KEITH A. BETTS, PH.D.
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Dr. Betts specializes in the application of advanced biostatistics techniques in the field of heath economics and outcomes research. He has broad experience developing research strategies in a range of disease areas, including immunology, hematology, oncology, psychiatry, and virology. Dr. Betts has developed and applied new research methods in the fields of individualized medicine methodology, meta-analyses/indirect comparisons, Bayesian statistics, missing data problems, and risk prediction. His expertise includes the design and analysis of clinical trials, health economic modeling, indirect comparisons / network meta-analysis, psychometrics, survey design, and retrospective database analyses (including administrative claims, electronic medical records, and registry data). His recent work includes developing risk benefit analyses, cost effectiveness models, and network meta-analyses for regulatory submission as well as treatment pattern and burden of illness research to support the launch of emerging products. Dr. Betts' research has been published in peer-reviewed statistical, medical, and health economics journals and presented at clinical and economic research conferences.

EMPLOYMENT

2010- present	**Analysis Group, Inc.** **Boston, MA**
2002-2003	**California Center for Population Research** **University of California, Los Angeles**

EDUCATION

2005-2010	**Ph.D., Harvard University** Department of Biostatistics School of Public Health
2003-2005	**M.A., University of California, Berkeley** Department of Biostatistics School of Public Health
1998-2002	**B.S., University of California, Los Angeles** Applied Mathematics with a minor in Statistics Department of Mathematics

PUBLICATIONS AND PRESENTATIONS

Journal Articles (Peer-reviewed Journals)

1. Mu F, Hurley D, **Betts KA,** Messali AJ, Paschoalin M, Kelley C, Wu EQ. Real-world costs of ischemic stroke by discharge status. *Current Medical Research and Opinion*. 2017; 33(2), 371-378.

2. Armstrong AW, **Betts KA**, Sundaram M, Thomason D, Signorovitch JE. Comparative efficacy and incremental cost per responder of methotrexate versus apremilast for methotrexate-naïve patients with psoriasis. *J Amer Acad of Dermatology*. 2016; 75(4), 740-6.

3. **Betts KA**, Griffith J, Song Y, Mittal M, Joshi A, Wu EQ, Ganguli A. Network Meta-Analysis and Cost Per Responder of Tumor Necrosis Factor-α and Interleukin Inhibitors in the Treatment of Active Ankylosing Spondylitis. *Rheumatol Ther*. 2016; 3(2), 323-336.

4. **Betts KA**, Griffith J, Ganguli A, Li N, Douglas K, Wu EQ. Economic Burden and Treatment Patterns of Cycling between Conventional Synthetic Disease-modifying Antirheumatic Drugs Among Biologic-treated Patients with Rheumatoid Arthritis. *Clinical therapeutics*. 2016; 38(5), 1205-16.

5. **Betts KA**, Griffith J, Friedman A, Zhou ZY, Signorovitch JE, Ganguli A. An indirect comparison and cost per responder analysis of adalimumab, methotrexate and apremilast in the treatment of methotrexate-naïve patients with psoriatic arthritis. *Curr Med Res Opin*. 2016; 32(4), 721-9.

6. Zhou ZY, Griffith J, Du E, Chin D, **Betts KA**, Ganguli A. Economic Burden of Switching to a Non-Tumor Necrosis Factor Inhibitor Versus a Tumor Necrosis Factor Inhibitor Biologic Therapy among Patients with Rheumatoid Arthritis. *Advances in therapy* 2016; 33, 5, 807-823.

7. Van der Heijde D, Joshi A, Pangan AL, Chen N, **Betts KA**, Mittal M, Bao Y. ASAS40 and ASDAS clinical responses in the ABILITY-1 clinical trial translate to meaningful improvements in physical function, health-related quality of life and work productivity in patients with non-radiographic axial spondyloarthritis. *Rheumatology*. 2015; 55(1), 80-88.

8. Signorovitch JE, **Betts KA**, Yan Y, Sorg R, Li J, Behl AS, Kalsekar A. Comparative efficacy and safety of daclatasvir/asunaprevir versus IFN-based regimens in genotype 1b hepatitis C virus infection. *Journal of Comparative Effectiveness Research*. 2015; 4(6), 593-605.

9. Signorovitch JE, **Betts KA**, Yan YS, LeReun C, Sundaram M, Wu EQ, Mulani P. Comparative efficacy of biological treatments for moderate-to-severe psoriasis: a network meta-analysis adjusting for cross-trial differences in reference arm response. *British Journal of Dermatology*. 2015; 172, 2, 504-12.

10. Signorovitch JE, **Betts KA**, Reichmann WM, Thomason D, Galebach P, Wu EQ, Chen L, DeAngelo DJ. One-year and long-term molecular response to nilotinib and dasatinib for newly diagnosed chronic myeloid leukemia: a matching-adjusted indirect comparison. *Curr Med Res Opin*. 2015; 31, 2, 315-322.

11. Sikirica V, Pliszka SR, **Betts KA,** Hodgkins P, Samuelson T, Xie J, Erder MH, Dammerman R, Robertson B, Wu EQ. Impact of atypical antipsychotic use among adolescents with attention-deficit/hyperactivity disorder. *Amer J Manag Care*. 2014; 20(9): 711-21.

12. **Betts KA,** Sikirica V, Hodgkins P, Zhou Z, Xie J, DeLeon A, Erder MH, Wu EQ. Period Prevalence of Concomitant Psychotropic Medication Usage Among Children and Adolescents with Attention-Deficit/Hyperactivity Disorder During 2009. *J Child and Adole Pyschopharm*. 2014; 24, 5, 260-8.

13. Sikirica V, Pliszka SR, **Betts KA,** Hodgkins P, Samuelson T, Xie J, Erder MH, Dammerman R, Robertson B, Wu EQ. Comparative Treatment Patterns, Resource Utilization, and Costs in Stimulant-Treated Children with ADHD Who Require Subsequent Pharmacotherapy with Atypical Antipsychotics Versus Non-Antipsychotics. *J Manag Care Pharm*. 2012; 18, 9, 676-89.

14. Signorovitch JE, Sikirica V, Erder MH, Xie J, Lu M, Hodgkins P, **Betts KA**, Wu EQ. Matching-Adjusted Indirect Comparisons: A New Tool for Timely Comparative Effectiveness Research. *Value in Health*. 2012; 15, 6, 940-7.

15. Erder MH, Signorovitch JE, Setyawan J, Yang H, Parikh K, **Betts KA**, Xie J, Hodgkins P, Wu EQ. Identifying patient subgroups who benefit most from a treatment: using administrative claims data to uncover treatment heterogeneity. *Journal of Medical Economics*. 2012; 15, 6, 1078-1087.

16. Signorovitch JE, Wu EQ, **Betts KA**, Parikh K., Kantor E, Guo A, Bollu V, Williams D, Wei LJ, DeAngelo DJ. Comparative Efficacy of Nilotinib and Dasatinib in Newly Diagnosed Chronic Myeloid Leukemia: A Matching-Adjusted Indirect Comparison of Randomized Trials. *Curr Med Res Opin*. 2011 27, 6, 1263-1271.
17. Alm El-Din M, Hughes K, Finkelstein D, **Betts KA**, Yock T, Tarbell N, Aisenberg A, Taghian A. Breast cancer after treatment of Hodgkin's lymphoma: Risk factors that really matter. *International Journal of Radiation Oncology, Biology, Physics*. 2009; 73, 1, 69-74.
18. **Betts, KA**, Harrington, DP. Robust methodology for predicting and evaluating prognosis in right censored time to event data. Harvard University PhD Thesis.

Selected Conference Presentations

1. **Betts KA**, Mittal M, Song J, Skup M, Joshi A. Relative efficacy of Adalimumab versus Secukinumab in active ankylosing spondylitis: a matching-adjusted indirect comparison. European League Against Rheumatism; London, 8-11 Jun 2016
2. Signorovitch J, Shaw J, **Betts KA**, Wu EQ. Identifying high-value treatment populations in clinical trials and real-world data. ISPOR 19th Annual International Meeting, May 31 - June 4, 2014, Montreal, QC, Canada.
3. Langley RG, **Betts KA**, YS Yan, Signorovitch JE, Sundaram M, Mulani P. Number Needed to Treat and Cost Per Responder for Biologic Therapies for the Treatment of Moderate to Severe Psoriasis. European Academy of Dermatology and Venereology 22nd Congress, Istanbul, Turkey, October 2013.
4. Signorovitch, JE, Navarro, R, **Betts, KA**, Wu, EQ. Improved Indirect Treatment Comparisons for Comparative Effectiveness Research. ISPOR 16th Annual International Meeting, Baltimore MD, May, 2011.
5. **Betts, KA**, Harrington, DP. Robust Survival Prediction via Linear Transformation Models. New England Statistics Symposium, Cambridge MA, April, 2010.
6. **Betts, KA**, Harrington, DP. Prediction and Misclassification in Right Censored Time-to-Event Data. ENAR Spring Meeting 2009, San Antonio TX, March, 2009.
7. **Betts, KA**, Harrington, DP. Evaluating Prediction and Risk Stratification in Right Censored Time-to-Event Data. Biostatistics and Computational Biology Seminar, Dana Farber Cancer Institute, Boston MA, February, 2009.
8. **Betts, KA,** Harrington, DP. Predicting survival and estimating prediction error with right censored data. Quantitative Issues in Cancer Research Working Seminar, Harvard School of Public Health, Boston MA, December, 2008.

AWARDS AND PROFESSIONAL ASSOCIATION MEMBERSHIPS

2015-   Best paper award, International Ocular Inflammation Society annual meeting

2014-   Best poster award, American Academy of Dermatology annual meeting

2010-   Member, International Society for Pharmacoeconomics and Outcomes Research

2009-   Member, American Statistical Association (ASA)

2009-   Member, International Biometric Society, Eastern North American Region (ENAR)

2009-   Member, Society of Industry Leaders (SIL)

2010-   Member, Mu Sigma Rho National Statistics Honorary Society

2010-   Best Student Paper Award, New England Statistics Symposium

2007-   Derek J. Bok Certificate of Distinction in Teaching, Harvard University

2007-10   NIH Cancer Predoctoral Fellowship

2005-07   NIH Interdisciplinary Biostatistics Predoctoral Fellowship

2002-   Member, Phi Beta Kappa Honorary Society

1998-   Member, Alpha Lambda Delta and Phi Eta Sigma Honorary Societies