

Conformity to Gender Norms are Associated Nociplastic Pain Diagnosis

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Introduction

Women are more likely than men to experience a wide variety of pain-related conditions¹. Despite the clear sex differences in these disorders the etiology of these disparities is not fully understood. Although individual social factors have been investigated for their role in determining sex differences in pain, previous work has not taken the step to explore the overarching role that conformity to gender norms plays in determining these outcomes.

Methods

In the following study, we derive a weighted gender index measuring each participant's conformity to gender norms based on a wide array of psychological and social features. We then use this gender index to assess gender's effect on the prevalence of chronic pain Diagnosis.

Population: We are conducting research within the All of Us Research Program, which includes a diverse group of 409,420 Americans, reflecting a wide range of socioeconomic and ethnic backgrounds.

Pain Phenotyping: Pain related diagnoses were obtained from participant health records.

WGI: We developed a weighted gender index using logistic regression modelling². In total we have selected 72 gender related variables covering the four dimensions of gender as defined by the CIHR's Women's Health Research Network (Gender Identity, Gender Relations, Gender Roles, and Institutionalized Gender)³. Each participant's percent likelihood of being a woman acted as an individual weighted gender index (WGI) value.

Analysis: WGI values were associated with diagnosis using logistic regression after stratifying by sex. Causal mediation analysis was used for each gender dimension score using diagnosis as an outcome and sex as an exposure.

Results

1. Nested Model Construction

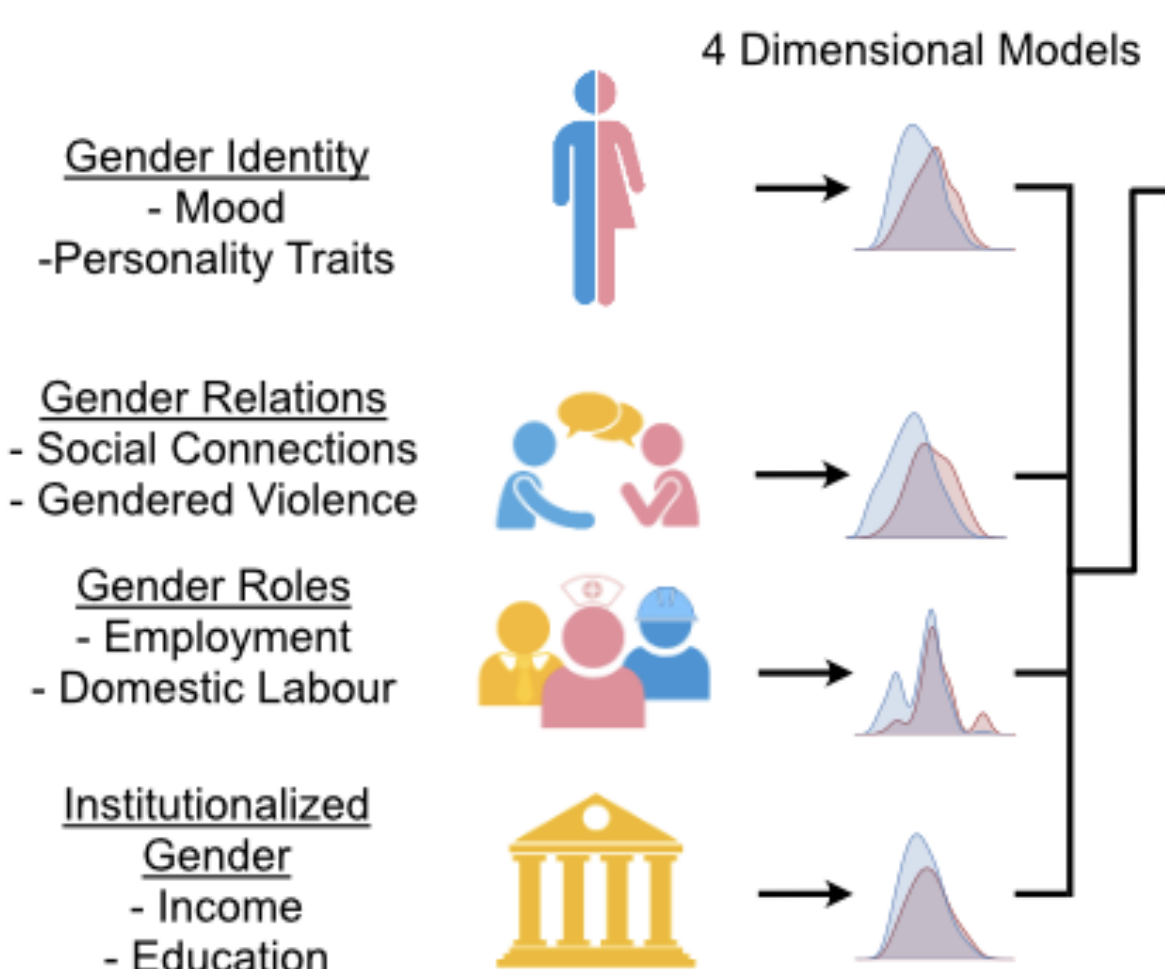
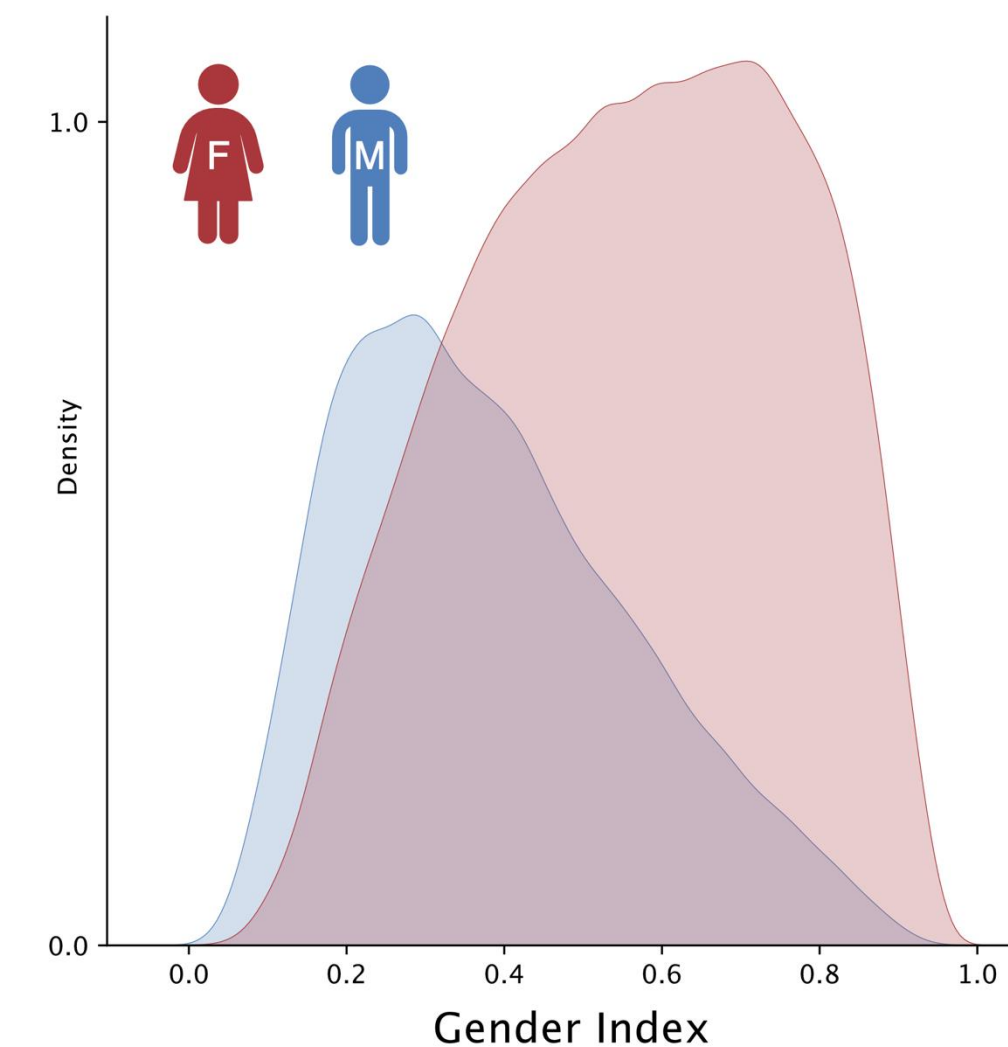


Fig 1. A nested approach was used to train the final model. 4 logistic regression models were trained to predict sex based on gendered features with in one of 4 gender dimensions. The resultant outcome predictions were fed into a final full model. The probability outcomes of the final model were used as the weighted gender index (WGI).



2. Model Performance

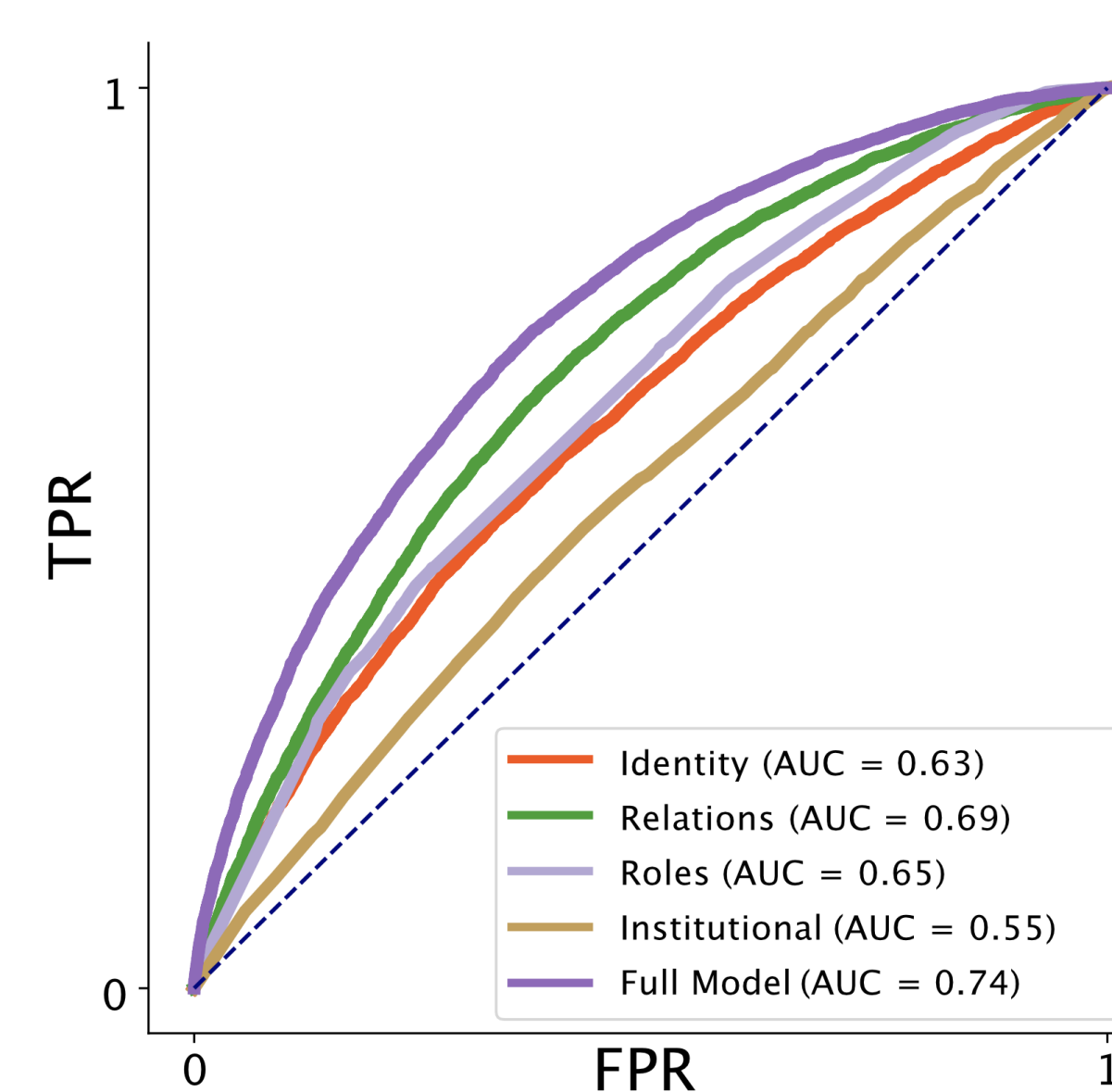


Fig 2. ROC-AUC performance for each model. We performed a moderate accuracy in the full model of 0.74. the top performing dimension was gender relations which included features associated with social connectedness, hobbies and experiences of violence.

Fig 3. Sex differences in diagnosis prevalence are presented in the heatmap with odds ratios above 1 indicating higher prevalence among women. The most sex differentiated condition was fibromyalgia with 6.27 high prevalence among women. Association between WGI and pain diagnosis is shown in the adjacent forest plot stratified by sex. The WGI is z-scored with odds ratios corresponding to increased odds of having each condition with a standard deviation increase in femininity on the WGI scale. Nociplastic conditions showed both the largest sex differences and strongest associations with the WGI.

4. Mediation by Dimension

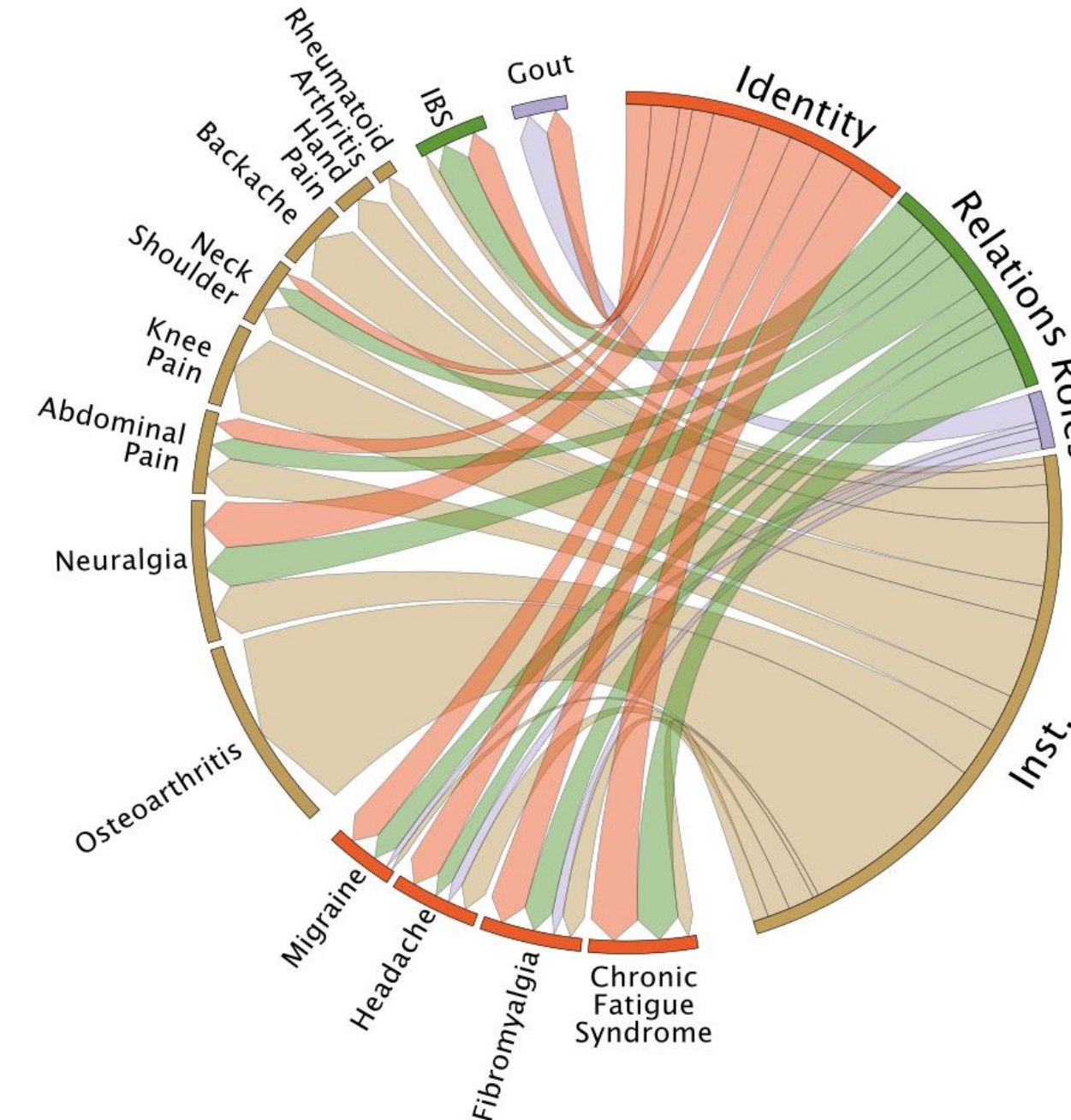
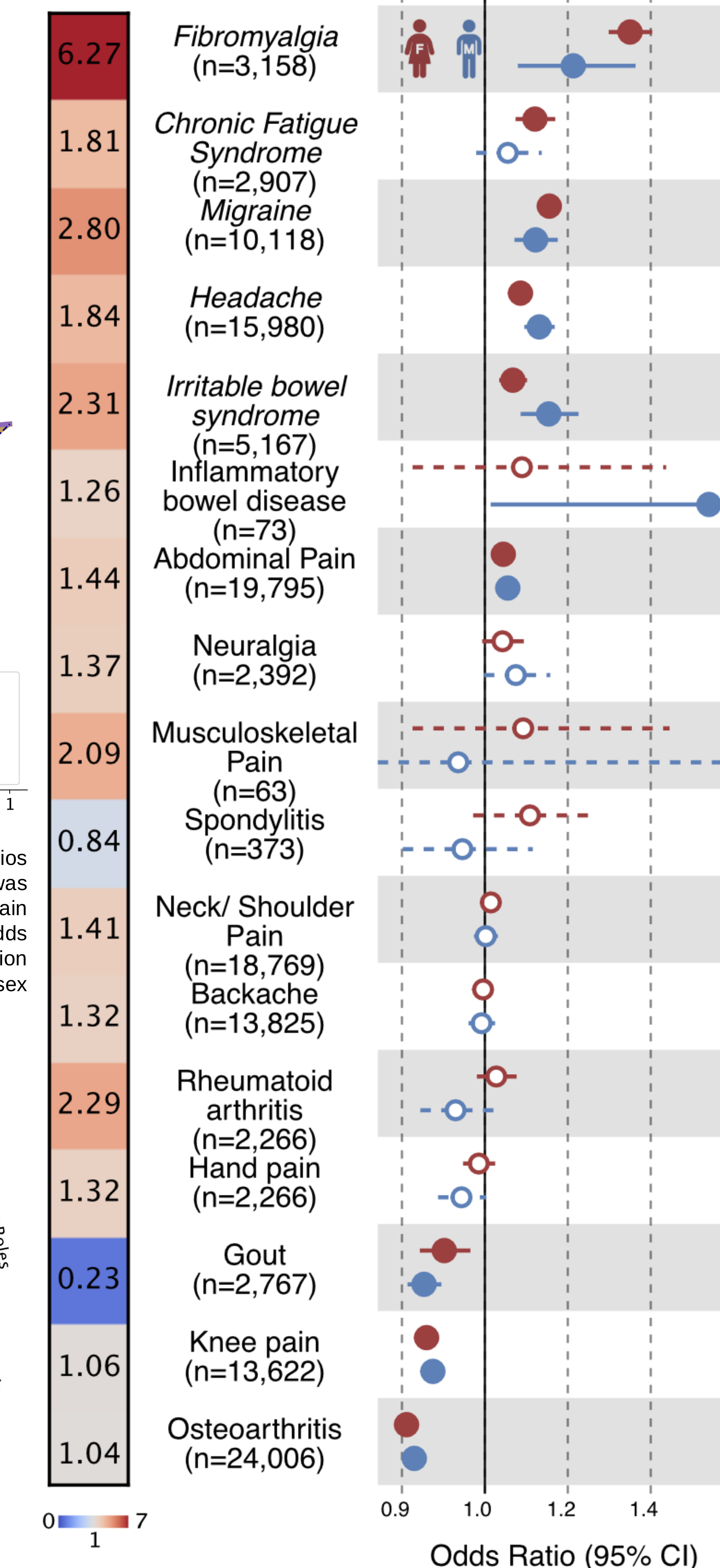


Fig 4. Causal mediation analysis was performed for each gender dimension model to determine the individual effects of these subdomains. Arrow size in the circus plot is proportional to percent mediation of the dimension in the effect of sex on occurrence of diagnosis. Nociplastic conditions were more strongly mediated by Identity and Relations while other pain conditions were more strongly mediated by institutional gender (reflecting socioeconomic differences between the sexes).

3. Sex Differences and Gender Association



Discussion

- 1) We were able to predict sex with high discrimination (AUC = 0.74) using our WGI based on psychosocial variables.
- 2) Women presented higher rates of chronic pain across most conditions most notably nociplastic conditions such as Fibromyalgia, CFS, Migraine, Headache, and IBS.
- 3) Femininity measured by our WGI was associated with a variety of chronic pain diagnoses most notably the same nociplastic conditions which showed the greatest sex differences/
- 4) Gender Identity and Gender Relations showed the strongest mediating role between sex and diagnoses for these conditions.

References

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