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Witness: Edward L. Spitznagel, Jr.
Exhibit Type: Rebuttal
Sponsoring Party: Missouri-American Water Company
Case No.: WR-2011-0337
SR-2011-0338
Date: January 19, 2012

MISSOURI PUBLIC SERVICE COMMISSION

**CASE NO. WR-2011-0337
CASE NO. SR-2011-0338**

REBUTTAL TESTIMONY

OF

EDWARD L. SPITZNAGEL, JR.

ON BEHALF OF

MISSOURI-AMERICAN WATER COMPANY

MAWC Exhibit No. 22
Date 2-21-12 Reporter JL
File No. WR-2011-0337

BEFORE THE PUBLIC SERVICE COMMISSION
OF THE STATE OF MISSOURI

IN THE MATTER OF MISSOURI-AMERICAN) WATER COMPANY FOR AUTHORITY TO) FILE TARIFFS REFLECTING INCREASED) RATES FOR WATER AND SEWER) SERVICE)	CASE NO. WR-2011-0337 CASE NO. SR-2011-0338
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AFFIDAVIT OF EDWARD L. SPITZNAGEL, JR.

Edward L. Spitznagel, Jr., being first duly sworn, deposes and says that he is the witness who sponsors the accompanying testimony entitled "Rebuttal Testimony of Edward L. Spitznagel, Jr."; that said testimony and schedules were prepared by him and/or under his direction and supervision; that if inquires were made as to the facts in said testimony and schedules, he would respond as therein set forth; and that the aforesaid testimony and schedules are true and correct to the best of his knowledge.

Edward L. Spitznagel, Jr.

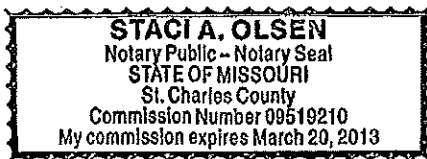
Edward L. Spitznagel, Jr.

State of Missouri
County of St. Louis
SUBSCRIBED and sworn to
Before me this 19th day of January 2012.

Staci A. Olsen

Notary Public

My commission expires:



1 **Q. WHAT IS THE PURPOSE OF YOUR REBUTTAL TESTIMONY?**

2 A. I was asked by Missouri-American Water Company (Company) to review,
3 compare and comment upon the predictions of water utilization for the period
4 rates will be in effect, as offered in the direct testimonies of the Company,
5 Commission Staff and Missouri Industrial Energy Consumers ("MIEC")
6 witnesses. In addition I was asked to compare the results of my own
7 normalized predictions of water utilization for St. Louis County residential
8 customers to that developed by Company witness Kevin Dunn.

9

10 **Q. WHY DID YOU LIMIT YOUR STUDY TO ST. LOUIS COUNTY RESIDENTIAL**
11 **CUSTOMERS?**

12 A. Because of time constraints, cost considerations and the fact that the Company
13 desired only a "test" of the results of Mr. Dunn's study, the Company requested
14 that I concentrate my study on St. Louis County, which constitutes about 75%
15 of their residential customers.

16

17 **Q. PLEASE EXPLAIN HOW YOU PROCEEDED.**

18 A. For ratemaking purposes, revenues need to be set at a normalized level,
19 factoring out the potential or actual results of unusual weather. In addition,
20 non-meteorological predictors, such as the the decline in consumption due to
21 water-conserving plumbing fixtures and appliances and even the month of the
22 year, must be factored into the determination of normal consumption. In
23 previous rate cases, I developed a multivariate model to predict normalized
24 consumption. This model was based on predictors whose variables correlated
25 consistently with utilization, primarily the Palmer Drought Severity Index

1 ("PDSI") and month of consumption. For the months of January through April,
2 there is no evidence that moisture predicts utilization; for the months of May,
3 June, November and December, it is a weak predictor, and in the months of
4 July and August it is a strong predictor. Because of this, I estimated twelve
5 separate predictive models, one for each month of the year.

6
7 **Q. HOW DID YOU ADAPT THE MEASURE OF DROUGHT SEVERITY TO**
8 **MAKING ESTIMATES ON AN ANNUAL RATHER THAN A MONTHLY**
9 **BASIS?**

10 **A.** Since the monthly predictions of my previous method were combined linearly to
11 obtain daily consumption averaged over a year, I calculated the average value
12 of the PDSI over the eight weather-sensitive months of May through December
13 and used this average value in an annual prediction equation. This effectively
14 produced the same prediction, just with the computations done in a different
15 order. I used ten years of consumption data beginning with the year 1999 and
16 ending with the year 2010, omitting the years 2003 and 2006. In years 2003
17 and 2006 the Company changed its accounting system and, as a result, sales
18 for those years were not recorded on the same basis as all other years. In
19 order to have ten (10) years of consistent data, I added years 1999 and 2000,
20 in place of years 2003 and 2006. The computations can be found in Schedule
21 ELS-2. I then fitted a least-squares regression model to predict consumption in
22 gallons per customer per day(gcd) from the year and the May-December
23 average of PDSI. The model fit the data well, achieving an R-square value of
24 93% (out of a maximum possible 100%). Both predictor variables were highly
25 statistically significant, with P-values of 0.0058 for PDSI and 0.0037 for year.

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Q. ONCE YOU HAD ESTIMATED THE COEFFICIENTS IN THESE MODELS, HOW DID YOU PROJECT UTILIZATION FOR JANUARY 2012 THROUGH DECEMBER 2012?

A. I added two lines of data to correspond to the years 2011 and 2012. In both lines I set the PSDI to the thirty-year average from 1981 to 2010 for the weather-sensitive months of May through December for the St. Louis County climate region. I left the daily consumption missing so the regression coefficients would not be affected by the addition of these two lines of data. I then requested the predicted values, resulting in the same results as if I had evaluated the regression equation with the year values of 2011 and 2012 and the average regional PDSI value, but with no risk of computational error.

Q. WHAT ARE YOUR PREDICTIONS OF DAILY UTILIZATION UNDER AVERAGE WEATHER FOR ST. LOUIS COUNTY RESIDENTIAL CUSTOMERS FOR THE YEAR 2012?

A. For St. Louis County residential customers, I calculated average daily utilization of 232.32 gallons per day for the year 2012.

Q. HOW DO YOUR RESULTS COMPARE TO THOSE OF MR. DUNN?

A. For St. Louis County residential customers, Mr. Dunn's approach resulted in the determination of 232.19 gallons per day. His predicted consumption level is slightly below what my model predicts. Ostensibly, this difference is because of the difference in weather normalization techniques for the summer months. Mr. Dunn correctly normalizes a base consumption level, which takes into

1 consideration approximately 80% of all consumption. However, his method for
2 estimating the weather impact on the variable consumption component is
3 simply based on a ten-year average, compared with my use of 30 years of
4 weather. Therefore, it appears that his results are very slightly understated.
5 However, they are more accurate than the approaches used by either Staff
6 Witness Jerry Scheible or MIEC witness Brian Collins.

7
8 **Q. WHY ARE THE METHODS USED BY MR. SCHEIBLE AND MR. COLLINS**
9 **LIKELY TO RESULT IN INACCURATE ESTIMATES?**

10
11 A. Mr. Scheible proposes using a four-year average to estimate future water
12 consumption. Mr. Collins uses a six-year average to estimate the same. Mr.
13 Scheible's use of an average of the previous four-years to predict future
14 consumption and Mr. Collins use of a six-year average are likely to result in an
15 overestimation of future water consumption. This is because the historical
16 average method fails to take into account declining water consumption trends.

17
18 **Q. CAN YOU DEMONSTRATE THESE OVERESTIMATES FOR PREVIOUS**
19 **YEARS?**

20 A. Yes, I have shown details in Schedule ELS-3 that demonstrate how Mr.
21 Scheible's proposed four-year average method leads to overestimation of water
22 consumption when compared to actual consumption data. We have
23 consumption data for the years 1990 through 2010. Therefore we can calculate
24 the difference between four-year averages and actual consumption two years
25 beyond those averages, to determine the accuracy of his methodology. We

1 can do this a total of sixteen times, beginning with the average consumption
2 over 1990-1993 used to estimate consumption in 1995 and ending with
3 average consumption over 2005-2008 used to estimate consumption in 2010.
4 Of those sixteen times, ten overestimates of consumption resulted, while only
5 six underestimates resulted. The most extreme overestimate was 40.677 gcd,
6 while the most extreme underestimate was -7.467. Over the sixteen
7 calculations, the average error of estimate was a positive 9.894 gcd. This is a
8 substantial bias, and because it is positive, its inaccuracy works to the
9 disadvantage of Missouri-American Water Company because it tends to
10 overstate normal consumption.

11 I have prepared a similar analysis in Schedule ELS-4 that demonstrates how
12 Mr. Collins' proposed six-year average method also leads to overestimation of
13 water consumption. Using the same consumption data for the years 1990
14 through 2010, we can calculate the difference between six-year averages and
15 actual consumption two years beyond those averages, to determine the
16 accuracy of his methodology. We can do this a total of fourteen times,
17 beginning with the average consumption over 1990-1995 used to estimate
18 consumption in 1997 and ending with average consumption over 2003-2008
19 used to estimate consumption in 2010. Of those fourteen times, nine
20 overestimates of consumption resulted, while only five underestimates resulted.
21 The most extreme overestimate was 38.800 gcd, while the most extreme
22 underestimate was -9.791. Over the fourteen calculations, the average error of
23 estimate was a positive 12.274 gcd. This is an even larger bias than that
24 resulting from the four-year averages of Mr. Scheible and therefore has a
25 greater likelihood of overstating normal consumption.

1

2 **Q. DO YOU HAVE ANY OTHER OBSERVATIONS REGARDING THE USE OF**
3 **SIMPLE HISTORICAL AVERAGES IN DETERMINING NORMALIZED**
4 **CONSUMPTION?**

5 A. Yes. Not only does the use of a simple historical average ignore declining
6 water consumption, it leads to widely varying degrees of results depending
7 upon the historical period selected. This is demonstrated by the fact that, while
8 both Mr. Scheible and Mr. Collins used the same general method, selection of a
9 four-year period by Mr. Scheible and a six-year period by Mr. Collins resulted in
10 consumption levels that differed by almost 5%, or almost 12 gpd.

11

12 **Q. DOES THIS CONCLUDE YOUR REBUTTAL TESTIMONY?**

13 A. Yes, it does.

14

15

Edward L. Spitznagel, Jr.

Born: Cincinnati, Ohio, September 4, 1941.

Education:

Xavier University, 1959-1962
Awarded Bachelor of Science Degree (Summa cum Laude), 1962
University of Chicago, 1962-1965
Awarded Master of Science Degree, 1963
Awarded Ph.D. in Mathematics, 1965

Scholarships and Fellowships:

Xavier University, 1959-1962
Honorary Woodrow Wilson Fellow, 1962-1963
National Science Foundation Fellow, 1962-1965

Positions:

Assistant Professor of Mathematics
Northwestern University, 1965-1969
Associate Professor of Mathematics
Washington University, 1969-1980
Professor of Mathematics
Washington University, 1980-present
Joint appointment, Division of Biostatistics,
Washington University School of Medicine, 1978-present

Consulting Experience:

Litton Industries (USACDCEC, Fort Ord, CA)
Price Waterhouse (Advanced Auditing Methods, NY)
Mallinckrodt, Inc.
St. Louis County Juvenile Court
Monsanto Company
American Red Cross
Carboline Corporation
Regional Justice Information Service
Harris-Stowe State College
Equal Employment Opportunity Commission
American Optometric Association
Petrolite Corporation
U.S. Army Atmospheric Sciences Laboratory (White Sands, NM)
St. Louis County Water Company
Gateway Medical Research, Inc.
MasterCard
Simmons Market Research Bureau
Transactional Data Solutions
Missouri-American Water Company
Capital City Water Company
Kentucky-American Water Company
Tennessee-American Water Company
Iowa-American Water Company
New Jersey-American Water Company
Anheuser-Busch, Inc.
Partek, Inc.
Santa Clara County Mental Health Administration (San Jose, CA)
and many law firms

Schedule ELS-1

Publications:

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2. Hall subgroups of certain families of finite groups. *Math. Z.* **97**, 259-290 (1967).
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5. Note on the alternating group. *Amer. Math. Monthly* **75**, 68-69 (1968).
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7. Density of finite simple group orders. *Math. Z.* **106**, 175-177 (1968). (With Dornhoff)
8. An experimental approach in the teaching of probability. *The Mathematics Teacher* **61**, 565-568 (1968).
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10. Poisson integrals: rigor or mortis? *Amer. J. Phys.* **38**, 266-267 (1970). (With Hart)
11. An elementary proof that primes are scarce. *Amer. Math. Monthly* **77**, 396-397 (1970).
12. *Selected topics in mathematics*. Holt, Rinehart and Winston (1971).
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14. The uses of computing in a modernized probability and statistics course. *Proceedings of the Second Annual Conference on Computers in the Undergraduate Curricula*, 217-222 (1971).
15. Properties of a game based on Euclid's algorithm. *Math. Mag.* **46**, 87-92 (1973).
16. Use of a questionnaire-oriented research project in teaching undergraduate statistics. *Proceedings of the Fourth Annual Conference on Computers in the Undergraduate Curricula*, 352-357 (1973).
17. An inexpensive computer assist in teaching large enrollment mathematics courses. *Proceedings of Symposia in Applied Mathematics (American Mathematical Society)* **20**, 175-179 (1974).
18. Use of SAS in teaching a first course in statistics. *Proceedings of the First Annual Conference of SAS Users Group International*, 85-89 (1976).
19. Maintenance and analysis of anesthesia/surgery data with SAS. *Proceedings of the Third Annual Conference of SAS Users Group International*, 74-76 (1978). (With Owens)
20. K.W.I.C. indexes with SAS. *Proceedings of the Third Annual Conference of SAS Users Group International*, 267-270 (1978).
21. The use of loglinear and multivariate logistic models to assess the associations between HLA antigen responses and disease. *Proceedings of the 1978 American Statistical Association Section on Statistical Computing*, 271-275 (1978). (With Miller and Kass)
22. ASA physical status classifications: a study of consistency of ratings. *Anesthesiology* **49**, 239-243 (1978). (With Owens and Felts)
23. Interfacing SAS with Mark IV. *Proceedings of the Fourth Annual Conference of SAS Users Group International*, 41-44 (1979).
24. SAS as a management tool for course registration and grading. *Proceedings of the Fourth Annual Conference of SAS Users Group International*, 158-161 (1979).
25. Tally of ASA classification responses. *Anesthesiology* **51**, 181 (1979). (With Owens and Felts)
26. Outcome studies of anesthesia - Washington University. in *Health Care Delivery In Anesthesia*, edited by R. A. Hirsh, W. H. Forrest, Jr., F. K. Orkin, and H. Wollman. George F. Stickley Co. 67-72 (1980). (With Owens)

27. Morphological and biochemical studies in the development of cholinergic properties in cultured sympathetic neurons I. Correlative changes in choline acetyltransferase and synaptic vesicle cytochemistry. *J. Cell Biology* 84, 680-691 (1980). (With Johnson et al.)
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29. Anesthetic side effects and complications: An overview. in *Anesthetic Side Effects and Complications: Seeking, Finding, and Treating*, edited by W. D. Owens. Little, Brown and Company. 1-9 (1980). (With Owens)
30. A SAS macro for computing the kappa statistic to assess reliability. *Proceedings of the Fifth Annual Conference of SAS Users Group International*, 159-163 (1980). (With Rice and Helzer)
31. Computer generated repeatable examinations. *Proceedings of the Fifth Annual Conference of SAS Users Group International*, 438-442 (1980).
32. Shaded map reports. *Proceedings of the Fifth Annual Conference of SAS Users Group International*, 475481 (1980).
33. Individual and combined effectiveness of palpation, thermography, and mammography in breast cancer screening. *Preventive Medicine* 9, 713-721 (1980). (With Gohagan et al.)
34. Effect of pedaling rate on submaximal exercise responses of competitive cyclists. *J. Appl. Physiol.* 51, 447-451 (1981). (With Hagberg et al.)
35. Simulation of population genetics models with SAS. *Proceedings of the Sixth Annual Conference of SAS Users Group International*, 605-606 (1981).
36. Optimal strategies for breast cancer detection. in *Systems Science in Health Care*, edited by C. Tilquin. Pergamon Press. 321-330 (1981). (With Gohagan et al.)
37. Computer graphics in selection of screening strategies. *Proceedings of the Seventh Annual Conference of SAS Users Group International*, 167-170 (1982). (With Gohagan)
38. Optimal stratified sampling, with an application to auditing. *Proceedings of the Seventh Annual Conference of SAS Users Group International*, 415-417 (1982).
39. *Early Detection of Breast Cancer: Risk, Detection Procedures, and Therapeutic Implications*. Praeger Publishers (1982). (With Gohagan et al.)
40. Plasma epinephrine and norepinephrine levels during anesthesia - enflurane-N₂O-O₂ compared with fentanyl-N₂O-O₂. *Anesth. Anal.* 61, 366-370 (1982). (With Brown et al.)
41. Heterogeneity in schizophrenia - a cluster-analytic approach. *Psychiat. R.* 8, 1-12 (1983). (With Farmer and McGuffin)
42. SAS methods for balanced repeated replications. *Proceedings of the Eighth Annual Conference of SAS Users Group International*, 844-847 (1983).
43. Breast self examination as a screening procedure. *Third International Conference on System Science in Health Care*, 455-458 (1984). (With Gohagan et al.)
44. ROC analysis of mammography alone and in combination with clinical palpation for breast screening. *Third International Conference on System Science in Health Care*, 463-466 (1984). (With Gohagan et al.)
45. Experimental design for the evaluation of nuclear magnetic resonance imaging in clinical medicine. *Third International Conference on System Science in Health Care*, 881-884 (1984). (With Gohagan et al.)
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47. Utilization patterns of health maintenance organization disenrollees. *Medical Care* 22, 827-833 (1984). (With Griffith and Baloff)
48. ROC analysis of mammography and palpation for breast screening. *Invest Radiol* 19, 587-592 (1984). (With Gohagan et al.)

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49. A proposed solution to the base rate problem in the kappa statistic. *Arch Gen Psychiatry* 42, 725-728 (1985). (With Helzer)
50. A comparison of clinical and Diagnostic Interview Schedule diagnoses: Physician reexamination of lay-interviewed cases in the general population. *Arch Gen Psychiatry* 42, 657-666 (1985). (With Helzer et al.)
51. A mouse embryo culture system for quality control testing of human in vitro fertilization and embryo transfer media and fetal cord sera. *Gamete Research* 11, 411-419 (1985). (With Cheung et al.)
52. Comparison of variance estimation methods for complex sample designs under extreme conditions. *Proceedings of the Tenth Annual Conference of SAS Users Group International*, 1084-1088 (1985).
53. Sampling the household population. in *Epidemiologic Field Methods in Psychiatry: The NIMH Epidemiologic Catchment Area Program*, edited by W. Eaton and L. Kessler. Academic Press. 23-48 (1985). (With Holzer et al.)
54. Sampling: The institutional survey. in *Epidemiologic Field Methods in Psychiatry: The NIMH Epidemiologic Catchment Area Program*, edited by W. Eaton and L. Kessler. Academic Press. 49-66 (1985). (With Leaf et al.)
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57. Radiogenic breast cancer effects of mammographic screening. *Journal of the National Cancer Institute* 77, 71-76 (1986). (With Gohagan et al.)
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59. Left globus pallidus abnormality in never-medicated patients with schizophrenia. *Proc Natl Acad Sci USA* 84, 561-563 (1987). (With Early et al.)
60. Multispectral analysis of MR images of the breast. *Radiology* 163, 703-707 (1987). (With Gohagan et al.)
61. The predictive validity of lay Diagnostic Interview Schedule diagnoses in the general population. *Arch Gen Psychiatry* 44, 1069-1077 (1987). (With Helzer and McEvoy)
62. The effect of medication compliance on the control of hypertension. *Journal of General Internal Medicine* 2, 298-305 (1987). (With Eisen et al.)
63. Teaching biostatistics with an emphasis on reading the medical literature. *Proceedings of the 1987 American Statistical Association Section on Statistical Education*, 111-115 (1987). (With Schechtman)
64. Evidence that the biliary migrating myoelectric complex (MMC) is preserved after feeding. *Gastroenterology* 95, 894 (1988). (With Zenilman et al.)
65. Scheduling mammograms for asymptomatic women. *Preventive Medicine* 17, 155-172 (1988). (With Gohagan et al.)
66. Increased fentanyl requirement in patients receiving long-term anticonvulsant therapy. *Anesthesiology Review* 15, 54-55 (1988). (With Tempelhoff and Modica)
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68. Antimicrobial misuse in patients with positive blood cultures. *The American Journal of Medicine* 87, 253-259 (1989). (With Dunagan et al.)
69. Exclusion of chromosomal mosaicism in amniotic-fluid cultures: efficacy of insitu versus flask techniques. *Prenatal Diagnosis* 10, 41-57 (1990). (With Cheung et al.)
70. Anticonvulsant therapy increases fentanyl requirements during anesthesia for craniotomy. *Can J Anaesth* 37, 327-332 (1990). (With Tempelhoff and Modica)

Schedule ELS-I

71. Nitrous oxide, nausea, and vomiting after outpatient gynecologic surgery. *J Clin Anesth* 2, 168-171 (1990). (With Felts and Poler)
72. The relation of ulcerative colitis to psychiatric factors: a review of findings and methods. *Am J Psychiatry* 147, 974-981 (1990). (With North et al.)
73. Clinical classification and staging for primary malignancies of the maxillary antrum. *Laryngoscope* 100, 1106-1111 (1990). (With Zamora et al.)
74. Time-series analysis of myoelectric cycling of sphincter of Oddi: evidence of cycling during fed state. *Am J Physiology* 259, 511-517 (1990). (With Zenilman et al.)
75. The effect of prescribed daily dose frequency on patient medication compliance. *Arch Intern Med* 150, 1881-1884 (1990). (With Eisen et al.)
76. Resistance to atracurium-induced neuromuscular blockade in patients with intractable seizure disorders treated with anticonvulsants. *Anesthesia and Analgesia* 71, 665-669 (1990). (With Tempelhoff et al.)
77. *California Mental Health Needs* 1, 1-182. California Department of Mental Health (1990). (With Meinhardt and Jerrell).
78. *California Mental Health Needs* 2, 1-467. California Department of Mental Health (1990). (With Meinhardt and Jerrell).
79. Comments on psychiatric aspects of ulcerative colitis - reply. *Am J Psychiatry* 148, 688 (1991). (With North et al.)
80. Do life events or depression exacerbate inflammatory bowel disease? *Annals of Internal Medicine* 114, 381-386 (1991). (With North et al.)
81. Antibiotic misuse in two clinical situations - positive blood culture and administration of aminoglycosides. *Reviews of Infectious Diseases* 13, 405-412 (1991). (With Dunagan et al.)
82. Agreement between DSM-III and III-R substance use disorders. *Drug and Alcohol Dependence* 29, 17-25 (1991). (With Cottler et al.)
83. New methods in cross-cultural psychiatry: Psychiatric illness in Taiwan and the United States. *Am J Psychiatry* 148, 1697-1704 (1991). (With Compton et al.)
84. Surgical pathology of cancer of the oral cavity and oropharynx. *Laryngoscope* 101, 1175-1197 (1991). (With Sessions et al.)
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86. Are hard-to-interview street dwellers needed in assessing psychiatric disorders in homeless men? *International Journal of Methods in Psychiatric Research* 1, 69-78 (1991). (With Smith and North)
87. Gender differences in sociopathy and somatization in men and women with homosexual experience. *International Journal of Methods in Psychiatric Research* 1, 89-99 (1991). (With North et al.)
88. Anticoagulant effects of nonionic versus ionic contrast-media in angiography syringes. *Investigative Radiology* 27, 185 (1992).
89. Posttraumatic stress disorder among substance users from the general population. *Am J Psychiatry* 149, 664-670 (1992). (With Cottler et al.)
90. A systematic study of mental illness, substance abuse, and treatment in 600 homeless men. *Annals of Clinical Psychiatry* 4, 111-120 (1992). (With Smith and North)
91. Clinical staging for primary malignancies of the supraglottic larynx. *Laryngoscope* 103, 69-77 (1993). (With Zamora et al.)
92. Symptomatic cytomegalovirus infection in renal transplant recipients given either Minnesota antilymphoblast globulin (MALG) or OKT3 for rejection prophylaxis. *American Journal of Kidney Diseases* 21, 196-201 (1993). (With Bailey et al.)

Schedule ELS-1

93. Alcohol, drugs, and psychiatric comorbidity among homeless women. *J Clin Psychiatry* 54, 82-87 (1993). (With Smith and North)
94. Is antisocial personality a valid diagnosis among the homeless? *Am J Psychiatry* 150, 578-583 (1993). (With North and Smith)
95. Post-traumatic stress in survivors of three disasters. *Journal of Social Behavior and Personality* 8, 353-368 (1993). (With Smith and North)
96. Cytomegalovirus infection and pneumonitis. *Am Rev Respir Dis* 147, 1017-1023 (1993). (With Ettinger et al.)
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98. Results of a rubella screening program for hospital employees: a five-year review (1986-1990). *American Journal of Epidemiology* 138, 756-764 (1993). (With Fraser et al.)
99. Subjective reports of withdrawal among cocaine users: recommendations for DSM-IV. *Drug and Alcohol Dependence* 33, 97-104 (1993). (With Cottler et al.)
100. Posttraumatic stress disorder in survivors of a mass shooting. *Am J Psychiatry* 151, 82-88 (1994). (With North and Smith)
101. Violence and the homeless: an epidemiologic study of victimization and aggression. *Journal of Traumatic Stress* 7, 95-110 (1994). (With North and Smith)
102. On-site PT, aPTT and platelet count: A comparison between whole blood and laboratory assays with coagulation factor analysis in patients presenting for cardiac surgery. *Anesthesiology* 80, 338-351 (1994). (With Despotis et al.)
103. Prospective evaluation and clinical utility of on-site coagulation monitoring in patients undergoing cardiac operation. *J Thorac Cardiovasc Surg* 107, 271-279 (1994). (With Despotis et al.)
104. Two-compartment pharmacokinetics. *Proceedings of the Fifth Annual International Conference on Technology in Collegiate Mathematics*, edited by L. Lum. Addison-Wesley Publishing Company. 417-420 (1994).
105. Inhalant use: characteristics and predictors. *American Journal on Addictions* 3, 263-272 (1994). (With Compton et al.)
106. Prediction of occult neck disease in laryngeal cancer by means of a logistic regression statistical model. *Laryngoscope* 104, 1280-1284 (1994). (With Ghouri et al.)
107. Comparison of activated coagulation time and whole blood heparin measurements to laboratory plasma anti-Xa heparin concentration in cardiac surgical patients. *J Thorac Cardiovasc Surg* 108, 1076-1082 (1994). (With Despotis et al.)
108. GAP: groups, algorithms, and programming (review). *Notices Amer Math Soc* 41, 780-782 (1994).
109. Prediction of subclinical neck disease in laryngeal cancer patients using a logistic regression statistical model. in *Laryngeal Cancer: Proceedings of the 2nd World Congress on Laryngeal Cancer, Sydney, 20-24 February 1994*, edited by R. Smee and G.P. Bridger. Elsevier Science B.V. 570-573 (1994). (With Ghouri et al.)
110. Predictors of mortality in alcoholic women: a 20-year follow-up study. *Alcoholism, Clinical and Experimental Research* 18, 1177-1186 (1994). (With Smith et al.)
111. Improvement in user performance following development and routine use of an expert system. *Medinfo* 8, 1064-1067 (1994). (With Kahn et al.)
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203. The course of PTSD, major depression, substance abuse, and somatization after a natural disaster. *J Nerv Ment Dis* 192, 823-829 (2004). (With North et al.)
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208. Influence of lifetime food restriction on causes, time, and predictors of death in dogs. *J Am Vet Med Assoc* 226, 225-231 (2005). (With Lawler et al.)
209. Preoperative use of enoxaparin increases the risk of postoperative bleeding and re-exploration in cardiac surgery patients. *J Cardiothorac Vasc Anesth* 19, 4-10 (2005). (With McDonald et al.)
210. Comparison of post-disaster psychiatric disorders after terrorist bombings in Nairobi and Oklahoma City. *Br J Psychiatry* 186, 487-493 (2005). (With North et al.)
211. Prevalence and predictors of pathological gambling: results from the St. Louis personality, health, and lifestyle (SLPHL) study. *J Psychiatr Res* 39, 377-390 (2005). (With Cunningham-Williams et al.)
212. The role of organizational characteristics in determining patterns of utilization of services for substance abuse, mental health, and shelter by homeless people. *J Drug Issues* 35, 575-591 (2005). (With North et al.)
213. Meta-analysis of soy food and risk of prostate cancer in men. *Int J Cancer* 117, 667-669 (2005). (With Yan)
214. Factors associated with the transition from abuse to dependence among substance abusers: Implications for a measure of addictive liability. *Drug Alcohol Depend* 80, 1-14 (2005). (With Ridenour et al.)
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218. A comparison of agency-based and self-report methods of measuring services across an urban environment by a drug-abusing homeless population. *Int J Methods Psychiatr Res* 15, 46-56 (2006). (With Pollio et al.)
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223. Interrater reliability and coding guide for nonpsychotic formal thought disorder. *Percept Mot Skills* 103, 395-411 (2006). (With North et al.)
224. Risk factors for preschool depression: the mediating role of early stressful life events. *J Child Psychol Psychiatry* 47, 1292-1298 (2006). (With Luby and Belden)
225. Relief of idiopathic subjective tinnitus: is gabapentin effective? *Arch Otolaryngol Head Neck Surg* 133, 390-397 (2007). (With Piccirillo et al.)
226. Preschoolers' contribution to their diagnosis of depression and anxiety: uses and limitations of young child self-report of symptoms. *Child Psychiatry Hum Dev* 38, 321-328 (2007). (With Luby et al.)
227. Racial/ethnic variation in the reliability of DSM-IV pathological gambling disorder. *J Nerv Ment Dis* 195, 551-559 (2007). (With Cunningham-Williams et al.)
228. Legal status, emotional well-being, and subjective health status of Latino Immigrants. *J Natl Med Assoc* 99, 1126-1131 (2007). (With Cavazos-Rehg and Zayas)
229. The temporal limits of cognitive change from music therapy in elderly persons with dementia or dementia-like cognitive impairment: a randomized controlled trial. *J Music Ther* 44, 308-328 (2007). (With Bruer and Cloninger)

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230. The relationship between alcohol problems and dependence, conduct problems and diagnosis, and number of sex partners in a sample of young adults. *Alcohol Clin Exp Res* 31, 2046-2052 (2007). (With Cavazos-Rehg et al.)
231. A comparison study of psychiatric and behavior disorders and cognitive ability among homeless and housed children. *Community Ment Health* 44, 1-10 (2008). (With Yu et al.)
232. Distinguishing distress and psychopathology among survivors of the Oakland/Berkeley firestorm. *Psychiatry* 71, 35-45 (2008). (With North et al.)
233. The association between gambling pathology and personality disorders. *J Psychiatr Res* 42, 1122-1130 (2008). (With Sacco et al.)
234. The changing prevalence of comorbidity across the age spectrum. *Crit Rev Oncol Hematol* 67, 35-45 (2008). (With Piccirillo et al.)
235. Older Youth Leaving the Foster Care System: Who, What, When, Where, and Why? *Child Youth Serv Rev* 30, 735-745 (2008). (With McCoy et al.)
236. The clinical significance of preschool depression: impairment in functioning and clinical markers of the disorder. *J Affect Disord* 112, 111-119 (2009). (With Luby et al.)
237. Escitalopram for older adults with generalized anxiety disorder: a randomized controlled trial. *JAMA* 301, 295-303 (2009). (With Lenze et al.)
238. Towards DSM-V: considering other withdrawal-like symptoms of pathological gambling disorder. *Int J Methods Psychiatr Res* 18, 13-22 (2009). (With Cunningham-Williams et al.)
239. Soy consumption and prostate cancer risk in men: a revisit of a meta-analysis. *Am J Clin Nutr* 4, 1155-1163 (2009). (With Yan)
240. Shame and guilt in preschool depression: evidence for elevations in self-conscious emotions in depression as early as age 3. *J Child Psychol Psychiatry* 50, 1156-1166 (2009). (With Luby et al.)
241. Age of sexual debut among US adolescents. *Contraception* 80, 158-162 (2009). (With Cavazos-Rehg et al.)
242. Risky sexual behaviors and sexually transmitted diseases: a comparison study of cocaine-dependent individuals in treatment versus a community-matched sample. *AIDS Patient Care STDS* 23, 727-734 (2009). (With Cavazos-Rehg et al.)
243. Preschool depression: homotypic continuity and course over 24 months. *Arch Gen Psychiatry* 66, 897-905 (2009). (With Luby et al.)
244. Alcohol use among older adults in the National Epidemiologic Survey on Alcohol and Related Conditions: a latent class analysis. *J Stud Alcohol Drugs* 70, 829-838 (2009). (With Sacco and Bucholz)
245. Exposure to bioterrorism and mental health response among staff on capitol hill. *Biosecur Bioterror* 7, 148-158 (2009). (With North et al.)
246. Children's mental health service use and maternal mental health: a path analytic model. *Child Youth Serv Rev* 31, 378-382 (2009). (With Pfefferle.)
247. Soy consumption and colorectal cancer risk in humans: a meta-analysis. *Cancer Epidemiol Biomarkers Prev* 19, 148-158 (2010). (With Yan and Bosland.)
248. Number of Sexual Partners and Associations with Initiation and Intensity of Substance Use. *AIDS Behav* DOI 10.1007/s10461-010-9669-0 (Springer Online 27 January 2010). (With Cavazos-Rehg et al.)
249. Understanding adolescent parenthood from a multisystemic perspective. *J Adolesc Health* 46, 525-531 (2010). (With Cavazos-Rehg et al.)
250. Infant head growth in male siblings of children with and without autism spectrum disorders. *J Neurodev Disord* 2, 39-46 (2010). (With Constantino et al.)
251. Predictors of sexual debut at age 16 or younger. *Arch Sex Behav* 39, 664-673 (2010). (With Cavazos-Rehg et al.)
252. The Benefit of Adjuvant Chemotherapy in Elderly Patients with Stage III Colorectal Cancer is Independent of Age and Comorbidity. *J Geriatr Oncol* 1, 48-56 (2010). (With Wildes et al.)

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253. Associations between multiple pregnancies and health risk behaviors among U.S. adolescents. *J Adolesc Health* 47, 600-603 (2010). (With Cavazos-Rehg et al.)
254. Psychosocial adjustment of directly exposed survivors 7 years after the Oklahoma City bombing. *Compr Psychiatry* 52, 1-8 (2011). (With North et al.)
255. Predictive capability of historical data for diagnosis of dizziness. *Otol Neurotol* 32, 284-290 (2011). (With Zhao et al.)
256. Substance use and the risk for sexual intercourse with and without a history of teenage pregnancy among adolescent females. *J Stud Alcohol Drugs* 72, 194-198 (2011). (With Cavazos-Rehg et al.)
257. Low-frequency repetitive transcranial magnetic stimulation to the temporoparietal junction for tinnitus. *Arch Otolaryngol Head Neck Surg* 137, 221-228 (2011). (With Piccirillo et al.)
258. Repetitive Transcranial Magnetic Stimulation for Tinnitus reply. *Arch Otolaryngol Head Neck Surg* 137, 730-732 (2011). (With Piccirillo et al.)
259. Number of sexual partners and associations with initiation and intensity of substance use. *AIDS Behav* 15, 869-874 (2011). (With Cavazos-Rehg et al.)
260. Postoperative myocardial injury after major head and neck cancer surgery. *Head Neck* 33, 1085-1091 (2011). (With Nagele et al.)
261. Use of the modified SNOT-16 in primary care patients with clinically diagnosed acute rhinosinusitis. *Arch Otolaryngol Head Neck Surg* 137, 792-797 (2011). (With Garbutt and Piccirillo.)
262. Prevalence and Correlates of Psychotropic Medication Use in Adolescents with an Autism Spectrum Disorder with and without Caregiver-Reported Attention-Deficit/Hyperactivity Disorder. *J Child Adolesc Psychopharmacol* Epub ahead of print (2011). (With Frazier et al.)

Schedule ELS-2

St Louis quarterly projections, omitting data from 2003 and 2006

The REG Procedure
 Model: MODEL1
 Dependent Variable: resdaily

Number of Observations Read	12
Number of Observations Used	10
Number of Observations with Missing Values	2

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	4902.53067	2451.26533	45.49	<.0001
Error	7	377.21310	53.88759		
Corrected Total	9	5279.74377			

Root MSE	7.34082	R-Square	0.9286
Dependent Mean	256.94910	Adj R-Sq	0.9081
Coeff Var	2.85691		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > t
Intercept	1	279.32623	3.67968	75.91	<.0001
pdsi5_12	1	-4.13563	1.05737	-3.91	0.0058
since_2000	1	-3.43734	0.80479	-4.27	0.0037

year	resdaily	p
1999	287.354	289.396
2000	273.989	273.934
2001	281.165	268.703
2002	271.307	273.899
2004	245.209	255.326
2005	267.914	270.307
2007	265.361	260.310
2008	226.399	231.010
2009	222.311	225.086
2010	228.482	221.519
2011	.	235.754
2012	.	232.317

Schedule ELS-3

Demonstration of the Tendency of Four-Year Averages to Over-Estimate Future Consumption

Year	Water Sales (1000 gal)	Total (Quarterly) Bills	Actual Daily Consumption per Customer	Four-Year Averages	Over or Under Estimates
1990	27,779,574	1,091,005	279.040		
1991	29,576,416	1,102,850	293.898		
1992	29,599,456	1,115,902	289.892		
1993	26,337,508	1,127,562	255.977		
1994	29,729,856	1,138,888	286.074		
1995	28,771,525	1,141,771	276.154	279.702	3.548
1996	29,250,936	1,154,046	277.010	281.460	4.450
1997	29,698,300	1,161,224	280.274	277.024	-3.250
1998	28,162,554	1,158,121	266.493	273.804	7.311
1999	30,760,506	1,173,121	287.354	279.878	-7.476
2000	29,511,009	1,177,143	273.989	274.983	0.993
2001	30,367,468	1,183,624	281.165	277.783	-3.383
2002	31,454,872	1,270,557	271.307	277.028	5.721
2003	27,889,513	1,255,656	243.409	277.250	33.841
2004	29,482,896	1,283,524	251.041	278.454	27.413
2005	32,063,233	1,285,386	273.364	267.468	-5.896
2006	33,071,276	1,362,792	265.943	261.731	-4.212
2007	31,515,189	1,320,220	261.602	259.780	-1.821
2008	27,219,145	1,313,949	226.399	258.439	32.040
2009	26,485,800	1,305,628	222.311	262.987	40.677
2010	27,300,873	1,309,461	228.482	256.827	28.345

Mean Overestimate: 9.894

Schedule ELS-4

Demonstration of the Tendency of Six-Year Averages to Over-Estimate Future Consumption

Year	Water Sales (1000 gal)	Total (Quarterly) Bills	Actual Daily Consumption per Customer	Six-Year Averages	Over or Under Estimates
1990	27,779,574	1,091,005	279.040		
1991	29,576,416	1,102,850	293.898		
1992	29,599,456	1,115,902	289.892		
1993	26,337,508	1,127,562	255.977		
1994	29,729,856	1,138,888	286.074		
1995	28,771,525	1,141,771	276.154		
1996	29,250,936	1,154,046	277.010		
1997	29,698,300	1,161,224	280.274	280.173	-0.101
1998	28,162,554	1,158,121	266.493	279.834	13.342
1999	30,760,506	1,173,121	287.354	277.564	-9.791
2000	29,511,009	1,177,143	273.989	273.664	-0.326
2001	30,367,468	1,183,624	281.165	278.893	-2.272
2002	31,454,872	1,270,557	271.307	276.879	5.572
2003	27,889,513	1,255,656	243.409	277.714	34.305
2004	29,482,896	1,283,524	251.041	276.764	25.723
2005	32,063,233	1,285,386	273.364	270.620	-2.744
2006	33,071,276	1,362,792	265.943	268.044	2.102
2007	31,515,189	1,320,220	261.602	265.713	4.111
2008	27,219,145	1,313,949	226.399	264.372	37.972
2009	26,485,800	1,305,628	222.311	261.111	38.800
2010	27,300,873	1,309,461	228.482	253.626	25.145
			Mean Overestimate:		12.274