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The Illinois Institute for Rural Affairs (IIRA) works to improve the quality of life for rural residents by partnering with public and private agencies on local development and enhancement efforts.

Western Illinois University

Gender and Health in the Midwest, Metro *versus* Nonmetro: Insights from the National Health Interview Survey

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Abstract

Research suggests that men and women exhibit varied symptoms for the same disease, for example, stroke. Almost one-in-four Midwestern women in the metro and the nonmetro suffer from anxiety disorder. This paper explores the causal role of sex / gender in the association between anxiety medication and life satisfaction. Empirical analysis suggests that taking anxiety medication would lower one's life satisfaction.

Introduction

> *The pendulum is swinging away from an era of erasure of differences within medicine and its emphasis on sameness (with the problems of male-as-norm), towards an era of valorizing the significance of sex differences.*
> Grace (2007:5)[2].

The common belief among health scientists in the 1980s is that male and female bodies functioned in a similar manner other than the reproductive areas[3]; since women's hormonal cycle could confound research results, most clinical research used only male subjects[4]. This situation changed in 1993 with the "revitalization act"; the National Institute of Health encouraged clinical research into females and racial groups[5]. Since then

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[2] Grace, V. (2007). Beyond dualism in the life sciences: Implications for a feminist critique of gender-specific medicine. *Journal of Interdisciplinary Feminist Thought*, *2*(1), 1.

[3] In the 1980s, the medical field use to harbor the view that a "woman is a little man"; see, Pardue, M. L., & Wizemann, T. M. (Eds.). (2001). Exploring the biological contributions to human health: does sex matter?

[4] Dresser, R. (1992). Wanted single, white male for medical research. *The Hastings Center Report*, *22*(1), 24-29.

[5] https://grants.nih.gov/policy/inclusion/women-and-minorities/guidelines.htm.

sex differences in medical research have become the area of study for the newly defined field of "gender-specific medicine"[6] (GSM); it is predicated on the view that the sex of the patient should guide medical care or treatment.

A search for meta analyses[7] on research into sex differences in health revealed findings such as:

(i) global functioning outcomes from a psychiatric inpatient stay favored women; women have slightly superior functioning outcomes than men[8];

(ii) females exhibit stronger interhemispheric co-activation than males - the connectivity between two mirrored areas of the two hemispheres in the brain[9];

(iii) among psoriatic arthritis sufferers, women suffer from higher rates of peripheral disease, including higher tender joint counts[10];

(iv) women who experience stroke are more likely than men to exhibit non-focal symptoms such as physical weakness, confusion, and mental-status change[11]; and

(v) in carotid atherosclerosis, plaque size, composition, and morphology were larger in men compared to women[12].

These findings suggest that men and women exhibit varied symptoms for the same disease, so a different approach is necessary to identify and treat diseases for the sexes. GSM studies these variations, variations in disease onset caused by sex hormones or genetic predispositions, for example, stroke, and different social conditions; on the latter, research suggests that gastrointestinal diseases such as irritable bowel syndrome are more likely to be caused by stress[13].

Table 1 provides conceptual definitions of sex and gender; furthermore, to justify the focus on GSM, the table provides mortality statistics for men and women for the nation.

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[6] Legato, M. J. (2003). Beyond women's health: The new discipline of gender-specific medicine. *Medical Clinics*, *87*(5), 917-937.

[7] PubMed was searched; https://pubmed.ncbi.nlm.nih.gov/.

[8] Tully S, Bucci S, Alkotob Y, Penn G, Berry K. Sex differences in functional outcome after hospitalisation: A systematic review and meta-analysis. Psychiatry Res. 2023 May; 323:115095.

[9] Bonelli C, Mancuso L, Manuello J, Liloia D, Costa T, Cauda F. Sex differences in brain homotopic co-activations: a meta-analytic study. Brain Struct Funct. 2022 Nov;227(8):2839-2855.

[10] Coates LC, van der Horst-Bruinsma IE, Lubrano E, Beaver S, Drane E, Ufuktepe B, Ogdie AR. Sex-Specific Differences in Patients With Psoriatic Arthritis: A Systematic Review. J Rheumatol. 2023 Apr;50(4):488-496.

[11] Shajahan S, Sun L, Harris K, Wang X, Sandset EC, Yu AY, Woodward M, Peters SA, Carcel C. Sex differences in the symptom presentation of stroke: A systematic review and meta-analysis. Int J Stroke. 2023 Feb;18(2):144-153.

[12] van Dam-Nolen DHK, van Egmond NCM, Koudstaal PJ, van der Lugt A, Bos D. Sex Differences in Carotid Atherosclerosis: A Systematic Review and Meta-Analysis. Stroke. 2023 Feb;54(2):315-326.

[13] Kim, N., & Schiebinger, L. (2022). Why Is Sex/Gender-Specific Medicine Needed? In *Sex/Gender-Specific Medicine in the Gastrointestinal Diseases* (pp. 3-10). Singapore: Springer Nature Singapore.

Table 1: Conceptual Definitions of Sex and Gender[14] and Mortality Statistics[15]

Definitions

Concept	Definition
Sex	Common biological criteria for classification as female or male, for example, chromosomes (XX for female, XY for male), hormones (estrogen for female, testosterone for male), etc.
Gender	Social, cultural, and legal status as a woman or man, usually based on sex assigned at birth, but may be legally changed. Gender status produces patterns of social expectations for bodies, behavior, emotions, family, and work roles.

Mortality Numbers, 2020, US

Rank	Cause	N	Higher Mortality for
1	Diseases of heart	696,962	♂
2	Malignant neoplasms	602,350	♂
3	COVID-19	350,831	♂
4	Accidents (unintentional injuries)	200,955	♂
5	Cerebrovascular diseases	160,264	♀
6	Chronic lower respiratory diseases	152,657	♀
7	Alzheimer disease	134,242	♀
8	Diabetes mellitus	102,188	♂
9	Influenza and pneumonia	53,544	♂
10	Nephritis, nephrotic syndrome and nephrosis	52,547	♂
11	Chronic liver disease and cirrhosis	51,642	♂
12	Intentional self-harm (suicide)	45,979	♂
13	Essential hypertension and renal disease	41,907	♀
14	Parkinson disease	40,284	♂
15	Septicemia	40,050	♀

Note: Women = ♀ ; Men = ♂

[14] Fausto-Sterling, A. (2000). *Sexing the body*. New York: Basic Books.
[15] CDC, National Center for Health Statistics, National Vital Statistics System, Mortality 1999-2020. CDC WONDER Online Database, Released in 2021; https://wonder.cdc.gov/. Accessed on May 6, 2023.

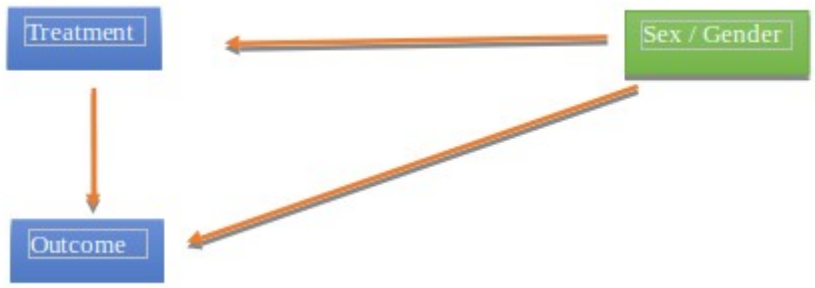
The mortality numbers for cerebrovascular and Alzheimer's diseases are higher for women whereas diseases of the heart harm men to their demise. The question is whether finer partitioning of these numbers would provide insights into marginalized groups, for example, race could interact with gender to reveal that "women of color", are disproportionately affected by a disease. This paper explores this 'intersectionality' among demographic and situational or contextual variables to explain health status of Midwesterners[16].

Methodology

Data are from the National Health Interview Survey (NHIS), 2021. The household survey contained responses from 29,482 adults on topics ranging from health status, or health conditions, to health insurance coverage[17]. Microdata on all 29,482 respondents and their status or measures on three groups of variables were sourced: demographics, life satisfaction, and health status. Table 2 lists the salient variables and their operational definitions.

Causal inferences are the primary motivation for data analysis. Causal models in the form of directed acyclic graphs are constructed and empirically assessed to delineate the relationship among 'sex', 'treatment', and 'outcome' variables. Figure 1 illustrates this process; the variable 'sex / gender' is a common cause of both treatment and outcome. An example of such a data generating process would be if 'treatment' is a binary variable that indicates whether a person is taking a particular drug and 'outcome' is a binary variable whether a person has experienced one or more side effects of the drug; if women are more likely than men to be prescribed the drug, then one's sex is a common cause of treatment and outcome.

Figure 1: Gender as a Mediating Covariate



[16] One could think of intersectionality as a sophisticated cross-classification of variables such as gender, race, age, etc.; the aim is to uncover new groups that suffer from health inequality. See, for example, Crenshaw, K. (1993). Mapping the margins: Intersectionality, identity politics, and violence against women of color. *Stanford Law Review*, 43, 1241-1299.

[17] See, https://www.cdc.gov/nchs/nhis/2021nhis.htm.

Table 2: Variables and their Definitions

NHIS Variable	Nominal Definition	Operational Definition
HISPALLP_A	Respondent's ethnicity	1 = White 2 = Black 3 = Asian 4 = Hispanic Origin
PCNT18UPTC	No. of persons age 18+ in the household	0=0; 1 = 1; 2 = 2; 3 = 3+.
PCNTLT18TC	No. of persons under 18 in the household	0=0; 1 = 1; 2 = 2; 3 = 3+.
RATCAT_A	Ratio of family income to poverty threshold for the respondent	Ratio measure; has a real zero.
URBRRL	Metro / Nonmetro	1= Rural 0= Urban
SEX_A	Respondent's self-reported gender classification	1= Male 2= Female
AGEP_A	Respondent's age	18+
EDUCP_A	Educational attainment	1 = ≤ high school; 2 = > than high school, but ≤ associate degree; 3 = Bachelors or master's degree; 4 = professional or doctorate.
LSATIS11R_A	Life satisfaction	11-point scale: 0 = Very dissatisfied; 10 = Very satisfied
PHSTAT_A	General health status	1 = Excellent; 2 = Very good; 3 = Good; 4 = Fair; 5 = Poor.
MEDICAID_A	Medicaid status	1, 2 = Yes; 3 = No
HYPEV_A	Hypertension	1 = Yes; 2 = No
HYPMED_A	Taking hypertension medicine	1 = Yes; 2 = No
CHL12M_A	High cholesterol in the past 12 months	1 = Yes; 2 = No.
CHLMED_A	Taking cholesterol medicine	1 = Yes; 2 = No
BREASCAN_A	Diagnosed with breast cancer	1 = Yes; 2 = No
OVARYCAN_A	Ovarian cancer mentioned	1 = Yes; 2 = No
UTERUCAN_A	Uterine cancer mentioned	1 = Yes; 2 = No
SKNNMCAN_A	Skin non-melanoma cancer	1 = Yes; 2 = No
THYROCAN_A	Thyroid cancer	1 = Yes; 2 = No
COLRCCAN_A	Colorectal cancer	1 = Yes; 2 = No
DIBTYPE_A	Type of diabetes	1= Type 1; 2 = Type 2; 3 = Other type
HEPEV_A	Ever had hepatitis	1 = Yes; 2 = No
BMICAT_A	Body mass index	1 = underweight; 2 = Healthy weight 3 = Overweight; 4 = Obese
OCWRKLIM_A	Health problem limits work	1 = Yes; 2 = No
COPDEV_A	Ever had COPD	1 = Yes; 2 = No
ARTHEV_A	Ever had arthritis	1 = Yes; 2 = No
CHDEV_A	Coronary heart disease?	1 = Yes; 2 = No

Findings

The Midwest region had 6,327 adult responses; a weighted equivalent of 52.61mil respondents, of which 21% or 10.89mil were from the rural areas. A majority of the respondents were females, 51%.

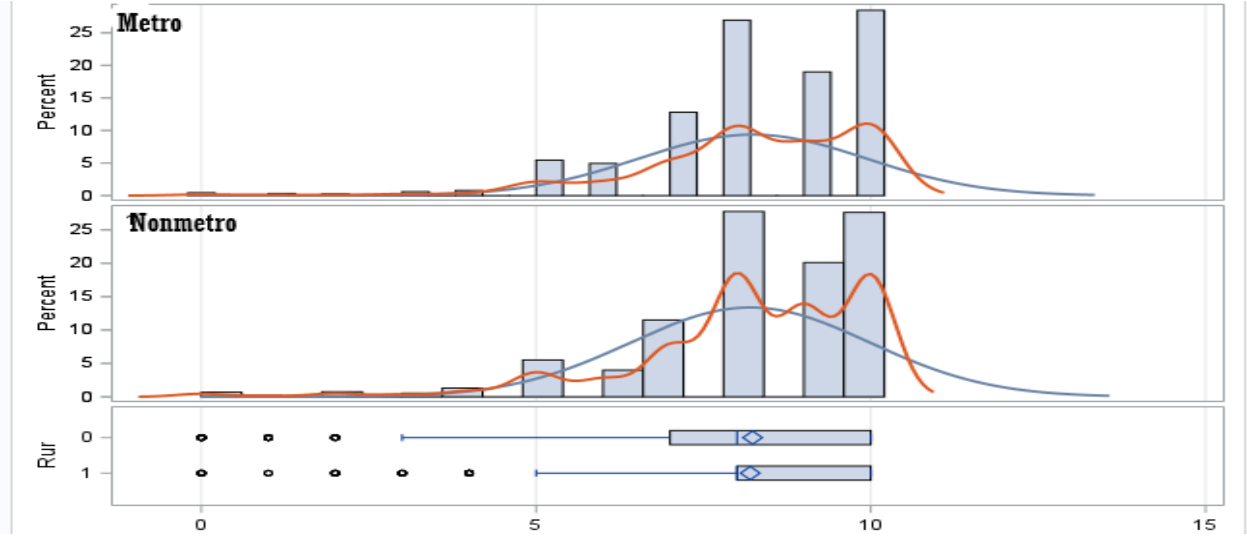
Table 3 shows that more respondents from the nonmetro perceive their health as "fair" and "poor", and compared to the metro, a smaller proportion of the nonmetro residents believe that their health is "excellent". This is true for both the sexes. Since general health impacts life satisfaction, $r = .35$, $p<.01$, more rural residents should be dissatisfied with their life. Figure 2 shows an empirical test of this assertion; while rural respondents do score lower on life satisfaction than their metro counterparts, the difference is not statistically significant.

Table 3: Health Status, Metro *versus* Nonmetro

	Metro		Nonmetro	
Health Status	**Male**	**Female**	**Male**	**Female**
Excellent	27%	24%	19%	17%
Very Good	36%	36%	36%	36%
Good	27%	28%	31%	30%
Fair	9%	10%	11%	14%
Poor	2%	2%	4%	4%
N	20.5mil	21.22mil	5,329,181	5,556,164

Note: All χ^2 significant at $p < .05$ level.

Figure 2: Distribution of Life Satisfaction Scores



Note: Mean scores: Metro = 8.234; Nonmetro = 8.199; Difference between means = .035; t=.69, p>.49.

To further explore the health status of the respondents, crosstabulations were constructed with 22 ailments or health variables, metro/nonmetro classification, and sex of the respondent. Table 4 shows the results of this exercise for all statistically significant associations[18].

Table 4: Health Status by Sex

	Metro		Nonmetro		Unit = Millions	
Ailment	**Male**	**Female**	**Male**	**Female**	**N (Male)**	**N (Female)**
Asthma	56%	67%	57%	69%	31.86	4.23
COPD	5%	5%	6%	10%	25.80	26.7
Smoke now	33%	35%	41%	44%	11.05	8.96
Arthritis	20%	26%	21%	32%	25.8	26.7
Pain	62%	66%	66%	70%	25.38	26.31
Backpain	33%	30%	28%	29%	15.86	17.58
Hypertension	68%	30%	62%	39%	25.80	26.7
Heart disease	6%	3%	7%	5%	25.80	26.7
Diabetes	10%	9%	11%	11%	25.80	26.7
Fatigue	1%	2%	<.5%	2%	25.80	26.7
Anxiety	12%	24%	13%	26%	25.80	26.7
Depression	13%	24%	15%	29%	25.80	26.7
Dementia	1%	1%	1%	1%	25.80	26.7
Breast cancer	<0.5%	32%		34%		2.69
Ovarian cancer		5%		5%		2.69
Uterine cancer		6%		6%		2.69
Skin cancer	25%	20%	18%	16%	2.44	2.69
Throat cancer	1%	2%	3%	9%	2.44	2.69
Rectal cancer	4%	5%	7%	4%	2.44	2.69
Kidney disease	3%	3%	4%	3%	25.78	26.76
Hepatitis	1%	1%	1%	2%	25.78	26.76
High Cholesterol	67%	69%	68%	73%	6.69	6.64

Note: Color-coded numbers highlight differential rates of affliction between the sexes; female = red and male = blue.

[18] χ^2 tests were performed.

As shown in Table 4, a higher proportion of females in both the metro and the non-metro suffers from asthma, high cholesterol, and pain; in contrast, hypertension afflicts more males.

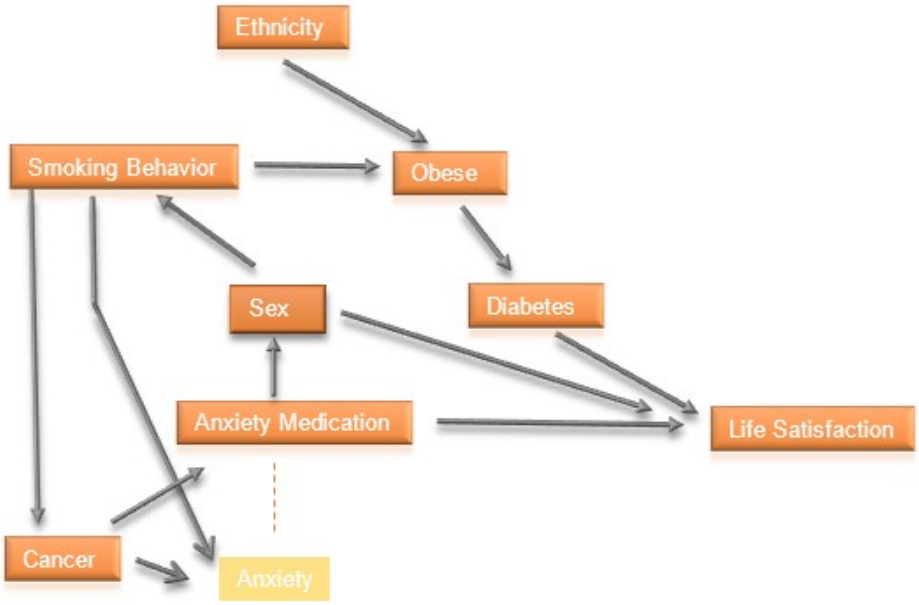
Causal Effect Identification

In line with the terminology associated with Figure 1, the treatment that is of interest is one's intake of anxiety medication and the outcome, 'life satisfaction'. For expositional purposes, I have expanded the nomological net in Figure 2 to include other influences on life satisfaction.

To elaborate, anxiety is unpleasant bodily responses (autonomic nervous system arousal) to a stimulus situation[19]; in Figure 2 it is stated as an unmeasured latent variable. The autonomic nervous system arousal often drives one to engage in escape or avoidance behavior, for example, smoking. The smoking behavior leads to obesity which in turn results in diabetes which affects life satisfaction.

Our focus is on assessing the causal role of sex / gender in the association between one's intake of anxiety medication and life satisfaction. In Figure 2, 'sex' mediates a portion of the causal effect of treatment on outcome; compared to males, a higher proportion of females suffer from anxiety disorder (take anxiety medication; see Table 4) and women are significantly more likely to report higher levels of life satisfaction than men[20].

Figure 2: Use of Anxiety Medication, Gender, and Life Satisfaction: A Causal Model



[19] Poppen, R. (1988). *Behavioral Relaxation Training and Assessment*. New York: Pergamon Press.

[20] Becchetti L, Conzo G. (2022). The Gender Life Satisfaction/Depression Paradox. *Social Indicator Research*, 160(1), 35-113.

The model variables are (also, see Table 2):

Anxiety medication: the treatment variable;
Life satisfaction: the outcome indicator;
Cancer: was the subject ever been told that she has cancer;
Sex: respondent's self-report of her sex / gender;
Smoking behavior: Smokes cigarettes;
Ethnicity: Classification variable for ethnicity;
Obese: BMI ≥ 30;
Diabetes: Ever had diabetes;
Anxiety: Unmeasured, latent variable.

Table 5 contains a summary of the model, the variables, nodes, edges, and a list of adjustment sets that have to be used to obtain an estimate for the causal effect of intake of anxiety medication and life satisfaction. The average treatment effect (AFT) was estimated using the inverse probability weighting method with ratio adjustment[21].

Table 5: Causal Analysis, Summary and Adjustment Sets

(i) Variables, Nodes, Edges, etc.

	N	Variables
Measured	8	Anxiety medication, Life satisfaction, Cancer, Sex, Smoking, Ethnicity, Obese, Diabetes.
Unmeasured	1	Anxiety

Model	Nodes	Edges	Treatments	Outcomes	Measured	Unmeasured
Impact of anxiety treatment on life satisfaction	9	11	1	1	8	1

(ii) Covariate Adjustment Sets

		Covariates		
Size	Minimal	Diabetes	Obese	Smokes
1	**Yes**	*		
1	**Yes**		*	
1	**Yes**			*

[21] Lunceford, J. K., & Davidian, M. (2004). Stratification and weighting via the propensity score in estimation of causal treatment effects: a comparative study. *Statistics in medicine*, *23*(19), 2937-2960.

Adjusting for the covariates produces an estimate of -0.11185; it means that subjects assigned to treatment, taking anxiety medication, would have lower life satisfaction, on average (Table 6). Life satisfaction should be worse without medication.

Sex / gender has little or no causal effect on life satisfaction[22].

Table 6: Analysis of Causal Effect

Analysis of Causal Effect							
Parameter	Treatment Level	Estimate	Robust Std Err	Wald 95% Confidence Limits		Z	Pr > |Z|
POM	1	1.7868	0.0184	1.7507	1.8230	96.85	<.0001
POM	2	1.9053	0.00650	1.8926	1.9181	292.94	<.0001
ATE		-0.1185	0.0195	-0.1568	-0.08026	-6.07	<.0001

Summary and Conclusion

The area of study, "gender specific Medicine", is predicated on the notion that men and women exhibit varied symptoms for the same disease, so a different approach is necessary to identify and treat diseases for the sexes. The mortality numbers for cerebrovascular and Alzheimer's diseases are higher for women whereas diseases of the heart harm men to their demise. The question is whether finer partitioning of these numbers would provide insights into marginalized groups, for example, race could interact with gender to reveal that "women of color", are disproportionately affected by a disease. This paper explores this 'intersectionality' among demographic and situational or contextual variables to explain health status of Midwesterners.

Data are from the National Health Interview Survey (NHIS), 2021. The Midwest region had 6,327 adult responses; a weighted equivalent of 52.61mil respondents.

Results of data analysis suggest that:

1. more respondents from the nonmetro perceive their health as "fair" and "poor", and compared to the metro, a smaller proportion of the nonmetro residents believe that their health is "excellent".

2. A higher proportion of females in both the metro and the nonmetro suffers from asthma, high cholesterol, and pain; in contrast, hypertension afflicts more males.

[22] Mean difference on life satisfaction for gender = -.00234; t = -.32, p > .74.

3. Anxiety medication lowers life satisfaction, for both the genders; life satisfaction would be much lower without medication.

On January 25, 2016, the NIH enacted the Sex as a Biological Variable, or SABV, policy requiring research into the effects of sex and gender on health. This research is a step in this direction.