC 18; 0 otherwise	Claims/discharge data
Skin	Binary	Equal to 1 if patient's MDC was classified as MDC 9; 0 otherwise	Claims/discharge data
Myeloproliferative	Binary	Equal to 1 if patient's MDC was classified as MDC 17; 0 otherwise	Claims/discharge data
Injury	Binary	Equal to 1 if patient's MDC was classified as MDC 21; 0 otherwise	Claims/discharge data
ENT	Binary	Equal to 1 if patient's MDC was classified as MDC 3; 0 otherwise	Claims/discharge data
Other	Binary	Equal to 1 if patient's MDC was classified as MDC 2, 16, 20, 22, 23, 24, or 25; 0 otherwise	Claims/discharge data

APPENDIX B
TECHNICAL APPENDIX

The indirect utility of inpatient i from choosing hospital j is:

$$U_{ij} = u_{ij} + \epsilon_{ij},$$

where $u_{ij} = U(T_{ij}, HX_{ij}, HS_{ij}, PX_{ij}, PTC_{ij}; \theta)$ is a function of driving time T_{ij} , hospital characteristics HX_{ij} , hospital services HS_{ij} , patient characteristics PX_{ij} , and patient treatment categories PTC_{ij} . Specifically, as shown in Table 9, we include in the utility function: (a) T_{ij} and squared T_{ij} , (b) HX_{ij} and their interactions with PX_{ij} , (c) HS_{ij} and their interactions with PTC_{ij} based on MDC, and (d) interactions of T_{ij} with HX_{ij} , PX_{ij} , and PTC_{ij} .

Under the assumption that ϵ_{ij} and ϵ_{ik} are independently-distributed, extreme value random variables, the probability that patient i chooses hospital j , given the hospital network G is:

$$s_{ij}^G = \frac{\exp(u_{ij})}{\sum_{k \in G} \exp(u_{ik})}.$$

Patient i 's expected utility from a given set of hospitals G is

$$EU_i^G = E \max_{j \in G} [u_{ij} + \epsilon_{ij}] = \ln \left(\sum_{j \in G} \exp(u_{ij}) \right),$$

where the last equality follows from the distribution assumption on ϵ_{ij} stated above.

Patient i 's willingness-to-pay ("WTP") for including hospital j in her choice set G can be measured as

$$WTP_{ij}^G = EU_i^G - EU_i^{G/j} = \ln \left(\sum_{k \in G} \exp(u_{ik}) \right) - \ln \left(\sum_{k \in G/j} \exp(u_{ik}) \right) = \ln \left(\frac{1}{1 - s_{ij}^G} \right),$$

where G/j denotes the choice set G excluding hospital j .²⁰

Similarly, Patient i 's WTP for including a hospital system (a set of hospitals) $J \subset G$ is

²⁰ Note that all terms in u_{ij} that does not vary by j will be cancelled out. Thus, if we assume that out-of-pocket payment is the same across hospitals for a given patient whether hospital j is included in the choice set or not, then we do not need to observe out-of-pocket payment.

$$WTP_{ij}^G = \ln \left(\frac{1}{1 - \sum_{j \in J} s_{ij}^G} \right).$$

Total WTP for all patients for including the hospital system J is simply the sum of WTPs across all patients: $WTP_J^G = \sum_{i=1}^N WTP_{ij}^G$.

The effect of a merger between two hospital systems J and K can be measured using the ratio of WTPs:

$$\frac{WTP_{J \cup K}^G}{WTP_J^G + WTP_K^G}.$$

Lastly, the diversion ratio of hospital j to hospital k when hospital j is excluded from the choice set can be measured by recalculating choice probabilities using the new set of hospitals G/j :

$$s_{ik}^{G/j} = \frac{\exp(u_{ik})}{\sum_{l \in G/j} \exp(u_{il})}.$$

Similarly, choice probability for hospital k when a hospital system J is excluded from patient i 's choice set is simply

$$s_{ik}^{G/J} = \frac{\exp(u_{ik})}{\sum_{l \in G/J} \exp(u_{il})}.$$

The sample average is

$$\frac{1}{N} \sum_{i=1}^N s_{ik}^{G/J} = \frac{1}{N} \sum_{i=1}^N \frac{\exp(u_{ik})}{\sum_{l \in G/J} \exp(u_{il})}.$$