

Aplicación del enfoque I-MAIHDA para el análisis de las desigualdades interseccionales en la salud

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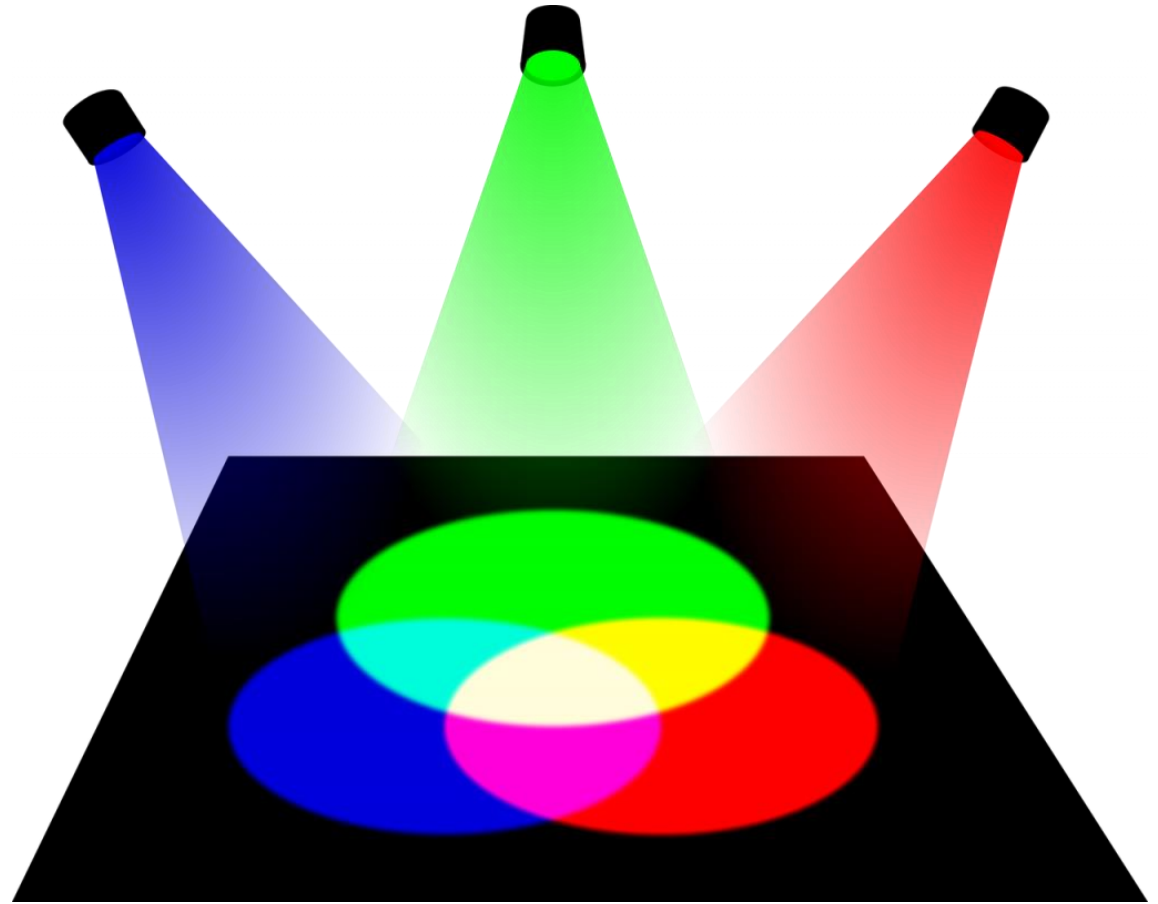


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¿Qué es la interseccionalidad?

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- Kimberlé Crenshaw (1989)
- Perspectiva sociopolítica que subraya el entrecruzamiento de sistemas de opresión (capitalismo, racismo, patriarcado, etc.)

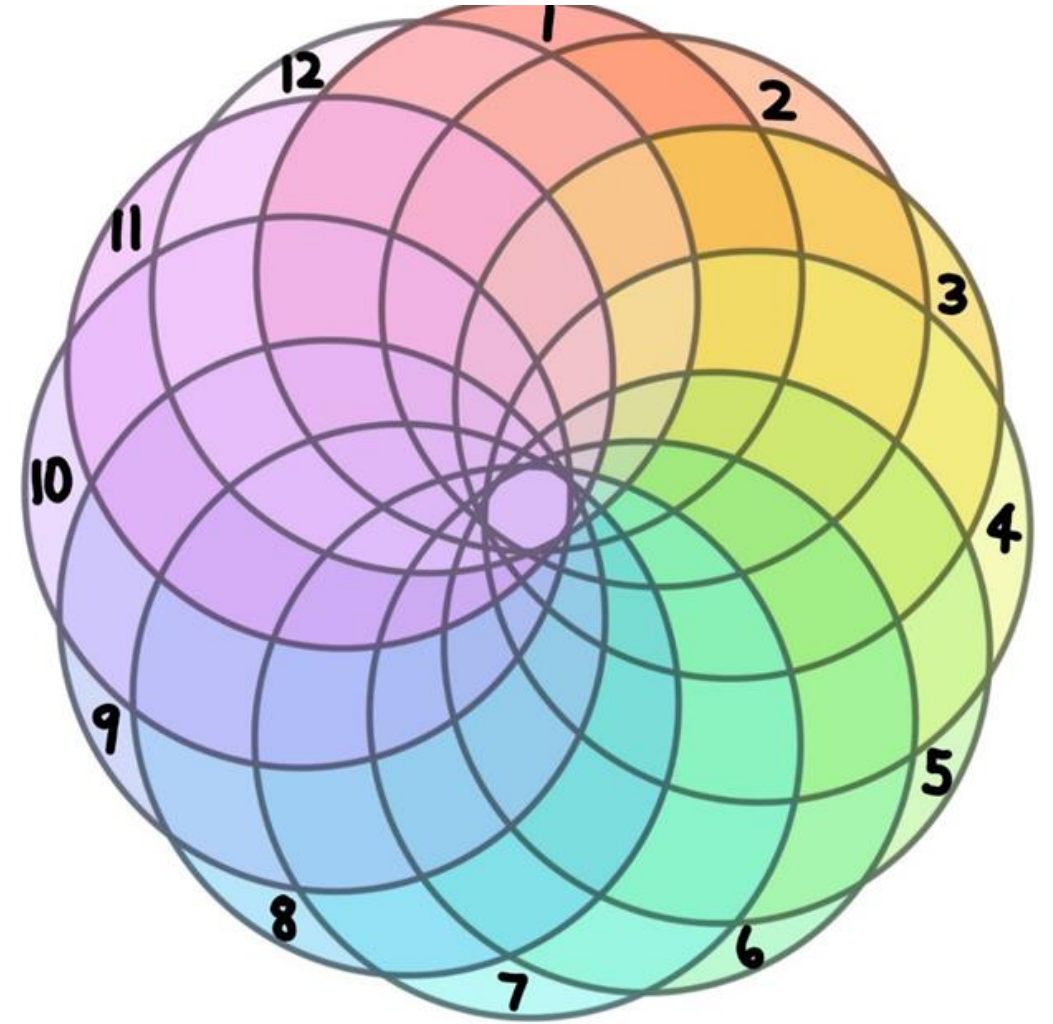


Crenshaw, K. Mapping the Margins: Intersectionality, Identity Politics, and Violence against Women of Color. Stanford Law Review. 1991; 43: 1241-1299.

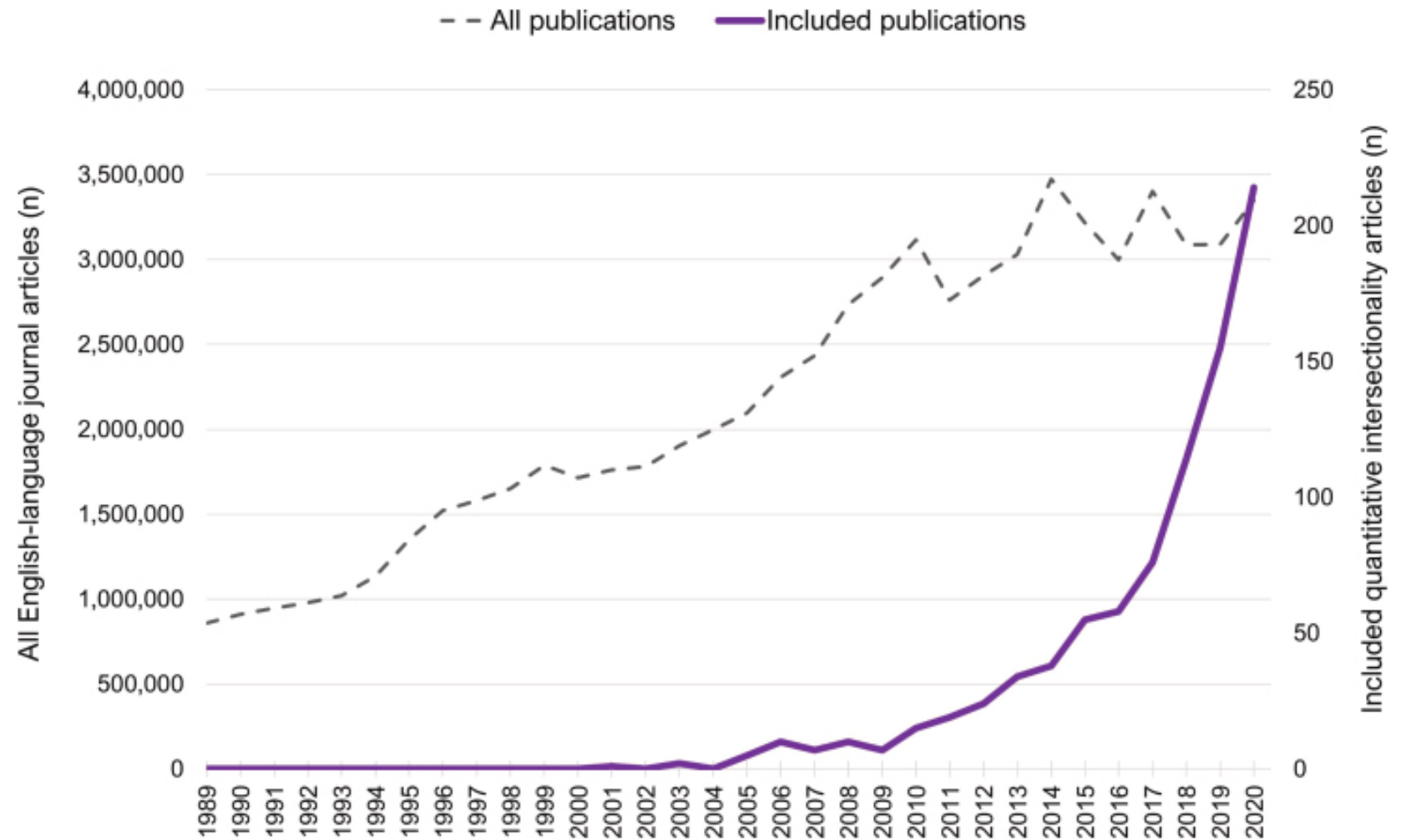


¿Qué es la interseccionalidad?

- Más allá de reconocer las discriminaciones múltiples (modelos aditivos) → la interacción genera y reproduce la desigualdad
- Identifica los efectos «hacia abajo», pero también «hacia arriba»

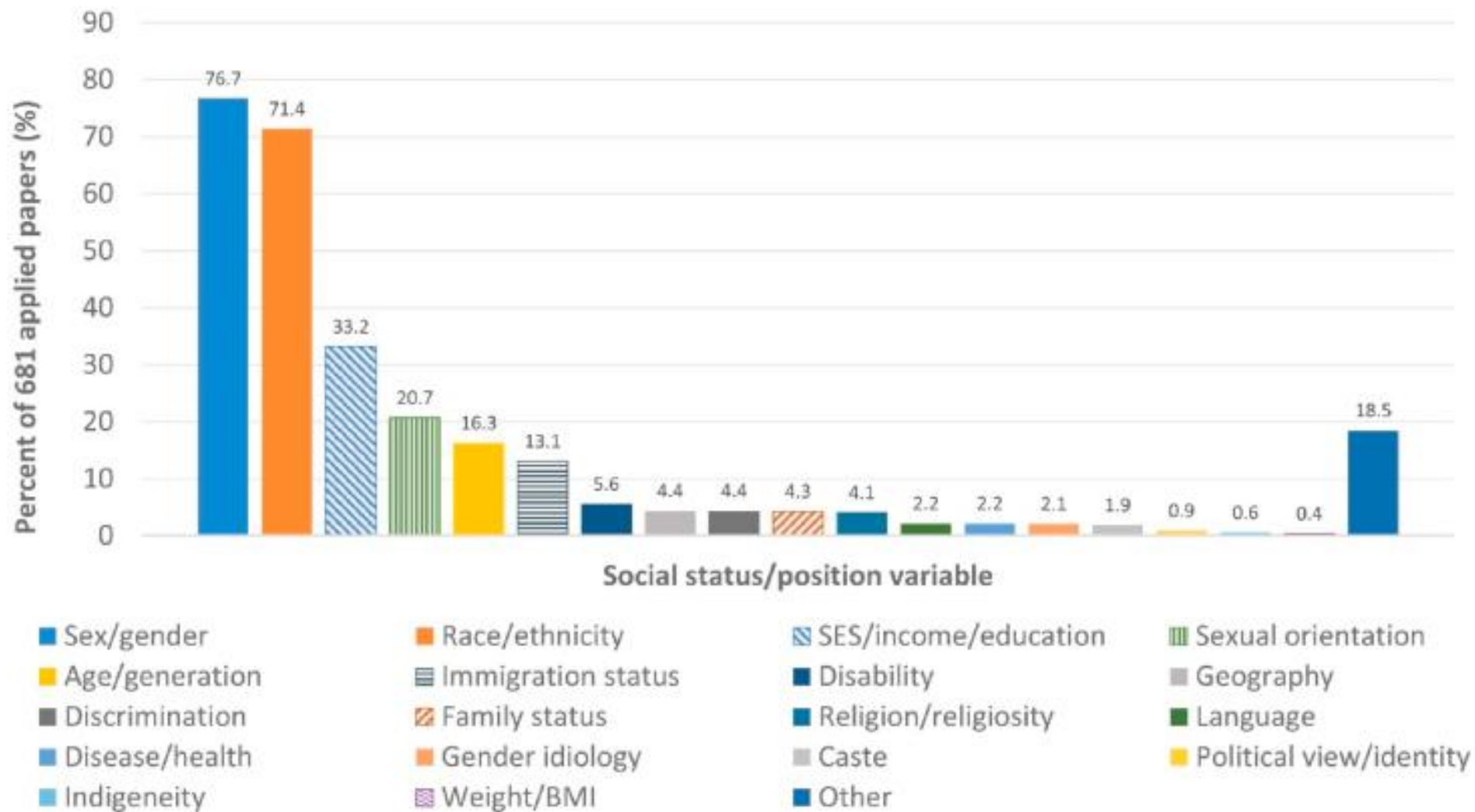


La interseccionalidad desde un enfoque cuantitativo



Bauer GR, et al. Intersectionality in quantitative research: A systematic review of its emergence and applications of theory and methods. *SSM Popul Health*. 2021. doi: [10.1016/j.ssmph.2021.100798](https://doi.org/10.1016/j.ssmph.2021.100798).





La interseccionalidad desde los métodos cuantitativos

- Enfoque intra-categorico, inter-categorico (anti-categorico)
- Los enfoques tradicionales (p.ej. modelos de regresión con términos de interacción) tienen limitaciones: 1) categoría de referencia; 2) interpretación de múltiples términos de interacción, 3) no consideran la heterogeneidad de los efectos individuales (tiranía de promedios)
- Analizar las interrelaciones entre diferentes categorías y procesos sociales, y su efecto diferencial en distintos grupos poblacionales



¿Qué es i-MAIHDA?



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A multilevel approach to modeling health inequalities at the intersection of multiple social identities



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ABSTRACT

Rationale: Examining interactions between numerous interlocking social identities and the systems of oppression and privilege that shape them is central to health inequalities research. Multilevel models are an alternative and novel approach to examining health inequalities at the intersection of multiple social identities. This approach draws attention to the heterogeneity within and between intersectional social strata by partitioning the total variance across two levels.

Method: Utilizing a familiar empirical example from social epidemiology—body mass index among U.S. adults ($N = 32,788$)—we compare the application of multilevel models to the conventional fixed effects approach to studying high-dimension interactions. Researchers are often confronted with the need to explore numerous interactions of identities and social processes. We explore the interactions of five dimensions of social identity and position—gender, race/ethnicity, income, education, and age—for a total of 384 unique intersectional social strata.

Results: We find that the multilevel approach provides advantages over conventional models, including scalability for higher dimensions, adjustment for sample size of social strata, model parsimony, and ease of interpretation.

Conclusion: Considerable variation is attributable to the within-strata level, indicating the low discriminatory accuracy of these intersectional identities and the high within-strata heterogeneity of risk that remains unexplained. Multilevel modeling is an innovative and valuable tool for evaluating the intersectionality of health inequalities.



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Multilevel analysis of individual heterogeneity and discriminatory accuracy (MAIHDA) within an intersectional framework



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ABSTRACT

Background: Analyzing Body Mass Index as a didactical example, the study by Evans, Williams, Onnela, and Subramanian (EWOS study) introduce a novel methodology for the investigation of socioeconomic disparities in health. By using multilevel analysis to model health inequalities within and between strata defined by the intersection of multiple social and demographic dimensions, the authors provide a better understanding of the health heterogeneity existing in the population. Their innovative methodology allows for gathering inductive information on a large number of stratum-specific interactions of effects and, simultaneously, informs on the discriminatory accuracy of such strata for predicting individual health. Their study provides an excellent answer to the call for suitable quantitative methodologies within the intersectionality framework.

Rationale: The EWOS study is a well-written tutorial; thus, in this commentary, I will not repeat the explanation of the statistical/epidemiological concepts. Instead, I will share with the reader a number of thoughts on the theoretical consequences derived from the application of *multilevel analysis of individual heterogeneity and discriminatory accuracy* (MAIHDA) in (social) epidemiology in general, and within the intersectional framework in particular. MAIHDA is a reorganization of concepts that allows for a better understanding of the distribution and determinants of individual health and disease risk in the population.

Conclusions: By applying MAIHD within an intersectional framework, the EWOS study provides a superior theoretical and quantitative instrument for documenting health disparities and it should become the new gold standard for investigating health disparities in (social) epidemiology. This approach is more appropriate for ecological perspectives than the habitual probabilistic strategy based on differences between group average risks. However, both, the translation of intersectionality theory into (social) epidemiology and the intersectional quantitative methodology (especially for generalized linear models) are still under development.

MAIHDA (*Multilevel Analysis Of Individual Heterogeneity And Discriminatory Accuracy*)

= Análisis multinivel de heterogeneidad individual y precisión discriminatoria

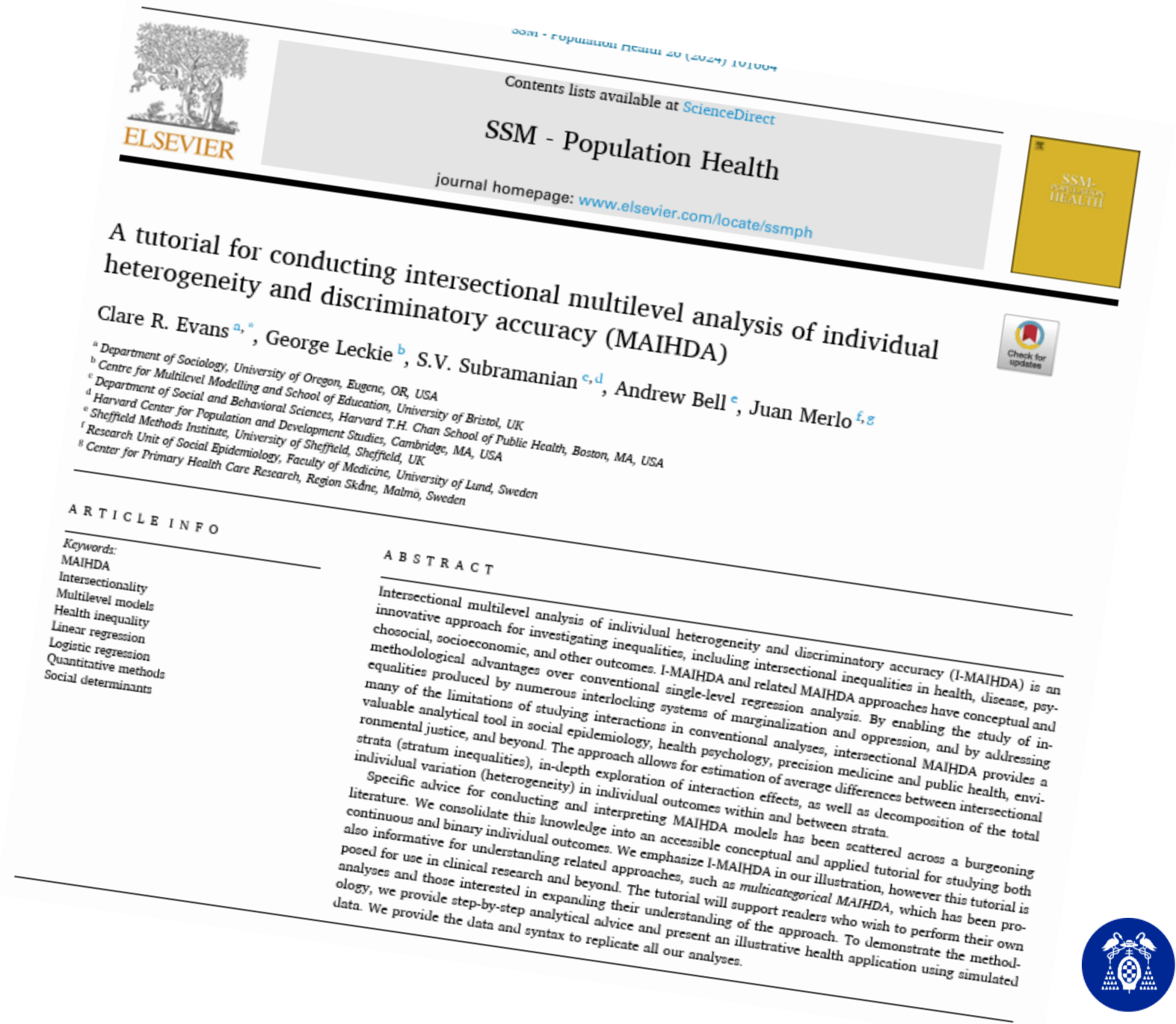
- Resultados que capturan las desigualdades en salud a lo largo de diferentes estratos interseccionales de población
- Variación intra e inter de los estratos (*'it partitions variance within and between intersectional clusters, where the significant residual values are interpreted as the additional intersectional effect'*)
 - Nivel 2: Identidades sociales interseccionadas de los individuos
 - Nivel 1: Individuos



i-MAIHDA: tutorial

Evans, C.R., et al. (2024). [A Tutorial for Conducting Intersectional Multilevel Analysis of Individual Heterogeneity and Discriminatory Accuracy \(MAIHDA\)](https://doi.org/10.1016/j.ssmph.2024.101664). *SSM - Population Health*.
<https://doi.org/10.1016/j.ssmph.2024.101664>

Código (STATA y R):
<https://osf.io/dtvc3/overview>



Aplicación del enfoque i-MAIHDA



Aplicación i-MAIHDA para el análisis de las desigualdades interseccionales en la obesidad en España

Body mass index inequities among adults in Spain: An intersectional multilevel analysis of individual heterogeneity and discriminatory accuracy of age, sex/gender, immigration status, and education

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^b Public Health and Epidemiology Research Group, Department of Surgery, Medical and Social Sciences, Faculty of Medicine and Health Sciences, Universidad de Alcalá, Alcalá de Henares, Madrid, Spain

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MAIHDA
Body mass index (BMI)
Obesity

ABSTRACT

Purpose: We aimed to examine intersectional BMI inequities across age, sex/gender, immigration status, and education among adults in Spain.

Methods: We analyzed data from 61,044 adults aged ≥ 18 years from the 2014 and 2020 European Health Interview Surveys in Spain and the 2017 Spanish National Health Survey. Using intersectional multilevel analysis of individual heterogeneity and discriminatory accuracy (I-MAIHDA) via linear mixed models, we examined BMI inequities across 100 intersectional strata, defined by age, sex/gender, immigration status, education, and survey year, and quantified the contribution of their intersections to BMI inequities.

Results: The intersectional strata explained 9.6 % of BMI inequities, with 37.1 % of the between-strata variance explained by age, sex/gender, immigration status, education, and survey year. On average, BMI was higher in older adults, immigrants, and those with lower education but lower in women. Interaction effects revealed that immigrant women had a higher predicted BMI than Spanish-born women. BMI inequities between immigrant and Spanish-born women were greatest for those aged 55–64 with middle and high education.

Conclusion: Although most BMI inequities were explained by the social factors considered as inequity axes, interaction effects were present. The latter calls for a universal public health intervention proportionate to the needs of specific groups in the population. I-MAIHDA revealed complex patterns of BMI inequities in Spain, which may inform the interventions needed to address weight-related outcomes.

Métodos

- Estudio interseccional descriptivo no causal, a partir de los datos de dos olas de la Encuesta Europea de Salud en España (2014 y 2020) y la Encuesta Nacional de Salud en España de 2017.
- La muestra de este estudio (nivel I) incluyó 61.844 personas adultas
- Resultado en salud: IMC (autorreportado, variable continua)



Estratos interseccionales

- Nivel 2: 180 estratos interseccionales ($= 5 \times 2 \times 2 \times 3 \times 3$)
 - Edad: 1) 18-34, 2) 35-44, 3) 45-54, 4) 55-64, 5) ≥ 65
 - Sexo/género: 1) Hombre, 2) Mujer
 - Status migratorio: 1) Nacido/a en España, 2) fuera de España
 - Nivel educativo: 1) Bajo (ISCED 1-4), 2) medio (ISCED 5-7), 3) alto (8)
 - Año de encuesta: 1) 2014, 2) 2017, 3) 2020



Resultados descriptivos

- IMC más alto en:
 - Edades más avanzadas
 - Hombres
 - Nivel educativo bajo

Table 1

Descriptive statistics for adults, aged 18 or older, who participated in the European Health Survey in Spain (2014 and 2020) and Spanish National Health Survey (2017).

Characteristics	N (% ^a , SE)	BMI (Kg/m ²), Mean (SE)
Individual values	61,844	26.1 (0.02)
Observed stratum means	180	25.9 (0.11)
Predicted stratum means	180	25.9 (0.09)
Strata Dimensions		
Age Group (years)		
18–34	9343 (15.1, 0.14)	24.1 (0.04)
34–44	11,738 (19.0, 0.16)	25.3 (0.04)
45–54	11,486 (18.6, 0.16)	26.2 (0.04)
55–64	10,790 (17.4, 0.15)	26.9 (0.04)
65 +	18,487 (29.9, 0.18)	27.1 (0.03)
Sex/Gender		
Men	29,208 (47.2, 0.20)	26.7 (0.02)
Women	32,636 (52.8, 0.20)	25.6 (0.03)
Immigration Status		
Yes	4494 (7.3, 0.10)	26.0 (0.07)
No	57,350 (92.7, 0.10)	26.1 (0.02)
Education		
Low	32,638 (52.8, 0.20)	27.0 (0.02)
Middle	17,181 (27.8, 0.18)	25.5 (0.03)
High	12,025 (19.4, 0.16)	24.6 (0.04)
Survey Year		
2014	20,845 (33.7, 0.19)	26.0 (0.03)
2017	20,980 (33.9, 0.19)	26.2 (0.03)
2020	20,019 (32.4, 0.19)	26.1 (0.03)

NOTE: BMI: Body mass index



MAIHDA: Modelo 1a

- VPC (variabilidad entre estratos interseccionales)
 - VPC = 9.6%
 - La mayoría de los estudios (5-10%)

Table 2

Estimates and their 95 % confidence intervals from linear mixed models of body mass index (BMI) for adults, aged 18 or older, who participated in the European Health Survey in Spain (2014 and 2020) and the Spanish National Health Survey (2017).

	Model 1A	Model 1B
Intercept	25.9 (25.6, 26.1)	23.8 (23.5, 24.1)
Age Group (Ref: 18–34)		
34–44		1.33 (1.05, 1.60)
45–54		2.05 (1.79, 2.32)
55–64		2.57 (2.31, 2.82)
65 +		2.35 (2.08, 2.61)
Sex/Gender (Ref: Men)		
Women		−1.22 (−1.40, −1.04)
Immigration Status (Ref: No)		
Yes		0.59 (0.36, 0.82)
Education (Ref: High)		
Low		1.54 (1.31, 1.77)
Middle		0.74 (0.53, 0.94)
Survey Year (Ref: 2020)		
2014		0.01 (−0.21, 0.23)
2017		0.21 (−0.01, 0.42)
Random Effects		
Strata-level Variance (σ_u^2)	1.90 (1.53, 2.43)	0.245 (0.18, 0.36)
Individual-level Variance (σ_e^2)	17.97 (17.77, 18.17)	17.98 (17.78, 18.18)
Summary Statistics		
Variance Partition Coefficient (%)	9.6	1.3
Proportional Change in Variance (%)		87.1

Note: Model 1A is the empty or null model and model 1B is the main additive effect model.



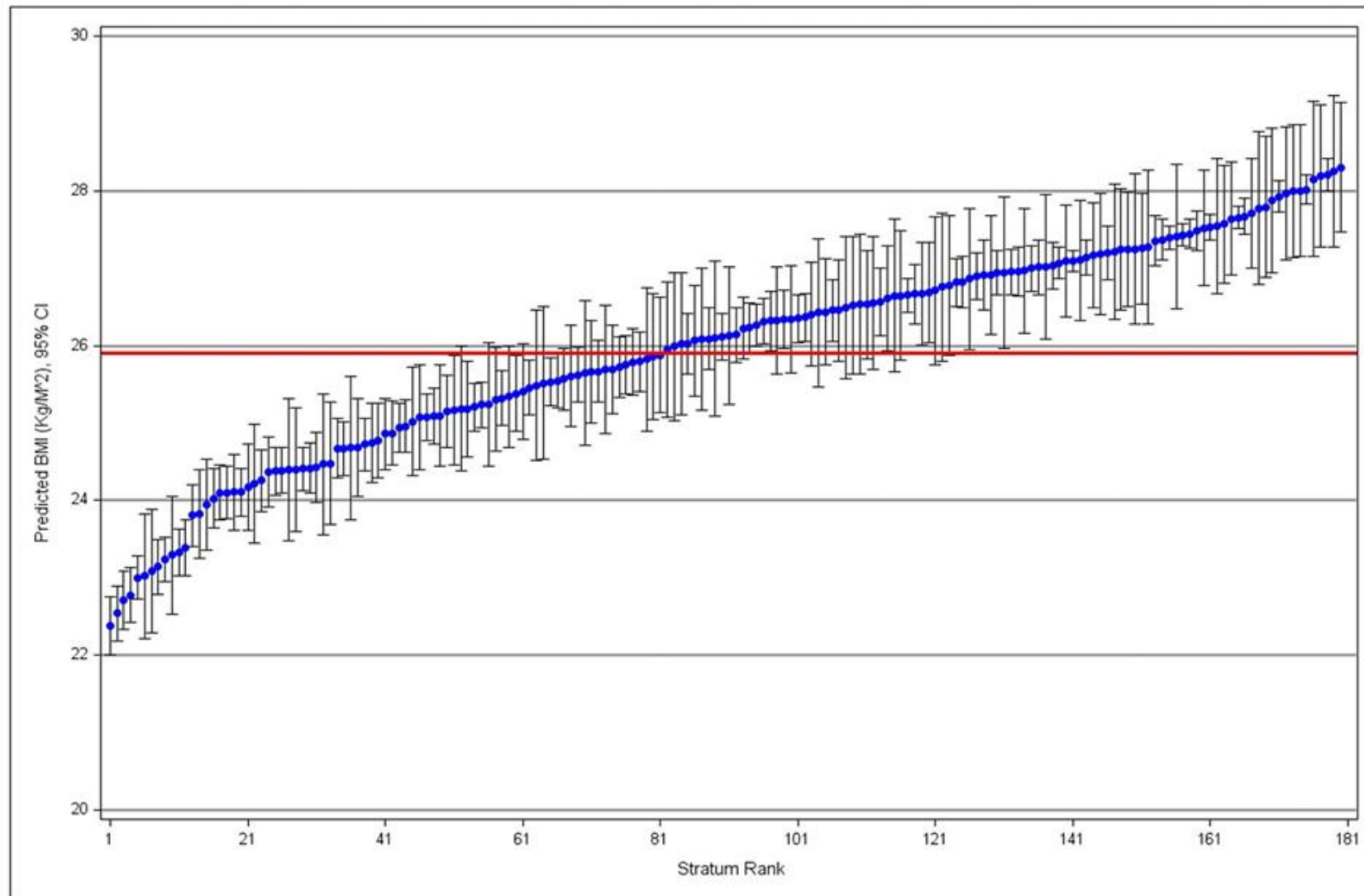
ESTIMATES AND THEIR 95% CI FOR BMI FOR ADULTS WHO PARTICIPATED IN THE EUROPEAN HEALTH SURVEY IN SPAIN (2014 AND 2020) AND THE SPANISH NATIONAL HEALTH SURVEY (2017)

	Model 1A	Model 1B
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Summary Statistics		
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Proportional Change in Variance (%)		87.1

the proportion of the total variance capturing the magnitude of between-stratum variation → **9.6% of the variation in BMI inequities is *between* intersections**
 → **90.4% of the variation in BMI is *within* intersections**



FIGURE 1. PREDICTED VALUES OF BODY INDEX MASS RANK BY STRATA, FROM LOW TO HIGH, FOR ADULTS AGED 18 OR OLDER WHO PARTICIPATED IN THE EUROPEAN HEALTH SURVEY IN SPAIN (2014 AND 2020) AND THE SPANISH NATIONAL HEALTH SURVEY (2017)



MAIHDA: Modelo 1b

- PCV (degree to which intersection means are additive)
 - PCV = 87.1%
 - La mayoría de los estudios (90%-95%)

Table 2

Estimates and their 95 % confidence intervals from linear mixed models of body mass index (BMI) for adults, aged 18 or older, who participated in the European Health Survey in Spain (2014 and 2020) and the Spanish National Health Survey (2017).

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65 +		2.35 (2.08, 2.61)
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Immigration Status (Ref: No)		
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Summary Statistics		
Variance Partition Coefficient (%)	9.6	1.3
Proportional Change in Variance (%)		87.1

Note: Model 1A is the empty or null model and model 1B is the main additive effect model.

ESTIMATES AND THEIR 95% CI FOR BMI FOR ADULTS WHO PARTICIPATED IN THE EUROPEAN HEALTH SURVEY IN SPAIN (2014 AND 2020) AND THE SPANISH NATIONAL HEALTH SURVEY (2017)

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Individual-level Variance (σ_e^2)	17.97	17.98
Summary Statistics		
Variance Partition Coefficient (%)	9.6	1.3
Proportional Change in Variance (%)		87.1

the proportion of the total variance capturing the magnitude of between-stratum variation → **87.1% of the intersectional inequalities are due to additive effects**
 → **12.9% are due to interactions**



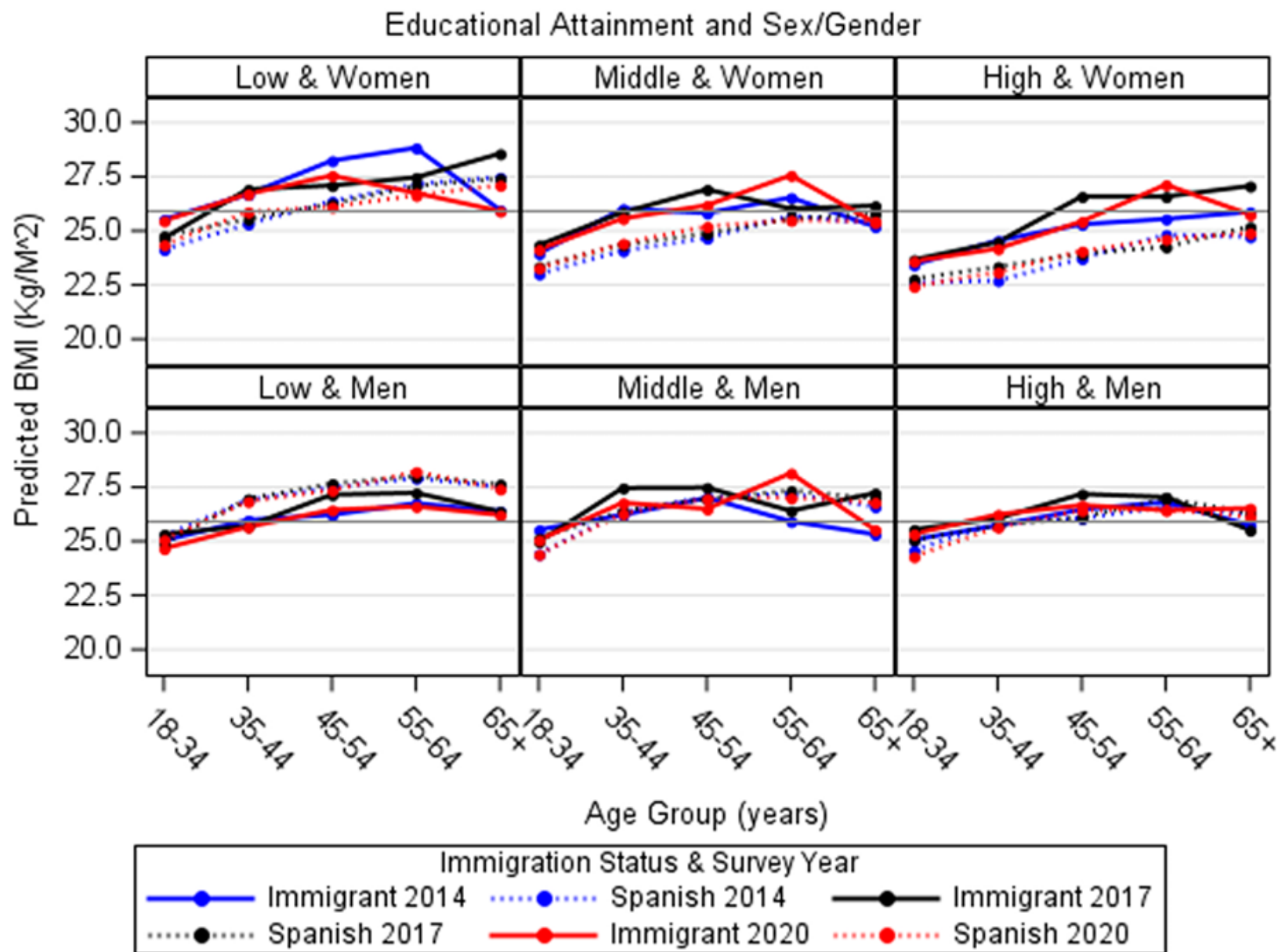
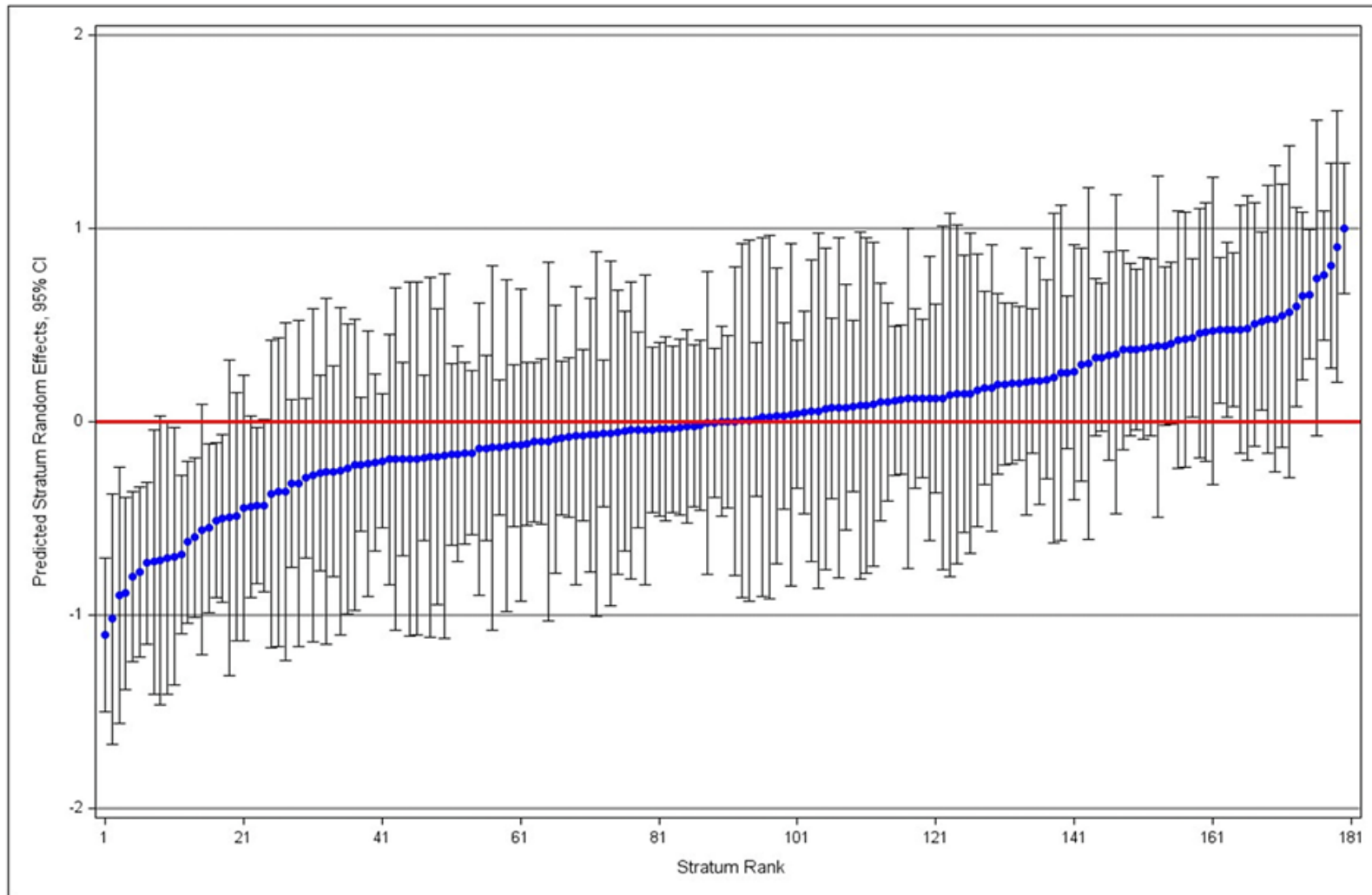


Fig. 2. Predicted body mass index (BMI) means by age, sex/gender, immigration status, education, and survey year for adults aged 18 or older: European Health Survey in Spain (2014 and 2020) and the Spanish National Health Survey (2017). Note: The reference gray line is the estimate for the intercept from model 1A (25.9 kg/m²).

FIGURE 1. PREDICTED STRATUM INTERACTION EFFECTS FOR BMI, FROM LOW TO HIGH, FOR ADULTS AGED 18 OR OLDER WHO PARTICIPATED IN THE EUROPEAN HEALTH SURVEY IN SPAIN (2014 AND 2020) AND THE SPANISH NATIONAL HEALTH SURVEY (2017)



LOWEST AND HIGHEST RANKED STRATA (N=180) FOR PREDICTED MEAN BMI WITH 95%CI FOR ADULTS WHO PARTICIPATED IN THE EUROPEAN HEALTH SURVEY IN SPAIN (2014, 2020) AND THE SPANISH NATIONAL HEALTH SURVEY (2017)

Stratum	N	Age group	Sex/gender	Immigrant status	Education	Survey	Predicted Mean BMI (95 % CI)
Lowest means							
12133	364	18–34	Woman	No	High	2020	22.4 (22.0, 22.9)
12131	474	18–34	Woman	No	High	2014	22.6 (22.2, 23.0)
22131	732	35–44	Woman	No	High	2014	22.7 (22.4, 23.0)
12132	437	18–34	Woman	No	High	2017	22.8 (22.4, 23.2)
12121	601	18–34	Woman	No	Middle	2014	23.0 (22.7, 23.3)
Highest means							
41223	29	55–64	Man	Yes	Middle	2020	28.1 (26.8, 29.5)
41113	903	55–64	Man	No	Low	2020	28.1 (27.9, 28.5)
32211	74	45–54	Woman	Yes	Low	2014	28.2 (27.3, 29.1)
52212	21	65 +	Woman	Yes	Low	2017	28.6 (27.1, 30.1)
42211	32	55–64	Woman	Yes	Low	2014	28.8 (27.5, 30.1)

NOTE: Age: 1) 18–34, 2) 35–44, 3) 45–55, 4) 56–65, 5) 65 + years; Sex/gender: 1) man, 2) woman; Immigration status: 1) No: born in Spain, 2) Yes: born outside Spain; Education: 1) low, 2) middle, 3) high; Survey year: 1) 2014, 2) 2017, 3) 2020. Predicted means were obtained from model 1B.

i-MAIHDA: limitaciones

- ¿Qué variables tenemos para definir los estratos sociales?
- Volvemos a agregar y categorizar
- Tamaño muestral (n° de estratos)



i-MAIHDA: limitaciones

- ¿Qué variables tenemos para definir los estratos sociales?
- Volvemos a agregar y categorizar
- Tamaño muestral (n° de estratos)

... y fortalezas

- No hay categoría de referencia
- Permite identificar variaciones inter e intra
- Más allá de medir el efecto de la interacción, se intenta capturar la experiencia interseccional



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