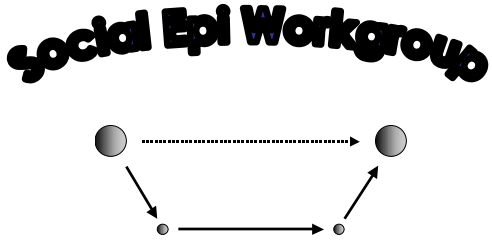

Methodological Issues in Neighborhood Effects Research

with special attention to "built environment" studies

This is an informal *in-progress* annotated bibliography compiled by Dr. Michael Oakes and colleagues at the University of Minnesota and the Social Epi Workgroup, including Kate Nygaard and Dr. Mary Hearst. We offer it in hopes of moving social epidemiologic research, especially, the subset addressing neighborhood effects, further along. Clearly papers listed are subjectively selected and related to Oakes' own experiences and research interests. There can be no question that the bibliography is incomplete and offers a biased – that is, subjective – perspective. Support for this work comes, in part, from Dr. Ann Forsyth, formerly of the Metropolitan Design Center at UMN.

Please feel free to offer comments, criticisms, and additions to Michael Oakes.
Also, please visit the website: http://www.tc.umn.edu/~oakes007/neighborhood%20effects.html

This document is organized into ten overlapping sections:

- Four *"Must Read"* Articles
- Four Basic Designs
- Stable Unit Treatment Value Assumption (SUTVA) & Dynamics
- Measurement Issues
- Matching and Other Methods to Control for Confounding
- Contextual Effects
- Counterfactuals
- Heterogeneity
- Statistical Modeling
- Design Issues

Four key Neighborhood Effects articles

Cochran, William G. 1957. "Analysis of Covariance: Its Nature and Uses." ***Biometrics*** **13:261-281**.

In this article, Cochran identifies concerns of extrapolation in observational studies. A traditional approach to account for confounding in observational studies is to adjust for covariates in the model. Provided the differences between groups on the confounding variable are small, adjustment is a reasonable approach. If, however, the differences among groups are large, the average value applied to each group with adjustment may represent "no man's land", a place where no actual observations exist. Given this scenario, the interpretation of the estimate becomes "speculative rather than soundly based".

Sobel, Michael E. 2000. "Causal Inference in the Social Sciences." ***Journal of the American Statistical Association*** **95:647-651.**

Stable Unit Treatment Value Assumption (SUTVA) demands homogeneity of treatment and no transference or interference among members (iid – independently and identically distributed). In this article, Sobel states "When interference is present (and interference is the essence of the idea that neighborhoods can affect the outcomes of its member), one cannot even define average treatment effects…" When interference is present, there is no longer meaningful interpretation of a contextual effect estimate. Interference is always present when studying contextual or neighborhood effects; therefore, it is not *when* SUTVA is violated, but that SUTVA *is* violated.

Rosenbaum, Paul R. 2005. "Heterogeneity and Causality: Unit Heterogeneity and Design Sensitivity in Observational Studies." ***The American Statistician*** **59:147-152.**

Rosenbaum emphasizes the importance of reducing heterogeneity in observational studies to reduce both sampling variability and sensitivity to unobserved bias. As observational studies may have selection bias inherent in them (non-random assignment to treatment condition), the author recommends matching to reduce the inherent heterogeneity.

Rubin, D. B., and N Thomas. 2006. "Matching Using Estimated Propensity Scores: Relating Theory to Practice." in ***Matched Sampling for Causal Effects*****, edited by D. B. Rubin. New York, NY: Cambridge University Press.**

Rubin presents propensity score matching for observational studies as a means of reducing heterogeneity and ultimately reducing improper extrapolation. Matching reduces bias and improves precision. Simply stated, the adjusting covariates are reduced to one, being the predicted probability of assignment to treatment. The propensity score becomes the observational study equivalent of randomization in an experimental design.

Four Basic Designs

Quasi-experiment (eg, Gautraeaux Program)

Move inner-city residents to suburban neighborhood (in Chicago) but not at random. The relative strength here is that an "exogenous" intervention actually took place.

Some papers…

Deluca, S., & Rosenbaum, J. E. (2003). If Low-Income Blacks are Given a Chance to Live in White Neighborhoods, Will They Stay? Examining Mobility Patterns in a Quasi-Experimental Program with Administrative Data. *Housing Policy Debate* 14(3), 305-346.

Keels, M., Duncan, G. J., DeLuca, S., Mendenhall, R., & Rosenbaum, J. E. (2005). Fifteen Years Later: Can Residential Mobility Programs Provide a Permanent Escape from Neighborhood Crime and Poverty? *Demography* 42(1), 51-73.

Mendenhall, R., DeLuca, S., & Duncan, G. (2006). Neighborhood Resources and Economic Mobility: Results from the Gautreaux Program. *Social Science Research* 35(4), 892-923.

Randomized experiment (eg, Moving to Opportunity (MTO))

5-city randomized experiment moving poor inner-city persons to less poor suburban neighborhood. Results are "complicated."

A nice summarizing text…

Goering, J., & Feins, J. D. (Eds.). 2003. *Choosing a Better Life: Evaluating the Moving to Opportunity Study*. Washington, DC: Urban Institute Press.

Kling, J. R., J. B. Liebman, et al. (2007). "Experimental Analysis of Neighborhood Effects." Econometrica **75**(1): 83-119.

Group-randomized trial (eg, MN Heart Health Program (MHHP))

A large randomized experiment that introduces community-wide (health) interventions to existing neighborhoods – flips MTO on its head. Few "positive" outcomes from this line of inquiry.

Some papers…

Luepker, R. V., Raczynski, J. M., Osganian, S., Goldberg, R. J., Finnegan, J. R., Jr., Hedges, J. R., et al. (2000). Effect of a community intervention on patient delay and emergency medical service use in acute coronary heart disease: The Rapid Early Action for Coronary Treatment (REACT) Trial. *JAMA.* 284(1), 60-67.

Murray, D. M. (1995). Design and Analysis of Community Trials: Lessons from the Minnesota Heart Health Program. *American Journal of Epidemiology*142, 569-575.

Susser, M. (1995). Editorial: The Tribulations of Trials--Intervention in Communities. *American Journal of Public Health* 85(2), 156-158.

Observational design

A hypothetical intervention. This is clearly the weakest design because one must worry about exchangeability and theorize from observed effect to cause, which may or may not have been observed. Excluding competing explanations is the tough work here. When it comes to neighborhood effects, because of sorting the intergenerational limits on social mobility, it is not clear whether longitudinal observational designs are of much use. Designs that sample similar (ie, exchangeable) people in dissimilar environments appear to be strongest as they minimize heroic modeling assumptions.

Some papers…

Diez-Roux, A. V., Nieto, F. J., Muntaner, C., Tyroler, H. A., Comstock, G. W., Shahar, E., et al. (1997). Neighborhood environments and coronary heart disease: a multilevel analysis. *Am J Epidemio* 146(1), 48-63.

The articles summarized below will be organized into topic categories using the main concepts presented in these four articles and a few additional concepts of neighborhood effects research. Any paper may be in more than one category.

Stable Unit Treatment Value Assumption (SUTVA)

Deluca, S., & Rosenbaum, J. E. 2003. "If Low-Income Blacks are Given a Chance to Live in White Neighborhoods, Will They Stay? Examining Mobility Patterns in a Quasi-Experimental Program with Administrative Data." ***Housing Policy Debate*** **14(3), 305-346.**

A well-done paper that exploits unique data and addresses a vexing question: what happens after folks are moved to new environment? Results show folks moved via Gautreaux did subsequently move again but remained in advantageous neighborhoods anyway.

Rubin, Donald B. 1986. "Which Ifs Have Causal Answers." ***Journal of the American Statistical Association*** **81:961-962.**

SUTVA, or stable-unit-treatment-value assumption, is the assumption that all units assigned to treatment receive the same treatment and that all units are independent. The author describes SUTVA's relation to Fisher's null hypothesis and Neyman's null hypothesis, two other methods of determining causality. Ultimately, one's study question must initially define units, treatments, and outcomes in a way that SUTVA can be applied.

Simon, Herbert A. 1952. "A Formal Theory of Interaction in Social Groups." ***American Sociological Review*** **17:202-211.**

This paper develops mathematical models based on specific postulates concerning behavior in human groups described by George C. Homans. The application of mathematical concepts is

a way to clarify a theory's concepts, investigate interdependence of postulates, and can help derive new hypotheses.

Sobel, Michael E. 2006. "Spatial Concentration and Social Stratification: Does the Clustering of Disadvantage "Beget" Bad Outcomes?" in *Poverty Traps*, edited by Samuel Bowles, Steven S. Durlauf, and Karla Hoff. Princeton, NJ: Princeton University Press.

The idea that a neighborhood affects the outcomes of an individual has been examined for decades. However, neighborhood effects have not been explicitly defined, making results difficult to interpret and possibly leading to misdirected social policy. Regardless of an adequate definition, though, the concept of interference (which is essentially the mechanism by which neighborhood effects occur) makes it inherently difficult to estimate neighborhood effects.

Sobel, Michael E. 2006. "What Do Randomized Studies of Housing Mobility Demonstrate?: Causal Inference in the Face of Interference." *Journal of the American Statistical Association* 101:1398-1407.

Sobel explored the SUTVA assumption as it applies to the MTO study. He states that if interference is present (SUTVA is violated), the difference observed between the neighborhood effects (living in low poverty, section 8, or control) is actually the difference between the neighborhood effects, each on a different defined population. There can be no generalization to a larger population when interference is present. As Sobel states, interference is always present when studying contextual or neighborhood effects; therefore it is not *when* SUTVA is violated, but that SUTVA *is* violated.

VanderWeele, T. J. (2007). "Ignorability and stability assumptions in neighborhood effects research." Statistics in Medicine.

In order to make causal statements about neighborhood effects when using observational (nonexperimental) data, certain assumptions must be met; VanderWeele discusses these assumptions within the context of a multilevel (hierarchical) model in this paper. First, the stable unit treatment value assumption (SUTVA) must hold, meaning that the outcome for an individual cannot depend on the treatment assigned to *another* neighborhood. It should be noted that there are analysis techniques for the situation when this assumption cannot be met. Second, the ignorability assumption must hold, which requires that there are no unmeasured confounders in the analysis. Finally, he briefly discusses the consistency assumption and concludes by highlighting additional assumptions specific to the multilevel model.

Measurement Issues

(especially in "built environment" research)

Echeverria, S. E., A. V. Diez-Roux, and B. G. Link. 2004. "Reliability of self-reported neighborhood characteristics." *J Urban Health* 81:682-701.

This study used Cronbach's alpha's and test-retest correlations to estimate the reliability of a

questionnaire measuring self-reported neighborhood environment characteristics possibly relevant to cardiovascular disease. Results showed high Cronbach alpha's and test-test reliability measures, indicating that self reported neighborhood characteristics can be reliably measured.

Kirtland, K. A., D. E. Porter, C. L. Addy, M. J. Neet, J. E. Williams, P. A. Sharpe, L. J. Neff, C. D. Kimsey, Jr., and B. E. Ainsworth. 2003. "Environmental measures of physical activity supports: perception versus reality." ***Am J Prev Med*** **24:323-31.**

This paper attempts to assess the accuracy of studies that investigate whether the environment is conducive to physical activity. The authors use a community survey to evaluate people's perceptions of the presence of environmental support and then apply GIS technology as an objective measure of the built environment. Kappa statistics were used for validity, and Spearman rank correlations were used for test-retest reliability. The researchers found that there was a fair to low level of agreement between perceptions and objective measures.

Raudenbush, S. W., & Sampson, R. J. 1999. "Ecometrics: Toward A Science of Assessing Ecological Settings, with Application to the Systematic Social Observation of Neighborhoods." In M. E. Sobel & M. P. Becker (Eds.), ***Sociological Methodology*** **(Vol. 29, pp. 1-41). Boston, MA: Blackwell.**

A classic paper on how to systematically measure social and built aspects of neighborhood environments.

See also:

Raudenbush, S. W. 2003. "The Quantitative Assessment of Neighborhood Social Environments." In I. Kawachi & L. F. Berkman (Eds.), *Neighborhoods and Health* (pp. 112-131). New York: Oxford.

Weich, S., E. Burton, M. Blanchard, M. Prince, K. Sproston, and B. Erens. 2001. "Measuring the built environment: validity of a site survey instrument for use in urban settings." ***Health Place*** **7:283-92.**

The purpose of this paper was to assess inter-rater reliability of built environment features using the built environment site survey checklist (BESSC). Of those built environment features with a Kappa greater than 0.50, logistic regression was used to determine the association between the built environment and the presences of depression and residence dissatisfaction. Reliability was found for 15 measures of the BESSC and validity for 5.

Matching and other Methods to Control for Confounding

Cochran, William G. 1953. "Matching in Analytic Studies." ***American Journal of Public Health*** **43:684-691.**

This paper illuminates the complexities of causal inference in observational studies. Cochran

describes several matching approaches and the corresponding strengths and limitations of each. Ultimately, the proper control group is more important than the matching approach and using multiple, independent analytic approaches strengthens inference.

Cochran, William G. 1957. "Analysis of Covariance: Its Nature and Uses." ***Biometrics*** **13:261-281.**

In this article, Cochran identifies concerns of extrapolation in observational studies. A traditional approach to account for confounding in observational studies is to adjust for covariates in the model. Provided the differences between groups on the confounding variable are small, adjustment is a reasonable approach. If, however, the differences among groups are large, the average value applied to each group with adjustment may represent "no man's land", a place where no actual observations exist. Given this scenario, the interpretation of the estimate becomes "speculative rather than soundly based".

Ho, Daniel E., Kosuke Imai, Gary King, and Elizabeth A. Stuart. 2005. "Matching as Nonparametric Preprocessing for Reducing Model Dependence in Parametric Causal Inference." Pp. 1-44.

Researchers interested in causal inference are subject to the assumptions of the model, and many studies use numerous models to analyze the data, choosing the parameter estimate that best fits the hypothesis. Matching is presented as a way to reduce model dependence that threatens the validity and conclusions of many studies. The technique compliments the parametric analysis that would have been conducted otherwise and ultimately, should strengthen the data and produce more reliable and trustworthy results.

Murray, M. P. (2006). Avoiding Invalid Instruments and Coping with Weak Instruments. ***Journal of Economic Perspectives*** **20(4), 111-132.**

Instrumental variable analysis is a modeling technique whereby one uses an "instrument" (a variable related to exposure but not (conditionally adjusted) outcome measure) to overcome missing/omitted variables in a typical regression model analysis. This readable paper reviews the technique and discusses the consequences of employing a weak or insufficient instrument – results may be more biased than otherwise.

See also…

Glymour, M. M. 2006. Natural experiments and instrumental variable analyses in social epidemiology. In J. M. Oakes & J. S. Kaufman, eds. *Methods in Social Epidemiology* (pp. 423-445). San Francisco: Jossey-Bass / Wiley.

Hernan, M. A., & Robins, J. M. 2006. Instruments for causal inference: an epidemiologist's dream? *Epidemiology*, 17(4), 360-372.

Oakes, J. M., & Johnson, P. J. 2006. "Propensity score matching methods for social epidemiology." In Oakes & Kaufman (Eds.), ***Methods in Social Epidemiology*** **(pp. 370-392). San Francisco: Jossey-Bass**

This chapter offers a simplified presentation of propensity score matching methods, and ties

the same to counterfactual inference. A worked example addressed a neighborhood effects problem.

Oreopoulos, Philip. 2003. "The Long-run consequences of living in a poor neighborhood." *The quarterly journal of economics* 118:1533-1575.

This paper investigates long-term outcomes for adults who were assigned as children to public housing projects; an advantage over earlier studies is that it uses natural neighborhood variation rather than requiring individuals to move to compare outcomes. Using linked tax data, the author compares means across categories and analyzes correlations, finding that neighborhood quality has little impact on long-term outcomes, while family background explains 30% of the variance in income and wages.

Rosenbaum, Paul R. 2002. "Attributing Effects to Treatment in Matched Observational Studies." *Journal of the American Statistical Association* 97:1-10.

This paper describes a method of sensitivity analysis for matched groups for case-referent, case-crossover and cohort studies, applying large sample approximation using asymptotic separability. An attributable is an effect caused by a treatment that varies as a function of randomization. Building on previous work, this paper looks at three study designs with matched sets, and using asymptotic separability due to differences in symmetry between matched and unmatched sets, the author concludes that case-referent and cohort studies have different forms of inference about attributable effects.

Rosenbaum, P. R., and J. H. Silber. 2001. "Matching and thick description in an observational study of mortality after surgery." *Biostatistics* 2:217-32.

The authors describe the pilot phase of a case-control study investigating patient mortality after surgery. Medicare billing data is combined with thick description, an ethnographic technique that can improve the accuracy of matching in observational studies and vice versa. Thick description helps control for overt biases present in studies without randomization, ultimately improving the chance of more sound statistical conclusions.

Rubin, D. B., and N Thomas. 2006. "Matching Using Estimated Propensity Scores: Relating Theory to Practice." in *Matched Sampling for Causal Effects*, edited by D. B. Rubin. New York, NY: Cambridge University Press.

Rubin presents propensity score matching for observational studies as a means of reducing heterogeneity and ultimately reducing improper extrapolation. Matching reduces bias and improves precision. Simply stated, the adjusting covariates are reduced to one, being the predicted probability of assignment to treatment. The propensity score becomes the observational study equivalent of randomization in an experimental design.

Smith, Herbert L. 1997. "Matching with Multiple Controls to Estimate Treatment Effects in Observational Studies." Pp. 325-353 in *Sociological Methodology*, edited by Adrian Raftery. Washington, DC: Blackwell.

Propensity score matching is a method to control for confounding variables present in observational studies. The author compares matching with regression and finds that standard errors resulting from matching are smaller, despite throwing out a substantial amount of data. Matching offers many advantages over regression and can lead a researcher towards a more causal analysis.

Contextual Effects

Farkas, George. 1974. "Specification, Residuals, and Contextual Effects." ***Sociological Methods & Research*** **2:333-63.**

Building on the contextual effect debate, this paper argues that contextual variables should not be disregarded despite evidence of weak effects. Although the author is not explicitly advocating for the use of contextual variables, he does not believe that the external environment has no effect on behavior and suggests looking at economic and econometric models for guidance in resolving the debate.

Keels, M., Duncan, G. J., DeLuca, S., Mendenhall, R., & Rosenbaum, J. E. 2005. Fifteen Years Later: Can Residential Mobility Programs Provide a Permanent Escape from Neighborhood Crime and Poverty? ***Demography*** **42(1), 51-73.**

A very well-written and thoughtful paper on Gautreaux data. Discussion of research design strengths and limitations is superb: while MTO has advantages due to randomization, these data may reflect a more defensible housing policy mechanism.

Kling, J. R., J. B. Liebman, et al. (2007). "Experimental Analysis of Neighborhood Effects." **Econometrica** **75(1): 83-119.**

This well-written paper offers results from the Moving to Opportunity (MTO) study, thus providing sound experimental evidence on the topic of neighborhood effects. Through a series of analysis, the authors find that the intervention had no impact on adult economic self-sufficiency but improvements in adult mental health did occur. Additionally, they find positive benefits among female youth, particularly in the areas of mental health, education and risky behavior. Conversely, male youth had more adverse outcomes in the areas of physical health and risky behavior. Furthermore, a comparative regression model analysis provides evidence to the claim that endogeneity is an important issue in nonexperimental data on neighborhood effects and that identifying the direction of bias in these studies is more difficult than most presume.

Hauser, Robert M. 1970. "Context and Consex: A Cautionary Tale." ***American Journal of Sociology*** **74:645-664.**

The purpose of this paper was to illustrate the problem of separating the "group" from the individuals who comprise it. Using a satirical approach, he analyses a large sample of high school seniors, and determines that a higher male-to-female ratio corresponds to higher educational aspirations. The shocking conclusions are used to show the flaws of this approach

and of contextual effects analysis in general.

Hauser, Robert M. 1974. "Contextual Analysis Revisited." *Sociological Methods & Research* 2:365-375.

In response to Farkas' article "Specification, Residuals, and Contextual Effects", this paper presents five threats to validity for contextual effects. While still considering the arguments made by Farkas, he asserts that of the five main shortcomings, two are so "potent" that the use of contextual variables is useless.

Oakes, J. M. 2004. The (mis)estimation of neighborhood effects: causal inference for a practicable social epidemiology. *Soc Sci Med*, 58(10), 1929-1952.

The purpose of this paper was to illustrate the problem of using the multilevel model to disentangle effects of neighborhood contexts from the background characteristics of residents. Oakes states that except for a limited set of circumstances when neighborhood socioeconomic conditions are similar, inferences about contextual effects are necessarily off-support of data and thus speculative. He argues that community-randomized trials are the only general way to identify neighborhood effects.

See also:

Oakes, J. M. (2004). Causal inference and the relevance of social epidemiology. Soc Sci Med, 58(10), 1969-1971.

Oakes, J. M. (2005). Invited Commentary: Advancing Research into the SES Mechanisms that Affect Health. International Journal of Epidemiology, 34, 835-837.

Vigdor, Jacob. 2002. "Locations, Outcomes, and Selective Migration." *The Review of Economics and Statistics* 84:751-755.

Two fundamental limitations of neighborhood effects research are that individuals choose where they live and that parents transmit characteristics to their children. This paper attempts to investigate the implications of selective migration for the outcomes of the subsequent generation. Regression analysis on data from 3 census years in 2 samples (1940 and 1970, 1970 and 1990) indicates that selective migration in one generation explains part of the "measured relationship" between segregation and outcomes in the next generation.

Counterfactuals

Greenland, S., and J. M. Robins. 1986. "Identifiability, exchangeability, and epidemiological confounding." *Int J Epidemiol* 15:413-9.

The purpose of this article is to highlight the complexities of identifiability. Using the language of exchangeability of comparison groups, the authors define confounding and the need for

comparability-based definitions of confounding.

Harding, David J. 2003. "Counterfactual models of neighborhood effects: the effect of neighborhood poverty on dropping out and teenage pregnancy." ***Am J Sociol*** **109:676–719.**

The author approaches selection bias (also known as confounding, hidden bias, unobserved heterogeneity or omitted variable bias depending on the field) using a counterfactual causal framework, propensity score matching, and sensitivity analysis. Instead of attempting to remove selection bias entirely, this paper also demonstrates that the results remain and are robust after changing the levels of certain unobserved factors.

Holland, P. W. (1986). Statistics and Causal Inference. ***Journal of the American Statistical Association*** **81(396), 945-960.**

This is a classic paper on counterfactual inference and statistical approaches to causal inference. Holland employs and clarifies "Rubin's Model" of potential outcomes. Ultimately Holland argues that statistics can and should address causality. Of note is that Holland argues that "… it is critical that each [subject] be potentially exposable to any one of the causes", and idea about the limits of counterfactual inference. This paper reviews much of the central statistical, philosophical and social science literature on causal inference.

King, Gary, and Langche Zeng. In Press. "When can history be our guide? The pitfalls of counterfactual inference." ***International Studies Quarterly*****.**

Social science research aims to make causal inferences, specifically counterfactual inferences; however, predictions are often made outside the range of data. Conclusions are therefore based more on model assumptions and less on empirical research. The authors present two techniques to help determine how far a counterfactual is from the available data and ultimately, the extent to which the question can be answered empirically.

Heterogeneity

Bowles, S., & Gintis, H. (2002). The Inheritance of Inequality. ***Journal of Economic Perspectives*****, 16(3), 3-30.**

A highly readable paper addressing social stratification across generations. Basic point is that children's SES is highly correlated with parents – there is little social mobility, especially at tails of distribution. There is a ton written on this topic.

See also:

Bowles, S., Durlauf, S. N., & Hoff, K. (eds.). 2006. *Poverty Traps*. New York: Russell Sage Foundation.

Bowles, S., Gintis, H., & Groves, M. (eds.). (2005). *Unequal Chances: Family background and economic success*. New York: Russell Sage.

Frennett, Marc, Garnett Picot, and Roger Sceviour. 2004. "When do they leave? The Dynamics of living in low-income neighborhoods." *The Journal of Urban Economics* 56:484-504.

This paper uses longitudinal tax data from three Canadian cities and applies econometric methods of analysis to compare duration of time spent in a low-income neighborhood with duration of time spent in a low-income state as well as negative duration dependence. Findings suggest that spells in a low-income neighborhood differ from those in a low-income state and that the likelihood of leaving a low-income neighborhood decreases with time, likely due to non-economic reasons. These results, among other things, may offer insight into why neighborhood effects are typically smaller when compared to family effects.

Ioannides, Yannis M. 2004. "Neighborhood Income Distributions." *Journal of Urban Economics* 56:435-457.

The purpose of this article is that there is heterogeneity within neighborhoods, although less with renters than home owners. So, while a person's income is highly correlated with their neighbor, depending upon home ownership, variability is present. The author uses data from the American Housing Survey (AHS) and employs both parametric and non-parametric econometric tools to evaluate the income distributions in US neighborhoods. Results indicate that mixing does exist in small neighborhoods and that owners exhibit more income mixing than renters.

Ioannides, Yannis M., and Tracy N. Seslen. 2002. "Neighborhood Wealth Distributions." *Economic Letters* 76:357-367.

This paper studies neighborhood sorting as it applies to wealth. Wealth appears to have greater mixing than income, refuting the hypothesis that substantial income mixing masks wealth mixing. To more accurately predict household wealth, the authors combine data from the American Housing Survey (AHS) and from the Panel Study of Income Dynamics (PSID), and then use the "decomposable inequality index" developed by Bourguignon to compare income and wealth distributions on multiple levels.

Rosenbaum, Paul R. 2005. "Heterogeneity and Causality: Unit Heterogeneity and Design Sensitivity in Observational Studies." *The American Statistician* 59:147-152.

Rosenbaum emphasizes the importance of reducing heterogeneity in observational studies to reduce both sampling variability and sensitivity to unobserved bias. As observational studies may have selection bias inherent in them (non-random assignment to treatment condition), the author recommends matching to reduce the inherent heterogeneity.

Schelling, T. C. 1971. Dynamic Models of Segregation. *Journal of Mathematical Sociology*, 1, 146-186.

Classic theoretical paper on social dynamics, disequilibria and tipping points.

Tiebout, C. M. 1956. A Pure Theory of Local Expenditures. The Journal of Political

Economy, 64(5), 416-424.

Classic paper on neighborhood sorting and the endogeneity of neighborhood characteristics.

Wilson, W. J. 1987. *The Truly Disadvantaged: The Inner City, the Underclass and Public Policy*. Chicago: University of Chicago Press.

Seminal text highlighting and addressing mechanisms for the increasing concentration of poverty and social isolation of African Americans.

Statistical Modeling

Becher, H. 1992. "The concept of residual confounding in regression models and some applications." *Stat Med* 11:1747-58.

This paper defines residual confounding within the context of regression analysis and concludes that dichotomizing a continuous variable is not advisable. Categorization into four or five levels is preferable to dichotomizing. While model misspecification may be preferable to crude categorization, more work is needed.

Berk, R. A. 2004. *Regression Analysis: A Constructive Critique*. Thousand Oaks: Sage.

This short, highly-readable text, highlights the many obstacles to sound inference through regression analysis.

Buzzelli, M., and J. Su. 2006. "Multi-level modelling in health research: A caution and rejoinder on temporally mismatched data." *Soc Sci Med* 62:1215-8.

This paper demonstrates the mobility of neighborhoods and the consequences of assuming a stable neighborhood population by analyzing census data from Canada, the US and the UK and through a brief example. The problem of temporal mismatch of neighborhood level to individual level data is common and must be considered in future studies.

Freedman, D. A. 2005. *Statistical models: theory and practice*. New York: Cambridge.

This graduate-student level statistics text offers many insights into the obstacles of drawing sound inference with regression models.

Manski, C. F. 1995. *Identification Problems in the Social Sciences*. Cambridge, MA: Harvard University Press.

This is Manski's classic text addressing obstacles to parameter identification in observational

data sets. Seven problems are organized into individual chapters: extrapolation; selection; mixing; response-based sampling; predicting individual behavior; simultaneity; reflection. Extrapolation, simultaneity, and the reflection problem are particularly relevant to neighborhood effects research.

Vandenbroucke, J. P. 1987. "Should we abandon statistical modeling altogether?" *Am J Epidemiol* 126:10-3.

Statistical modeling is a set of assumptions applied to data. The results are often solely reliant on the assumptions chosen and data available. This preliminary discussion of criticisms directed towards statistical modeling frames the author's proposal: either abandon statistical modeling or use a family of models when performing data analysis. If the latter is chosen, the researcher must address "theoretical uncertainties" by using both stratification and regression analysis.

Design Issues

Cochran, William G. 1965. "The Planning of Observational Studies of Human Populations." *Journal of the Royal Statistical Society, Series A* 128:243-265.

The author presents a few of the factors that differentiate observational from controlled experimental studies, namely the handling of disturbing variables, setting up a causal hypothesis, and the step between association and causation. He also describes strategies that can help overcome some of the problems inherent to observational studies, with the ultimate goal of raising discussion about these difficult methodological issues and increasing statistical contributions to the field of observational studies.

Goering, J., & Feins, J. D. (Eds.). 2003. *Choosing a Better Life: Evaluating the Moving to Opportunity Study*. Washington, DC: Urban Institute Press.

An insightful text on the promise and obstacles of the critically important (economist driven) randomized field trial to estimate neighborhood effects. Take home message is that such a study is complicated, extremely expensive and difficult, at best.

Moffitt, Robert A. 2004. "The role of randomized field trials in social science research." *American Behavioral Scientist* 47:506-540.

In the context of the cash welfare program AFDC (Aid to Families with Dependent Children), the author critically examines the role of the randomized field trial (RFT). He summarizes the historical development of RFTs as well as their strengths and weaknesses. He discusses five key limitations of RFTs, giving a corresponding lesson for each limitation. Ultimately, much has been learned from RFTs but limitations are inherent in trial design and result from important external constraints.

Oreopoulos, Philip. 2003. "The Long-run consequences of living in a poor neighborhood." *The quarterly journal of economics* 118:1533-1575.

This paper investigates long-term outcomes for adults who were assigned as children to public housing projects; an advantage over earlier studies is that it uses natural neighborhood variation rather than requiring individuals to move to compare outcomes. Using linked tax data, the author compares means across categories and analyzes correlations, finding that neighborhood quality has little impact on long-term outcomes, while family background explains 30% of the variance in income and wages.

Susser, Mervyn. 1995. "Editorial: The Tribulations of Trials--Intervention in Communities." ***American Journal of Public Health*** **85:156-158.**

The effects of community trials are often small compared to the efforts put forth. The author reflects on why this gap exists and using knowledge drawn from anti-tobacco campaigns, eventually draws four conclusions for the future of community trails: they require time, change accelerates when the movement acquires enough momentum to bring about policy change, that the seemingly small effects are a part of a broader social movement, and that we should not abandon these trails but gather and apply knowledge to refine them.