Geographic disparities in online searches for psoriasis biologics in the United States: A Google Trends analysis

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Geographic disparities in online searches for psoriasis biologics in the United States: A Google Trends analysis

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Abstract

Twelve biologics targeting TNF-?, IL-12/23, IL-17, and IL-23 are FDA-approved for treating moderate-to-severe psoriasis. We analyzed Google Trends search volumes for these medications to examine public interest and awareness over time and geography in the US. We included all 12 FDA-approved psoriasis biologics in our analysis of Relative Search Volume Index from Google Trends, scaling from 0 (no searches) to 100 (peak volume). We analyzed trends since each medication's approval using Mann-Kendall tests and compared search volumes geographically over the past year. Most biologics showed rising search volumes over time, except etanercept and brodalumab. Search interest was higher along the coasts versus the Midwest. Despite no proven superiority, searches rose rapidly for risankizumab since 2021 (P<0.001). Our findings reveal disparities in patient awareness of psoriasis treatments, with consistently low search volumes for many standard biologics across US regions. This study highlights the need to improve public knowledge on the range of available psoriasis medications through comprehensive patient education.

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Twelve biologics targeting cytokines TNF-α, IL-12/23, IL-17, and IL-23 have been approved for the treatment of moderate to severe psoriasis in the United States, including most recently bimekizumab in October 2023.[1,2] In this study, we used publicly available Google Trends data to monitor search volumes for psoriasis biologics, a methodology that has been used in prior studies[3,4].

All 12 FDA-approved psoriasis biologics were included in our analysis. We examined temporal search volume data from each biologic's approval date for plaque psoriasis until November 1, 2023, and geographic search volume data over the past twelve months (November 2022 – November 2023). Search volume was indicated by a Relative Search Volume (RSV) Index, scaling from 0 (no searches for that medication) to 100 (peak search volume for that medication). This index is calibrated in relation to each state's total search volume within the United States and specified time range. Trend analysis was conducted using the Mann-Kendall test in R software (version 4.3.1).

Overall, our analysis of search trends over time revealed increasing public interest in most psoriasis biologics (**Figure 1**) based on relative search volumes. Rising trends in relative search volumes since FDA approval were observed for adalimumab, ustekinumab, ixekizumab, guselkumab, certolizumab, and risankizumab. Declining relative search volumes were observed for etanercept and brodalumab, while search volumes were generally stable for infliximab, secukinumab, tildrakizumab, and bimekizumab. For detailed relative search volume ranges, please refer to **Supplement 1**. It is important to note that these relative search volumes represent the search interest in each medication relative to the total search volume within the specified region and time period, rather than absolute search volumes. Therefore, while risankizumab has shown increased relative popularity, this does not necessarily imply that its absolute search volume surpasses that of older medications like infliximab. Over the past year, geographic analysis revealed heterogeneous public interest patterns across biologics in the US (**Figure 2**). Coastal states, particularly California and the Eastern seaboard, had higher relative search volumes, whereas Midwestern states had the lowest. In many areas of the United States, IL-17 and IL-23 inhibitors remain among the lesser-searched psoriasis treatments. Notably, risankizumab demonstrated a rapid rise in nationwide search volume from mid-2021 ($P<0.001$).

Our results highlight consistently low Google search volumes for many standard-of-care psoriasis biologics across regions, indicating disparities in patient awareness regarding these treatments. These findings add to previous studies showing regional disparities in psoriasis medication use and treatment outcomes in the US, including research indicating that Southern states had the highest proportion of patients receiving psoriasis biologics per year based on the 1996-2015 Medicare Expenditure Panel Survey.[5,6] Furthermore, while risankizumab has shown increased popularity, it does not necessarily correlate with clinical superiority. A recent meta-analysis of psoriasis RCTs found no significant difference in efficacy, defined as proportion of patients who achieved Psoriasis Area and Severity Index (PASI) 90, 8 to 24 weeks following treatment onset, between risankizumab, infliximab, bimekizumab, and ixekizumab.[7]

To our knowledge, this study represents the first to examine disparities in patient awareness of psoriasis medications both geographically and longitudinally. While the analysis of relative search volumes does not provide information on absolute search volumes, it offers valuable insights into the relative popularity and public interest in different psoriasis medications across regions and over time. By analyzing relative trends for each medication, we can identify medications that are gaining or declining in awareness, which can inform efforts to improve patient education. A limitation of our study is the nonspecific nature of search queries, which may not relate exclusively to psoriasis (e.g., "etanercept" searches could include other indications). This likely underestimates the disparity in searches between TNF-α agents and newer biologics, suggesting that the observed decline in etanercept searches could be more pronounced than indicated. Incorporating per capita search data in future research could improve our understanding by providing a normalized metric that reflects search interest adjusted for population size. This study serves as an initial investigation into the utility of online search trends as a proxy for public awareness of psoriasis biologics, underscoring the need for comprehensive patient education on the wide array of available psoriasis treatments.

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Figure 1. Temporal trends in relative search volume for psoriasis biologics after FDA approval.

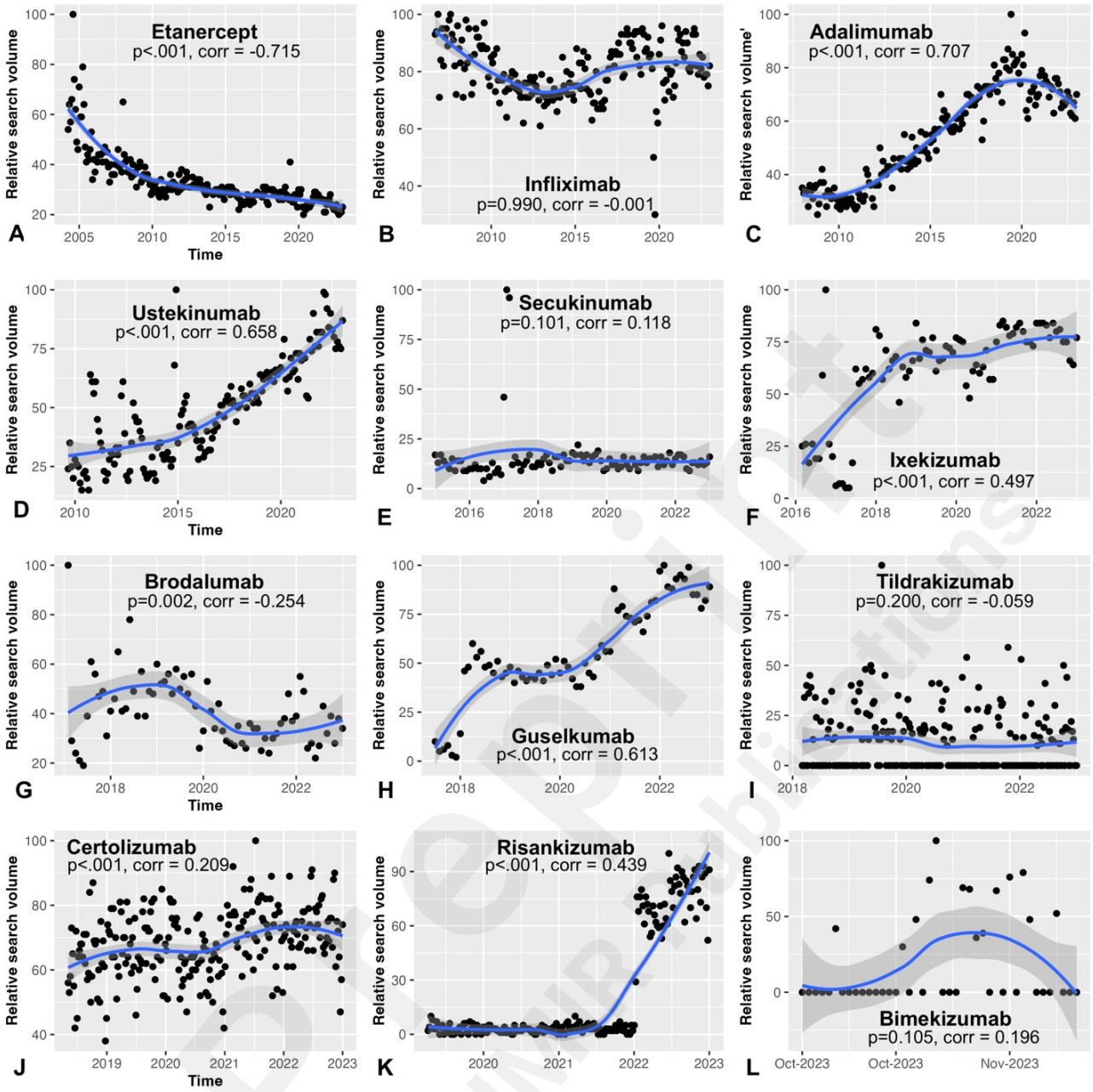
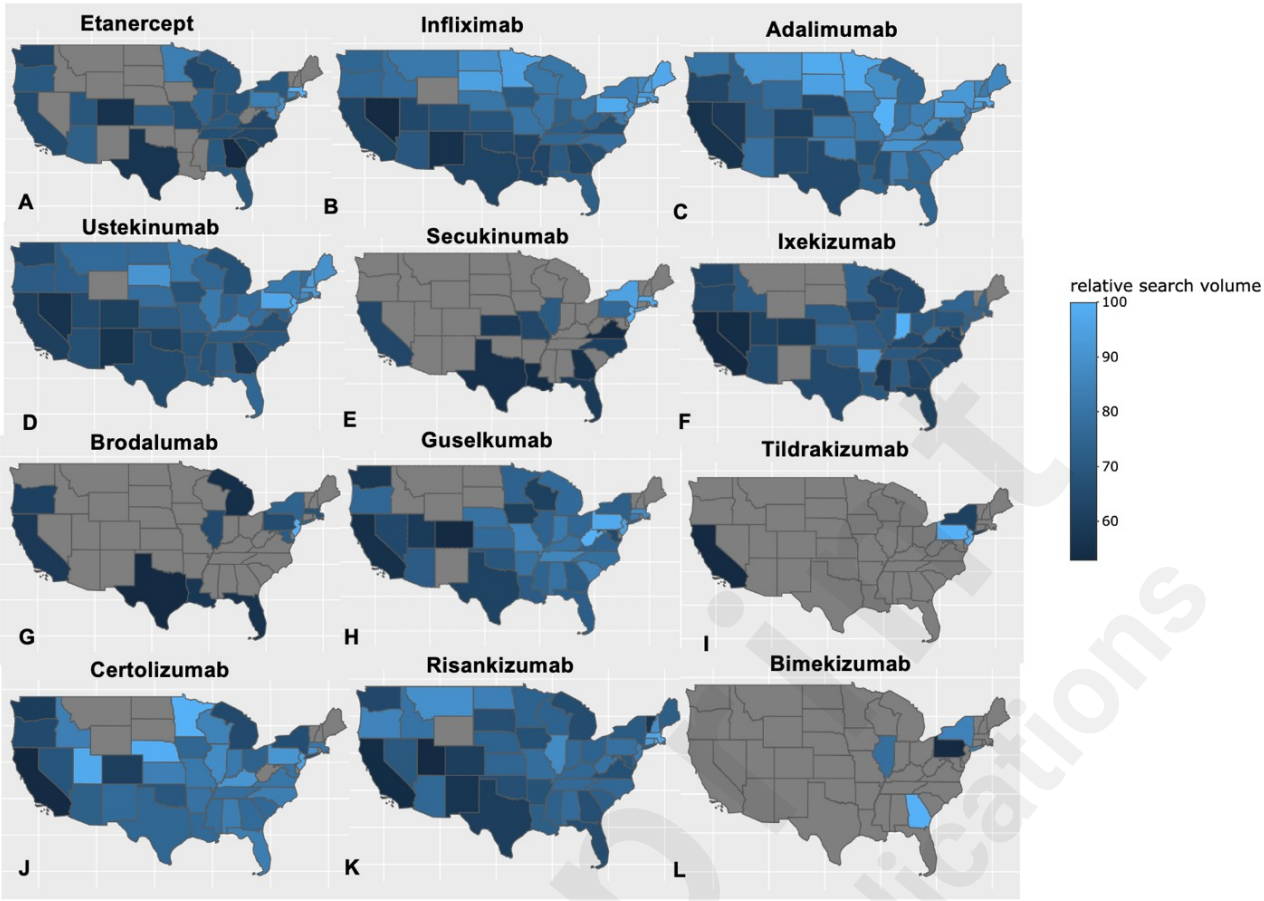


Figure 2. Geographic distribution of relative search volume for psoriasis biologics in the past 12 months (November 2022 – November 2023) across the United States. The relative search volumes are based on each state's total search volume within the designated geography and time frame. The color scale ranges from 0 (no searches) to 100 (peak search volume), with the gray in the maps representing no data available.



Supplement 1. Minimum and maximum relative search volumes (RSV) for each biologic.

Biologic	Minimum RSV	Maximum RSV
Etanercept	20	100
Infliximab	30	100
Adalimumab	25	100
Ustekinumab	15	100
Secukinumab	4	100

Ixekizumab	5	100
Brodalumab	19	100
Guselkumab	2	100
Tildrakizumab	0	100
Certolizumab	38	100
Risankizumab	0	100
Bimekizumab	0	100

Supplementary Files

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Figures

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Brodalumab	19	100
Guselkumab	2	100
Tildrakizumab	0	100
Certolizumab	38	100
Risankizumab	0	100
Bimekizumab	0	100

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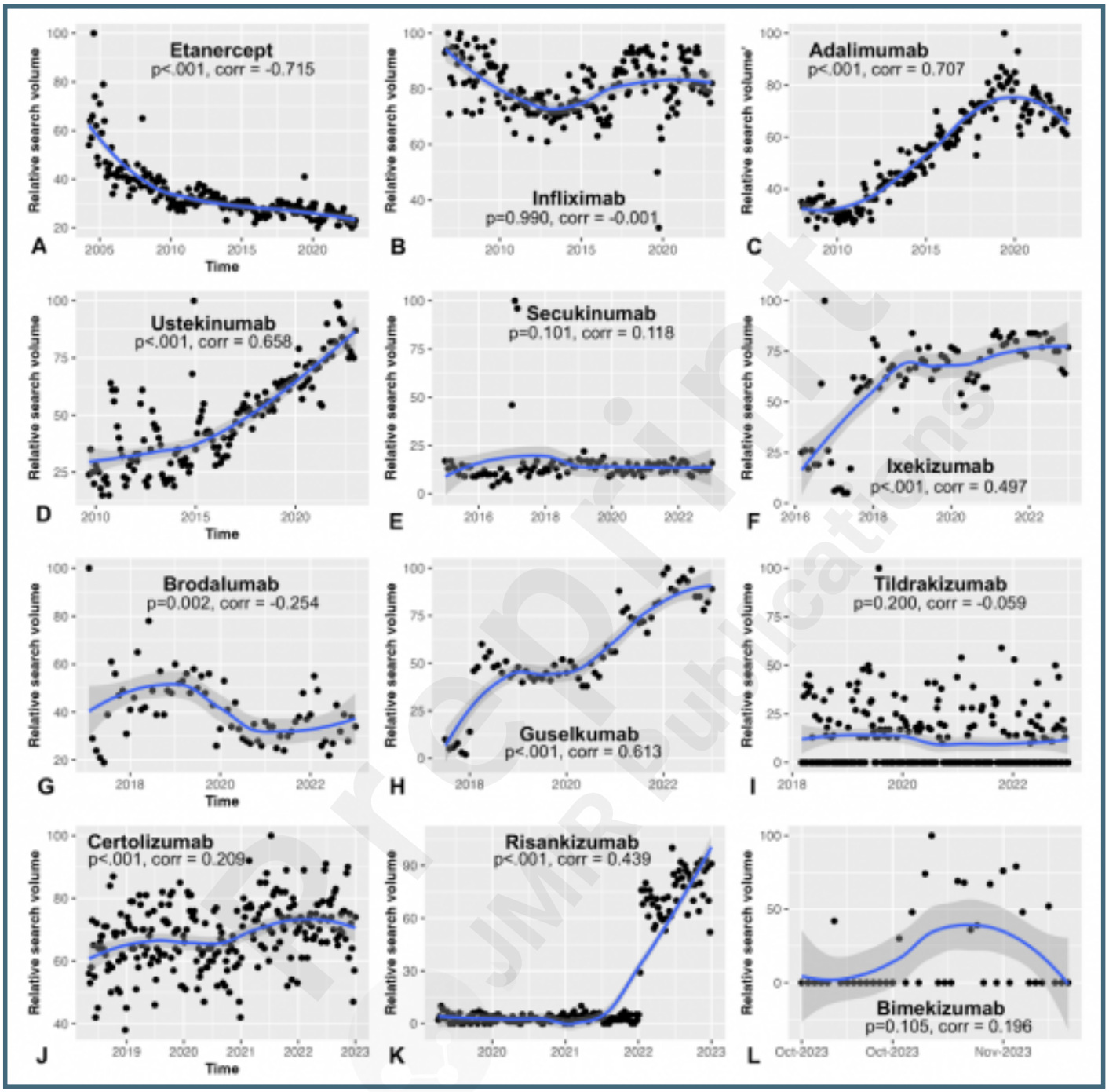
Etanercept
p<.001, corr = -0.715
A
Infliximab
p=0.990, corr = -0.001
B
Adalimumab
p<.001, corr = 0.707
C
Ustekinumab
p<.001, corr = 0.658
D
Secukinumab
p=0.101, corr = 0.118
E
Ixekizumab
p<.001, corr = 0.497
F
Brodalumab
p=0.002, corr = -0.254
G
Guselkumab
p<.001, corr = 0.613
H
Tildrakizumab
p=0.200, corr = -0.059
I
Certolizumab
p<.001, corr = 0.209
J
Risankizumab
p<.001, corr = 0.439
K
Bimekizumab
p=0.105, corr = 0.196
L
Relative search volume
Time

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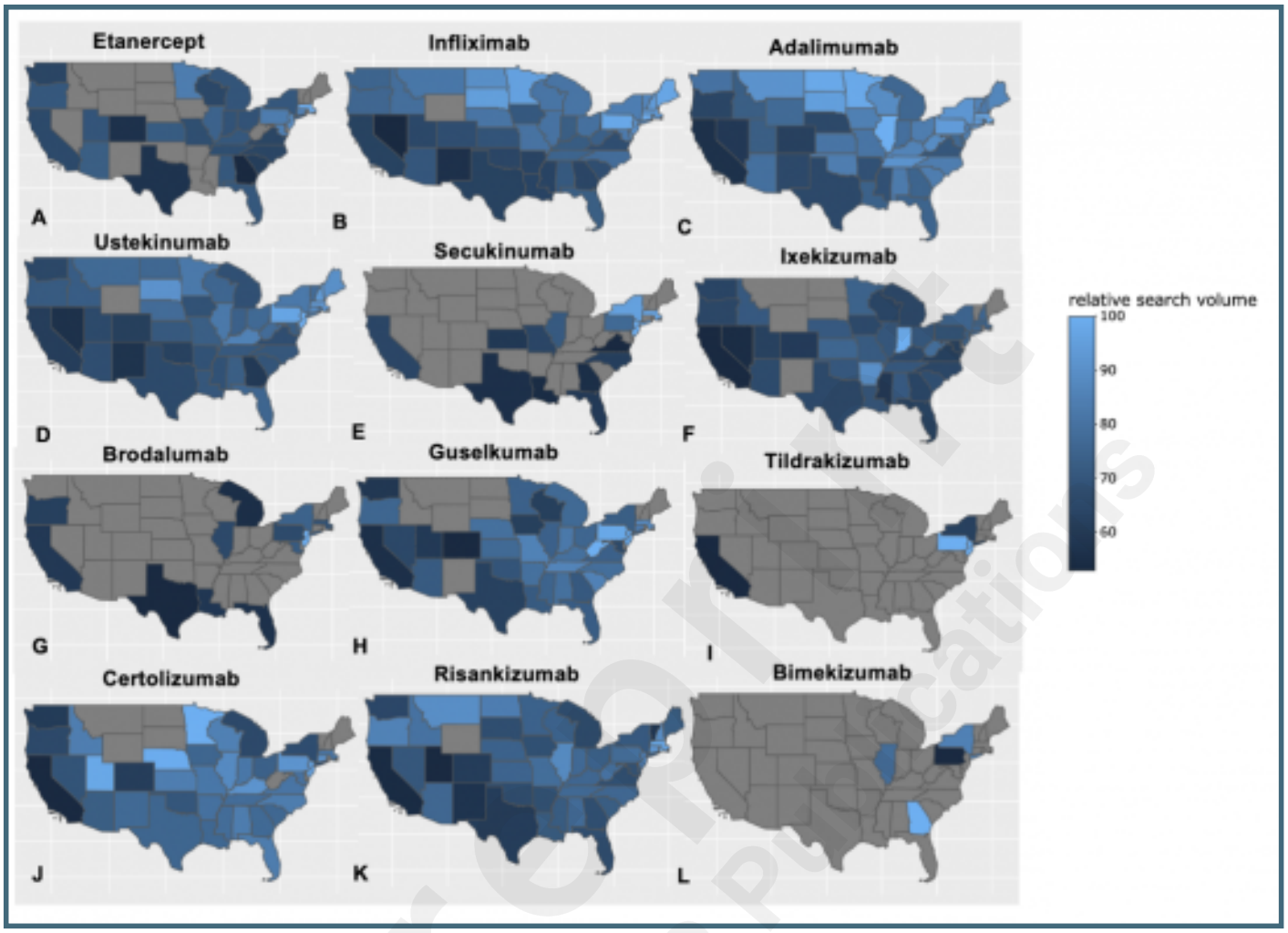
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Bimekizumab
J
K
L
relative search volume
100
90
80
70
60