



CENTRO DE  
INVESTIGACIÓN EN  
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Universidad del Desarrollo  
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DCCS | DOCTORADO EN  
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COMPLEJIDAD SOCIAL

## Econometría

Trastornos por consumo de sustancias y hospitalizaciones por salud mental en Chile 2010-2022

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## 1 Introducción

### 1.1 Relevancia del problema

### 1.2 Pregunta de investigación

### 1.3 Modelo teórico o mecanismo que explicaría la relación entre las variables que se van a analizar e hipótesis

## 2 Metodología

### 2.1 Datos

### 2.2 Variables de interés

### 2.3 Modelos

## 3 Resultados

Tabla 1: Estadísticas descriptivas según el estado de hospitalización psiquiátrica

Variable	Level	No Mental Hosp	Mental Hosp	Total
<b>Sample Size</b>		90239	7456	97695
<b>First Treatment Duration (days)</b>		228.3 (198.3, 0.0, 93.0, 173.0, 305.0, 4056.0)	226.3 (220.6, 0.0, 84.0, 162.0, 300.0, 2947.0)	228.1 (200.1, 0.0, 92.0, 172.0, 305.0, 4056.0)
<b>Total Treatment Duration (days)</b>		300.8 (274.9, 0.0, 115.0, 222.0, 397.0, 6168.0)	463.4 (436.0, 0.0, 154.0, 333.0, 625.0, 4258.0)	313.2 (293.5, 0.0, 117.0, 229.0, 411.0, 6168.0)
<b>Number of Previous Mental Hospitalizations</b>		0.1 (0.7, 0.0, 0.0, 0.0, 0.0, 63.0)	1.0 (2.2, 0.0, 0.0, 0.0, 1.0, 31.0)	0.2 (0.9, 0.0, 0.0, 0.0, 0.0, 63.0)
<b>Number of Re-treatments</b>		0.3 (0.8, 0.0, 0.0, 0.0, 0.0, 11.0)	1.1 (1.5, 0.0, 0.0, 1.0, 2.0, 14.0)	0.4 (0.9, 0.0, 0.0, 0.0, 1.0, 14.0)
<b>Total Number of Treatments</b>		1.3 (0.8, 1.0, 1.0, 1.0, 1.0, 12.0)	2.1 (1.5, 1.0, 1.0, 2.0, 3.0, 15.0)	1.4 (0.9, 1.0, 1.0, 1.0, 2.0, 15.0)
<b>Sex</b>	Female	22778 (25.2%)	2627 (35.2%)	25405 (26.0%)
	Male	67461 (74.8%)	4829 (64.8%)	72290 (74.0%)
	Alcohol	31137 (34.5%)	2633 (35.3%)	33770 (34.6%)
	Other substances	400 (0.4%)	52 (0.7%)	452 (0.5%)
<b>Principal Substance</b>	Cocaine	18014 (20.0%)	1190 (16.0%)	19204 (19.7%)
	Depressants	1372 (1.5%)	237 (3.2%)	1609 (1.6%)
	Marijuana	6737 (7.5%)	470 (6.3%)	7207 (7.4%)
	Cocaine paste	32579 (36.1%)	2874 (38.5%)	35453 (36.3%)
<b>Plan Type</b>	Outpatient	81024 (89.8%)	5987 (80.3%)	87011 (89.1%)
	Residential	9215 (10.2%)	1469 (19.7%)	10684 (10.9%)
<b>Previous Mental Hospitalization</b>	No	82324 (91.2%)	4660 (62.5%)	86984 (89.0%)
	Yes	7915 (8.8%)	2796 (37.5%)	10711 (11.0%)
	0	69368 (76.9%)	3375 (45.3%)	72743 (74.5%)
<b>Re-treatments Category</b>	1	14276 (15.8%)	1994 (26.7%)	16270 (16.7%)
	2	4185 (4.6%)	989 (13.3%)	5174 (5.3%)
	3+	2410 (2.7%)	1098 (14.7%)	3508 (3.6%)
	Late Dropout	31440 (34.8%)	2246 (30.1%)	33686 (34.5%)
	Early Dropout	14023 (15.5%)	1126 (15.1%)	15149 (15.5%)
<b>Discharge Reason</b>	Administrative Discharge	7165 (7.9%)	703 (9.4%)	7868 (8.1%)
	Therapeutic Discharge	23731 (26.3%)	1467 (19.7%)	25198 (25.8%)
	Referral	13879 (15.4%)	1914 (25.7%)	15793 (16.2%)
	NA	1 (0.0%)	0 (0.0%)	1 (0.0%)
<b>Marital Status</b>	Divorced / Separated	9359 (10.4%)	982 (13.2%)	10341 (10.6%)
	Married / Partnered	30592 (33.9%)	2158 (28.9%)	32750 (33.5%)
	Other / No answer	185 (0.2%)	18 (0.2%)	203 (0.2%)
	Single	49038 (54.3%)	4194 (56.2%)	53232 (54.5%)
	Widowed	1065 (1.2%)	104 (1.4%)	1169 (1.2%)
<b>Education Level</b>	Primary or less	23823 (26.4%)	1970 (26.4%)	25793 (26.4%)
	Secondary	49018 (54.3%)	3822 (51.3%)	52840 (54.1%)
	University or higher	7329 (8.1%)	739 (9.9%)	8068 (8.3%)
	Unknown	415 (0.5%)	39 (0.5%)	454 (0.5%)
	Technical	9578 (10.6%)	886 (11.9%)	10464 (10.7%)
	NA	76 (0.1%)	0 (0.0%)	76 (0.1%)
<b>Employment Status</b>	Unemployed	28646 (31.7%)	3102 (41.6%)	31748 (32.5%)
	Studying	1306 (1.4%)	86 (1.2%)	1392 (1.4%)
	Other	7890 (8.7%)	775 (10.4%)	8665 (8.9%)
	Retired / Pensioned	1358 (1.5%)	234 (3.1%)	1592 (1.6%)
	Household tasks	5328 (5.9%)	632 (8.5%)	5960 (6.1%)
	Working	45711 (50.7%)	2627 (35.2%)	48338 (49.5%)
<b>Treatment Center Region</b>	De Antofagasta	3574 (4.0%)	207 (2.8%)	3781 (3.9%)
	De Arica Y Parinacota	2096 (2.3%)	261 (3.5%)	2357 (2.4%)
	De Atacama	2459 (2.7%)	108 (1.4%)	2567 (2.6%)
	De Aysen Del General Carlos Ibáñez Del Campo	964 (1.1%)	160 (2.1%)	1124 (1.2%)
	De Coquimbo	3661 (4.1%)	139 (1.9%)	3800 (3.9%)
	De La Araucanía	2555 (2.8%)	246 (3.3%)	2801 (2.9%)
	De Los Lagos	3419 (3.8%)	403 (5.4%)	3822 (3.9%)
	De Los Ríos	1471 (1.6%)	152 (2.0%)	1623 (1.7%)
	De Magallanes Y La Antártica Chilena	1089 (1.2%)	195 (2.6%)	1284 (1.3%)
	De Ñuble	687 (0.8%)	83 (1.1%)	770 (0.8%)
	De Tarapacá	2019 (2.2%)	309 (4.1%)	2328 (2.4%)
	De Valparaíso	6681 (7.4%)	866 (11.6%)	7547 (7.7%)
	Del Bío-Bío	6293 (7.0%)	563 (7.6%)	6856 (7.0%)
	Del Libertador General Bernardo O'Higgins	4725 (5.2%)	315 (4.2%)	5040 (5.2%)
	Del Maule	5401 (6.0%)	375 (5.0%)	5776 (5.9%)
	Metropolitana	43144 (47.8%)	3074 (41.2%)	46218 (47.3%)
	NA	1 (0.0%)	0 (0.0%)	1 (0.0%)

Note:

For numeric variables: mean (sd, min, q1, median, q3, max). For categorical variables: n (%)

Tabla 2: Modelos de regresión logística (Logit): Predictores de la hospitalización psiquiátrica posterior al tratamiento rehabilitador de drogas

Variable	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Intercept	-2.756*** [-2.871, -2.641]	-2.831*** [-2.946, -2.715]	-2.972*** [-3.092, -2.852]	-3.593*** [-3.721, -3.464]	-3.549*** [-3.943, -3.156]	-3.800*** [-4.225, -3.375]	-5.395*** [-5.923, -4.866]
Substance: Other substances	0.454** [0.160, 0.747]	0.422** [0.128, 0.717]	0.283 [0.030, 0.596]	0.354* [0.031, 0.677]	0.336* [0.013, 0.659]	0.271 [-0.051, 0.593]	0.026 [-0.536, 0.587]
Substance: Cocaine	-0.136*** [-0.210, -0.062]	-0.166*** [-0.240, -0.092]	-0.086* [-0.162, -0.010]	-0.191*** [-0.269, -0.113]	-0.188*** [-0.267, -0.110]	-0.120** [-0.201, -0.038]	-0.019 [-0.154, 0.117]
Substance: Depressants	0.569*** [0.424, 0.715]	0.544*** [0.398, 0.690]	0.458*** [0.304, 0.612]	0.485*** [0.325, 0.645]	0.463*** [0.303, 0.623]	0.435*** [0.273, 0.596]	0.463*** [0.243, 0.683]
Substance: Marijuana	-0.038 [-0.143, 0.068]	-0.025 [-0.130, 0.081]	-0.023 [-0.133, 0.086]	-0.013 [-0.125, 0.099]	-0.019 [-0.131, 0.093]	0.013 [-0.101, 0.127]	-0.093 [-0.301, 0.116]
Substance: Cocaine paste	0.150** [0.091, 0.208]	0.007 [-0.053, 0.068]	0.101** [0.039, 0.163]	-0.149*** [-0.214, -0.084]	-0.138*** [-0.203, -0.073]	-0.105** [-0.175, -0.036]	0.042 [-0.068, 0.153]
Age	0.013*** [0.011, 0.016]	0.014*** [0.011, 0.016]	0.011*** [0.009, 0.013]	0.013*** [0.011, 0.016]	0.015*** [0.013, 0.018]	0.015*** [0.012, 0.018]	0.089*** [0.074, 0.105]
Sex: Male	-0.470*** [-0.521, -0.420]	-0.447*** [-0.498, -0.396]	-0.382*** [-0.434, -0.329]	-0.245*** [-0.300, -0.191]	-0.251*** [-0.305, -0.196]	-0.215*** [-0.275, -0.155]	-0.105* [-0.203, -0.006]
Plan: Residential	0.763*** [0.699, 0.827]	0.527*** [0.459, 0.594]	0.421*** [0.351, 0.490]	0.402*** [0.332, 0.472]	0.284*** [0.210, 0.358]	0.279*** [0.205, 0.353]	
Nº previous mental hosp.		0.520*** [0.498, 0.542]	0.524*** [0.502, 0.546]	0.517*** [0.495, 0.540]	0.483*** [0.460, 0.505]	0.478*** [0.455, 0.500]	
Retreatments: 1			1.063*** [1.002, 1.124]	1.063*** [1.002, 1.124]	1.059*** [0.998, 1.121]	1.048*** [0.986, 1.110]	
Retreatments: 2			1.619*** [1.538, 1.701]	1.619*** [1.537, 1.700]	1.615*** [1.533, 1.697]	1.597*** [1.514, 1.679]	
Retreatments: 3+			2.291*** [2.206, 2.375]	2.288*** [2.203, 2.372]	2.302*** [2.216, 2.387]	2.277*** [2.191, 2.362]	
Education: Primary				-0.078	-0.091	-0.066	
Education: Secondary				-0.439, 0.284]	-0.454, 0.272]	-0.430, 0.297]	
Education: University				-0.109	-0.111	-0.097	
Education: Higher technical				-0.469, 0.251]	-0.473, 0.251]	-0.459, 0.266]	
Marital status: Married/Partnered				-0.306, 0.429]	-0.321, 0.419]	-0.322, 0.419]	
Marital status: Other/No answer				0.015	0.021	0.016	
Marital status: Single				-0.351, 0.380]	-0.347, 0.389]	-0.352, 0.385]	
Marital status: Widowed				-0.153***	-0.123**	-0.126**	
Occupation: Studying				-0.239, -0.067]	-0.210, -0.036]	-0.213, -0.039]	
Occupation: Other				0.085	-0.001	0.029	
Occupation: Retired/Pensioned				-0.443, 0.613]	-0.539, 0.536]	-0.508, 0.567]	
Occupation: Household tasks				0.015	0.003	0.016	
Occupation: Working				-0.070, 0.100]	-0.083, 0.089]	-0.070, 0.101]	
Age <sup>2</sup>				-0.186	-0.244*	-0.113	
Interaction: Male × Other substances				-0.415, 0.042]	-0.475, -0.013]	-0.345, 0.120]	
Interaction: Male × Cocaine					-0.251*	-0.129	
Interaction: Male × Depressants					-0.488, -0.014]	-0.367, 0.110]	
Interaction: Male × Marijuana					-0.139**	-0.119*	
Interaction: Male × Cocaine paste					-0.230, -0.047]	-0.211, -0.027]	
<b>Model statistics</b>					0.128	0.359***	
N observations	97,618	97,618	97,618	97,618	97,618	97,618	97,618
Log Likelihood	-26023.76	-25776.08	-24435.20	-22629.97	-22602.34	-22290.06	-22223.12
Deviance	52047.51	51552.15	48870.41	45259.94	45204.68	44580.12	44446.24
AIC	52063.51	51570.15	48890.41	45285.94	45246.68	44662.12	44540.24
BIC	52139.42	51655.55	48985.29	45409.29	45445.94	45051.16	44986.21
Pseudo R <sup>2</sup> (McFadden)	0.012	0.021	0.072	0.141	0.142	0.154	0.156
Pseudo R <sup>2</sup> (Nagelkerke)	0.016	0.028	0.092	0.176	0.177	0.191	0.194

Note:

\*\*\* p < 0.001, \*\* p < 0.01, \* p < 0.05

95% Confidence intervals in brackets

Reference categories: Alcohol (substance), Female (sex), Outpatient (plan), etc.

Models 6-7 additionally adjusted for Region

Model 7 includes Sex × Substance interaction and Age<sup>2</sup>

Tabla 3: Modelos de regresión Probit: Predictores de la hospitalización psiquiátrica posterior al tratamiento rehabilitador de drogas

Variable	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Intercept	-1.563*** [-1.620, -1.506]	-1.600*** [-1.658, -1.543]	-1.670*** [-1.729, -1.611]	-1.958*** [-2.021, -1.895]	-1.917*** [-2.113, -1.721]	-2.040*** [-2.252, -1.828]	-2.747*** [-3.006, -2.488]
Substance: Other substances	0.239** [0.086, 0.393]	0.218** [0.064, 0.373]	0.145 [0.017, 0.306]	0.174* [0.006, 0.341]	0.163 [-0.004, 0.331]	0.131 [-0.037, 0.299]	-0.009 [-0.297, 0.278]
Substance: Cocaine	-0.067*** [-0.103, -0.031]	-0.081*** [-0.117, -0.045]	-0.041* [-0.078, -0.005]	-0.095*** [-0.134, -0.057]	-0.093*** [-0.132, -0.055]	-0.061** [-0.101, -0.021]	-0.013 [-0.082, 0.056]
Substance: Depressants	0.304*** [0.226, 0.383]	0.291*** [0.212, 0.370]	0.246** [0.165, 0.328]	0.254*** [0.170, 0.339]	0.245*** [0.160, 0.330]	0.230*** [0.144, 0.315]	0.240*** [0.123, 0.356]
Substance: Marijuana	-0.016 [-0.067, 0.035]	-0.010 [-0.061, 0.042]	-0.014 [-0.067, 0.039]	-0.006 [-0.061, 0.048]	-0.010 [-0.065, 0.045]	0.006 [-0.050, 0.062]	-0.052 [-0.156, 0.051]
Substance: Cocaine paste	0.073** [0.043, 0.102]	0.007 [-0.023, 0.037]	0.050** [0.020, 0.081]	-0.067*** [-0.099, -0.035]	-0.062*** [-0.094, -0.029]	-0.046** [-0.080, -0.011]	0.028 [-0.029, 0.085]
Age	0.007*** [0.006, 0.008]	0.007*** [0.006, 0.008]	0.006*** [0.004, 0.007]	0.007*** [0.005, 0.008]	0.008*** [0.006, 0.009]	0.007*** [0.006, 0.009]	0.040*** [0.033, 0.048]
Sex: Male	-0.234*** [-0.259, -0.209]	-0.223*** [-0.248, -0.197]	-0.194*** [-0.220, -0.167]	-0.127*** [-0.154, -0.099]	-0.129*** [-0.157, -0.101]	-0.112*** [-0.142, -0.081]	-0.058* [-0.108, -0.009]
Plan: Residential	0.388*** [0.354, 0.421]	0.273*** [0.238, 0.308]	0.226*** [0.189, 0.262]	0.217*** [0.180, 0.254]	0.158*** [0.119, 0.196]	0.155*** [0.116, 0.194]	
Nº previous mental hosp.		0.260*** [0.248, 0.272]	0.261*** [0.249, 0.273]	0.258*** [0.246, 0.270]	0.243*** [0.231, 0.255]	0.242*** [0.229, 0.254]	
Retreatments: 1			0.517*** [0.487, 0.548]	0.518*** [0.487, 0.548]	0.517*** [0.486, 0.548]	0.512*** [0.481, 0.543]	
Retreatments: 2			0.819*** [0.775, 0.863]	0.819*** [0.775, 0.863]	0.816*** [0.771, 0.860]	0.808*** [0.763, 0.852]	
Retreatments: 3+			1.209*** [1.161, 1.256]	1.207*** [1.159, 1.255]	1.212*** [1.164, 1.261]	1.201*** [1.152, 1.249]	
Education: Primary				-0.053 [-0.233, 0.127]	-0.056 [-0.238, 0.126]	-0.043 [-0.226, 0.139]	
Education: Secondary				-0.072 [-0.251, 0.107]	-0.068 [-0.249, 0.113]	-0.060 [-0.242, 0.121]	
Education: University				0.017 [-0.167, 0.200]	0.014 [-0.171, 0.200]	0.016 [-0.170, 0.201]	
Education: Higher technical				-0.011 [-0.193, 0.172]	-0.002 [-0.186, 0.182]	-0.002 [-0.187, 0.182]	
Marital status: Married/Partnered				-0.078*** [-0.122, -0.035]	-0.065** [-0.109, -0.022]	-0.068** [-0.112, -0.024]	
Marital status: Other/No answer				0.006 [-0.264, 0.277]	-0.040 [-0.315, 0.235]	-0.022 [-0.297, 0.252]	
Marital status: Single				0.005 [-0.038, 0.048]	-0.004 [-0.047, 0.040]	0.000 [-0.043, 0.044]	
Marital status: Widowed				-0.095 [-0.211, 0.020]	-0.126* [-0.243, -0.009]	-0.065 [-0.183, 0.052]	
Occupation: Studying					-0.128* [-0.243, -0.012]	-0.074 [-0.191, 0.042]	
Occupation: Other					-0.074** [-0.121, -0.028]	-0.064** [-0.111, -0.018]	
Occupation: Retired/Pensioned					0.067 [-0.024, 0.157]	0.170*** [0.076, 0.265]	
Occupation: Household tasks					-0.044 [-0.100, 0.012]	-0.047 [-0.103, 0.010]	
Occupation: Working					-0.178*** [-0.209, -0.148]	-0.186*** [-0.217, -0.155]	
Age <sup>2</sup>					-0.000*** [-0.000, -0.000]		
Interaction: Male × Other substances					0.257 [-0.098, 0.612]		
Interaction: Male × Cocaine					-0.078 [-0.159, 0.003]		
Interaction: Male × Depressants					0.061 [-0.112, 0.234]		
Interaction: Male × Marijuana					0.096 [-0.025, 0.216]		
Interaction: Male × Cocaine paste					-0.126*** [-0.191, -0.060]		
<b>Model statistics</b>							
N observations	97,618	97,618	97,618	97,618	97,618	97,618	97,618
Log Likelihood	-26021.79	-25776.43	-24439.56	-22653.35	-22625.26	-22325.50	-22264.94
Deviance	52043.57	51552.86	48879.12	45306.71	45250.52	44651.00	44529.88
AIC	52059.57	51570.86	48899.12	45332.71	45292.52	44733.00	44623.88
BIC	52135.48	51656.26	48994.01	45456.06	45491.78	45122.04	45069.85
Pseudo R <sup>2</sup> (McFadden)	0.012	0.021	0.072	0.140	0.141	0.152	0.155
Pseudo R <sup>2</sup> (Nagelkerke)	0.016	0.028	0.092	0.174	0.176	0.189	0.192

Note:

\*\*\* p < 0.001, \*\* p < 0.01, \* p < 0.05

95% Confidence intervals in brackets

Reference categories: Alcohol (substance), Female (sex), Outpatient (plan), etc.

Models 6-7 additionally adjusted for Region

Model 7 includes Sex × Substance interaction and Age<sup>2</sup>

Tabla 4: Modelos de regresión logística con ajuste (Firth): Predictores de hospitalización psiquiátrica posterior al tratamiento rehabilitador de drogas

Variable	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Intercept	-2.756*** [-2.870, -2.641]	-2.830*** [-2.946, -2.715]	-2.971*** [-3.091, -2.851]	-3.592*** [-3.720, -3.463]	-3.536*** [-3.928, -3.144]	-3.784*** [-4.208, -3.361]	-5.374*** [-5.901, -4.847]
Substance: Other substances	0.462** [0.169, 0.755]	0.430** [0.137, 0.724]	0.292 [0.020, 0.604]	0.362* [0.040, 0.684]	0.344* [0.022, 0.666]	0.279 [-0.043, 0.600]	0.052 [-0.504, 0.608]
Substance: Cocaine	-0.136*** [-0.210, -0.062]	-0.166*** [-0.240, -0.092]	-0.086* [-0.162, -0.010]	-0.191*** [-0.269, -0.113]	-0.188*** [-0.266, -0.110]	-0.120** [-0.201, -0.038]	-0.018 [-0.154, 0.117]
Substance: Depressants	0.571*** [0.425, 0.716]	0.545*** [0.400, 0.691]	0.460*** [0.306, 0.613]	0.486*** [0.327, 0.646]	0.465*** [0.304, 0.625]	0.436*** [0.274, 0.597]	0.465*** [0.245, 0.685]
Substance: Marijuana	-0.037 [-0.143, 0.069]	-0.024 [-0.130, 0.082]	-0.022 [-0.132, 0.087]	-0.012 [-0.124, 0.100]	-0.018 [-0.130, 0.094]	0.014 [-0.100, 0.127]	-0.090 [-0.298, 0.119]
Substance: Cocaine paste	0.150** [0.091, 0.208]	0.007 [-0.053, 0.068]	0.101** [0.038, 0.163]	-0.149*** [-0.214, -0.084]	-0.138*** [-0.203, -0.073]	-0.105** [-0.175, -0.036]	0.042 [-0.068, 0.153]
Age	0.013*** [0.011, 0.016]	0.014*** [0.011, 0.016]	0.011*** [0.009, 0.013]	0.013*** [0.011, 0.016]	0.015*** [0.013, 0.018]	0.015*** [0.012, 0.018]	0.089*** [0.074, 0.104]
Sex: Male	-0.470*** [-0.521, -0.420]	-0.447*** [-0.498, -0.397]	-0.382*** [-0.434, -0.329]	-0.245*** [-0.300, -0.191]	-0.251*** [-0.305, -0.196]	-0.215*** [-0.275, -0.155]	-0.105* [-0.203, -0.007]
Plan: Residential	0.763*** [0.699, 0.827]	0.527*** [0.459, 0.594]	0.421*** [0.351, 0.490]	0.402*** [0.332, 0.472]	0.284*** [0.210, 0.358]	0.279*** [0.205, 0.353]	
Nº previous mental hosp.		0.520*** [0.498, 0.542]	0.524*** [0.501, 0.546]	0.517*** [0.494, 0.539]	0.482*** [0.460, 0.504]	0.477*** [0.454, 0.499]	
Retreatments: 1			1.063*** [1.002, 1.124]	1.063*** [1.002, 1.124]	1.059*** [0.997, 1.120]	1.047*** [0.986, 1.109]	
Retreatments: 2			1.619*** [1.538, 1.701]	1.619*** [1.537, 1.700]	1.614*** [1.532, 1.697]	1.596*** [1.513, 1.678]	
Retreatments: 3+			2.290*** [2.206, 2.374]	2.287*** [2.203, 2.371]	2.300*** [2.215, 2.385]	2.275*** [2.189, 2.360]	
Education: Primary			-0.089	-0.103	-0.078		
Education: Secondary			-0.449, 0.270	-0.464, 0.259	-0.440, 0.284		
Education: University			-0.121	-0.122	-0.108		
Education: Higher technical			-0.479, 0.237	-0.482, 0.238	-0.469, 0.252		
Marital status: Married/Partnered			0.050	0.038	0.038		
Marital status: Other/No answer			-0.316, 0.416	-0.330, 0.406	-0.331, 0.406		
Marital status: Single			0.003	0.010	0.005		
Marital status: Widowed			-0.361, 0.367	-0.356, 0.376	-0.361, 0.372		
Occupation: Studying			-0.153*** [-0.239, -0.067]	-0.123** [-0.210, -0.036]	-0.126** [-0.213, -0.039]		
Occupation: Other			0.109	0.023	0.054		
Occupation: Retired/Pensioned			-0.414, 0.632	-0.509, 0.555	-0.478, 0.586		
Occupation: Household tasks			0.015	0.003	0.015		
Occupation: Working			-0.070, 0.100	-0.083, 0.088	-0.070, 0.101		
Age <sup>2</sup>			-0.182	-0.240*	-0.109		
Interaction: Male × Other substances			-0.411, 0.046	-0.471, -0.010	-0.341, 0.123		
Interaction: Male × Cocaine			-0.246*	-0.124			
Interaction: Male × Depressants			-0.483, -0.010	-0.362, 0.114			
Interaction: Male × Marijuana			-0.138** [-0.230, -0.047]	-0.118* [-0.210, -0.027]			
Interaction: Male × Cocaine paste			0.130	0.360***			
<b>Model statistics</b>							
N observations	97,618	97,618	97,618	97,618	97,618	97,618	97,618
Log Likelihood	-26023.76	-25776.08	-24435.22	-22629.97	-22602.35	-22290.09	-22223.16
Deviance	52047.52	51552.16	48870.44	45259.94	45204.70	44580.18	44446.33
AIC	52063.52	51570.16	48890.44	45285.94	45246.70	44662.18	44540.33
BIC	52139.43	51655.56	48985.33	45409.30	45445.97	45051.23	44986.30
Pseudo R <sup>2</sup> (McFadden)	0.012	0.021	0.072	0.141	0.142	0.154	0.156
Pseudo R <sup>2</sup> (Nagelkerke)	0.016	0.028	0.092	0.176	0.177	0.191	0.194

Note:

\*\*\* p < 0.001, \*\* p < 0.01, \* p < 0.05

95% Confidence intervals in brackets

Reference categories: Alcohol (substance), Female (sex), Outpatient (plan), etc.

Models 6-7 additionally adjusted for Region

Model 7 includes Sex × Substance interaction and Age<sup>2</sup>

Tabla 5: Model Comparison - AIC and AUC across Model Types

Model	Logit AIC	Probit AIC	Firth AIC	Logit AUC	Probit AUC	Firth AUC
<b>Model 1</b>	52063.51	52059.57	52063.52	0.5835	0.5838	0.5835
<b>Model 2</b>	51570.15	51570.86	51570.16	0.6074	0.6075	0.6074
<b>Model 3</b>	48890.41	48899.12	48890.44	0.6923	0.6920	0.6923
<b>Model 4</b>	45285.94	45332.71	45285.94	0.7672	0.7672	0.7672
<b>Model 5</b>	45246.68	45292.52	45246.70	0.7680	0.7681	0.7680
<b>Model 6</b>	44662.12	44733.00	44662.18	0.7768	0.7770	0.7768
<b>Model 7</b>	44540.24	44623.88	44540.33	0.7787	0.7789	0.7786

Tabla 6: Comparación de modelos de regresión logística anidados

Model Comparison	Df	LR Chi <sup>2</sup>	P-value
<b>Null vs Model 1</b>	7	634.227	< 0.001***
<b>Model 1 vs Model 2</b>	1	495.357	< 0.001***
<b>Model 2 vs Model 3</b>	1	2681.749	< 0.001***
<b>Model 3 vs Model 4</b>	3	3610.469	< 0.001***
<b>Model 4 vs Model 5</b>	8	55.261	< 0.001***
<b>Model 5 vs Model 6</b>	20	624.556	< 0.001***
<b>Model 6 vs Model 7</b>	6	133.880	< 0.001***

Note:

\*\*\* p < 0.001, \*\* p < 0.01, \* p < 0.05

Likelihood ratio tests comparing nested models

Tabla 7: Comparaciones de modelos de regresión Probit anidados

Model Comparison	Df	LR Chi <sup>2</sup>	P-value
<b>Null vs Model 1</b>	7	638.166	< 0.001***
<b>Model 1 vs Model 2</b>	1	490.708	< 0.001***
<b>Model 2 vs Model 3</b>	1	2673.743	< 0.001***
<b>Model 3 vs Model 4</b>	3	3572.411	< 0.001***
<b>Model 4 vs Model 5</b>	8	56.195	< 0.001***
<b>Model 5 vs Model 6</b>	20	599.518	< 0.001***
<b>Model 6 vs Model 7</b>	6	121.118	< 0.001***

Note:

\*\*\* p < 0.001, \*\* p < 0.01, \* p < 0.05

Likelihood ratio tests comparing nested models

Tabla 8: Comparaciones de modelos de regresión logística con ajuste de Firth anidados

Model Comparison	Df	LR Chi <sup>2</sup>	P-value
<b>Null vs Model 1</b>	7	634.222	< 0.001***
<b>Model 1 vs Model 2</b>	1	495.356	< 0.001***
<b>Model 2 vs Model 3</b>	1	2681.722	< 0.001***
<b>Model 3 vs Model 4</b>	3	3610.494	< 0.001***
<b>Model 4 vs Model 5</b>	8	55.241	< 0.001***
<b>Model 5 vs Model 6</b>	20	624.519	< 0.001***
<b>Model 6 vs Model 7</b>	6	133.856	< 0.001***

Note:

\*\*\* p < 0.001, \*\* p < 0.01, \* p < 0.05

Likelihood ratio tests comparing nested models

Tabla 9: Performance Metrics for All Models

Model	AUC	Sens	Spec	Acc	Prec	NPV
<b>Standard Logit Models</b>						
Logit Model 1	0.584	0.402	0.714	0.690	0.104	0.935
Logit Model 2	0.607	0.435	0.728	0.706	0.117	0.940
Logit Model 3	0.692	0.561	0.740	0.726	0.151	0.953
Logit Model 4	0.767	0.714	0.700	0.701	0.165	0.967
Logit Model 5	0.768	0.672	0.742	0.737	0.177	0.965
Logit Model 6	0.777	0.655	0.771	0.762	0.191	0.964
Logit Model 7	0.779	0.636	0.793	0.781	0.202	0.963
<b>Probit Models</b>						
Probit Model 1	0.584	0.402	0.715	0.691	0.104	0.935
Probit Model 2	0.607	0.430	0.732	0.709	0.117	0.940
Probit Model 3	0.692	0.560	0.740	0.726	0.151	0.953
Probit Model 4	0.767	0.683	0.732	0.728	0.174	0.965
Probit Model 5	0.768	0.679	0.737	0.733	0.176	0.965
Probit Model 6	0.777	0.656	0.771	0.762	0.191	0.964
Probit Model 7	0.779	0.643	0.786	0.775	0.199	0.964
<b>Firth Logit Models</b>						
Firth Model 1	0.584	0.402	0.714	0.690	0.104	0.935
Firth Model 2	0.607	0.435	0.728	0.705	0.117	0.940
Firth Model 3	0.692	0.561	0.740	0.726	0.151	0.953
Firth Model 4	0.767	0.714	0.700	0.701	0.165	0.967
Firth Model 5	0.768	0.672	0.742	0.737	0.177	0.965
Firth Model 6	0.777	0.656	0.770	0.761	0.191	0.964
Firth Model 7	0.779	0.636	0.792	0.780	0.202	0.963

Notes:

AUC = Area Under ROC Curve; Sens = Sensitivity; Spec = Specificity; Acc = Accuracy

Prec = Precision (PPV); NPV = Negative Predictive Value; F1 = F1 Score

Bal Acc = Balanced Accuracy; MCC = Matthews Correlation Coefficient; Brier = Brier Score

Threshold = Optimal threshold based on Youden's J statistic

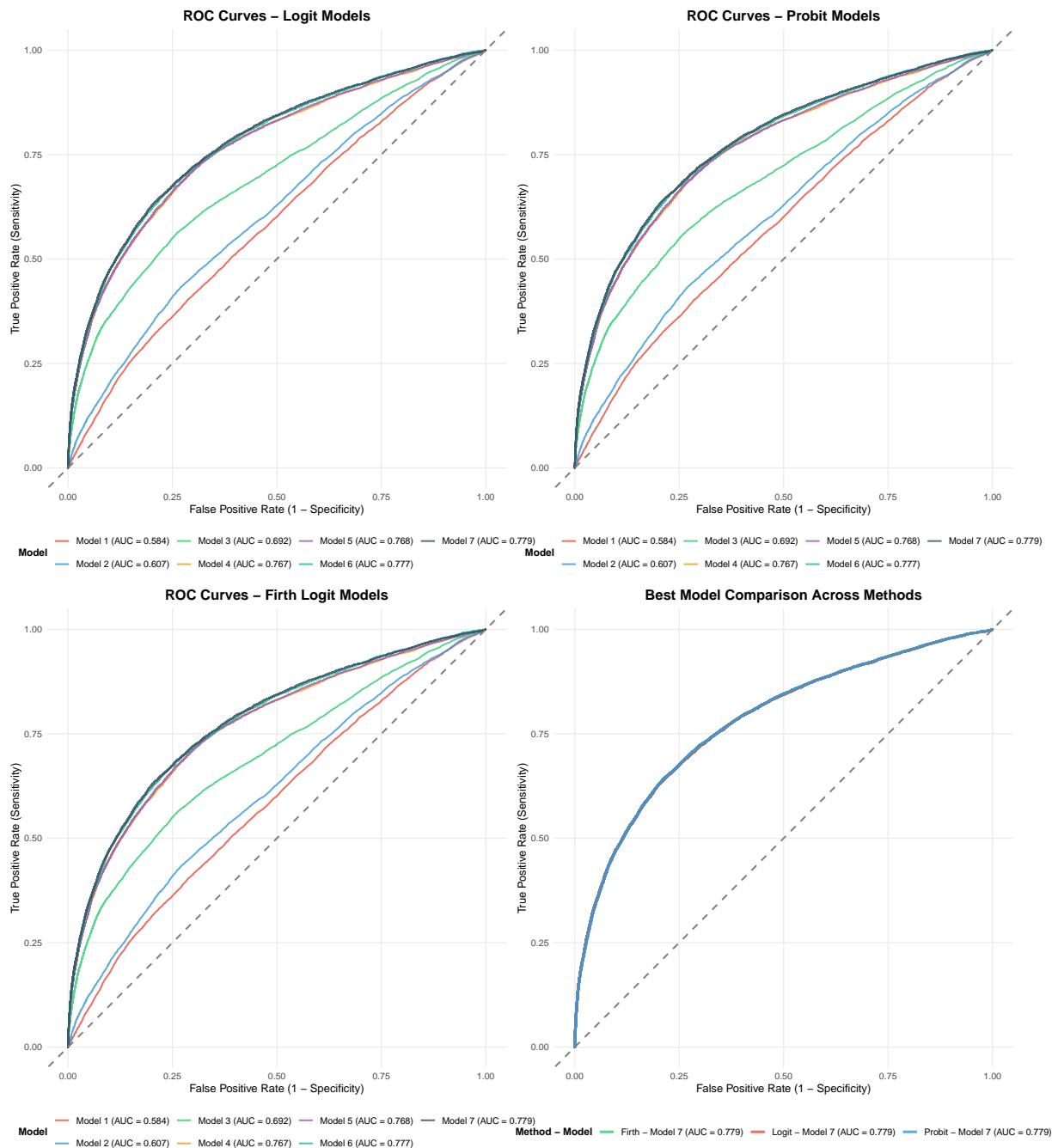


Figura 1: Curvas ROC (Característica Operativa del Receptor) que comparan el rendimiento predictivo de siete modelos utilizando tres métodos de estimación diferentes: regresión logística estándar (logit), regresión probit y regresión logística penalizada de Firth. El cuarto panel muestra una comparación del modelo con mejor rendimiento de cada método. Cada curva muestra el equilibrio entre sensibilidad y especificidad con los valores correspondientes del Área Bajo la Curva (AUC) para la evaluación del modelo.

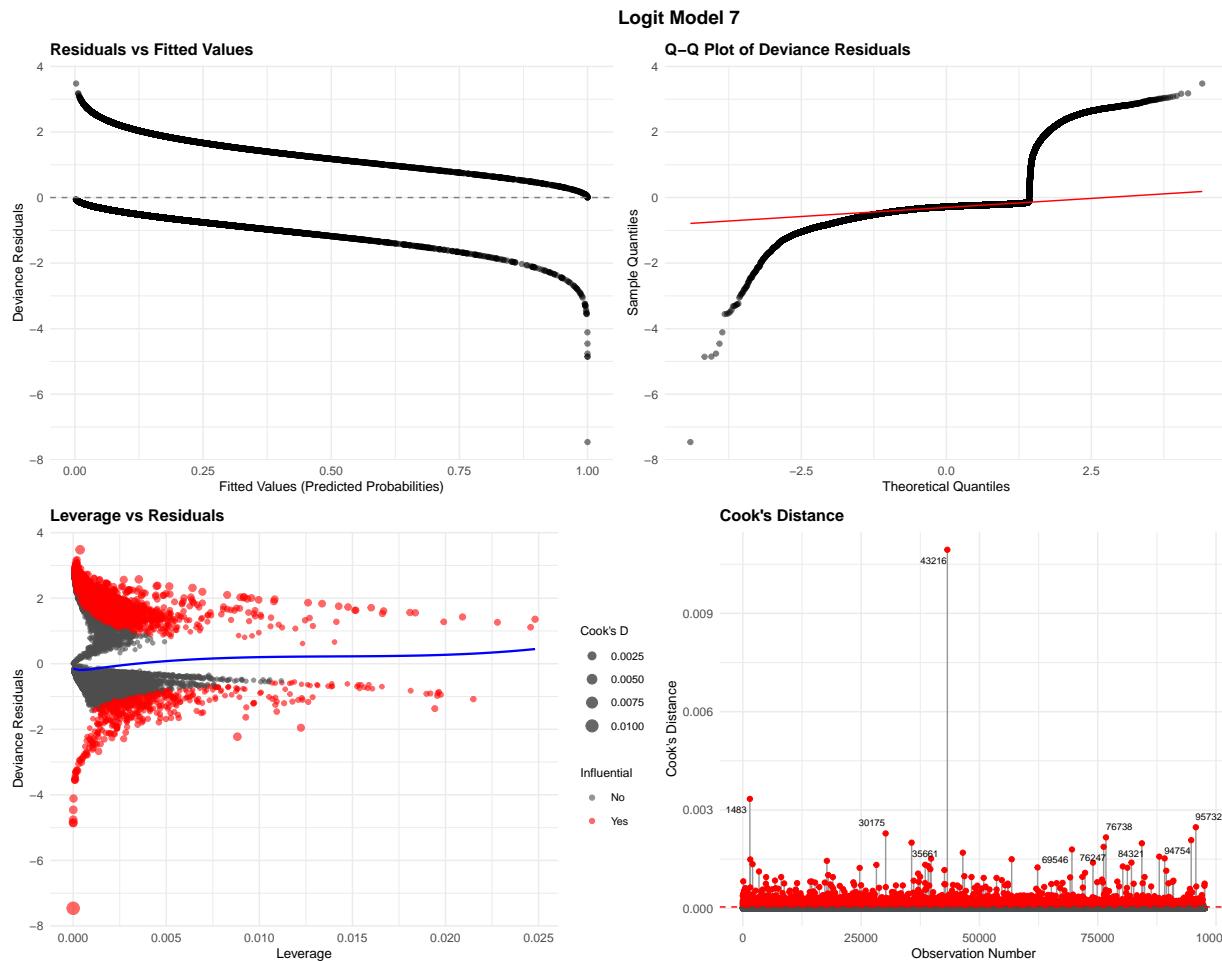


Figura 2: Gráficos de diagnóstico para evaluar los supuestos del modelo e identificar observaciones influentes en las variantes del Modelo 7. Cada fila representa un método de estimación diferente (logit estándar, probit y logit ajustado de Firth). La visualización de cuatro paneles incluye: (1) Residuos de desviación frente a valores ajustados para evaluar la linealidad y la homocedasticidad, (2) Gráficos Q–Q para evaluar la dsitribución de los residuos, (3) Laverage frente a residuos para identificar valores atípicos y puntos de altos de leverage, y (4) Distancia de Cook para detectar observaciones influyentes que puedan afectar indebidamente las estimaciones del modelo.

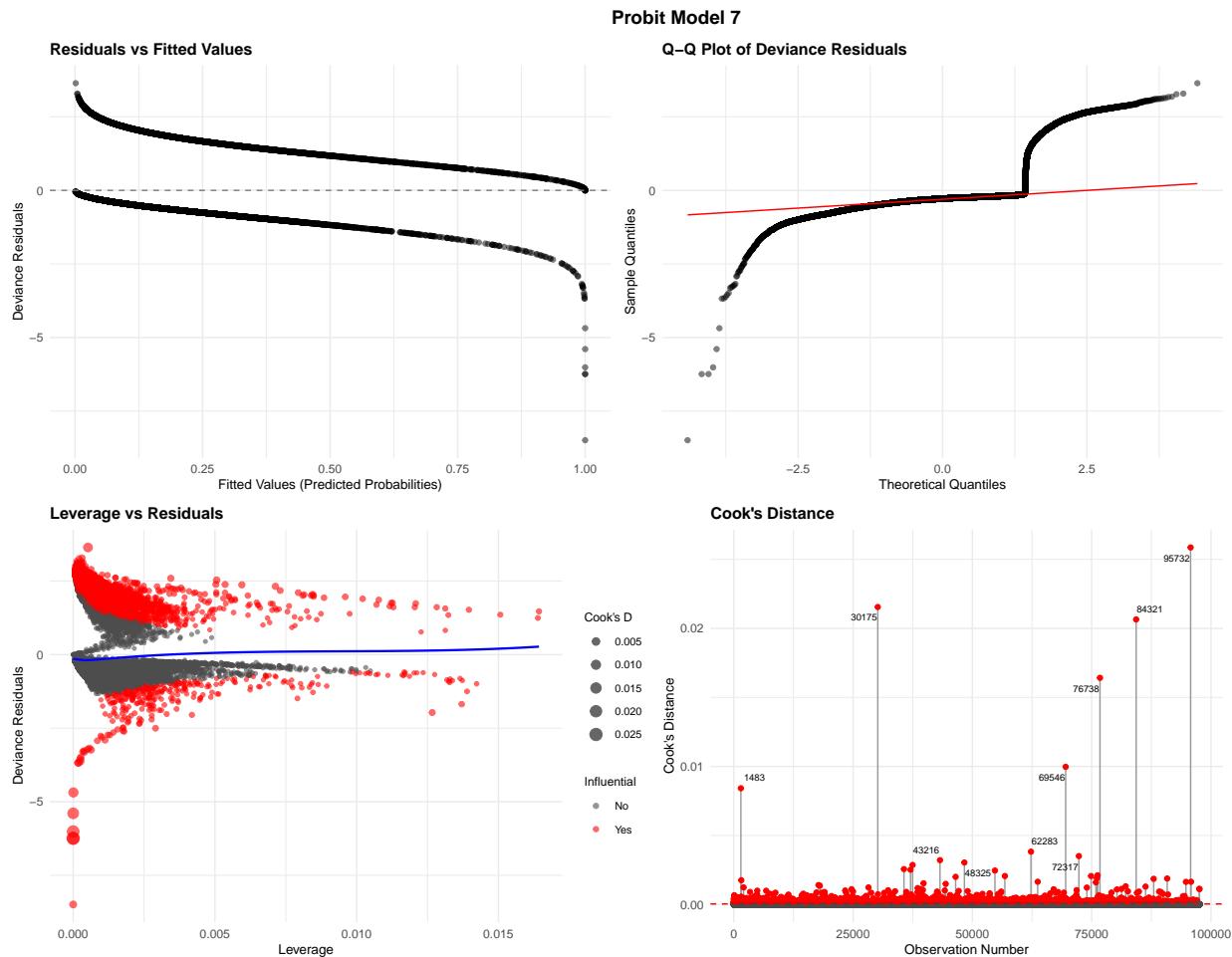


Figura 3: Gráficos de diagnóstico para evaluar los supuestos del modelo e identificar observaciones influentes en las variantes del Modelo 7. Cada fila representa un método de estimación diferente (logit estándar, probit y logit ajustado de Firth). La visualización de cuatro paneles incluye: (1) Residuos de desviación frente a valores ajustados para evaluar la linealidad y la homocedasticidad, (2) Gráficos Q-Q para evaluar la dsitribución de los residuos, (3) Laverage frente a residuos para identificar valores atípicos y puntos de altos de leverage, y (4) Distancia de Cook para detectar observaciones influyentes que puedan afectar indebidamente las estimaciones del modelo.

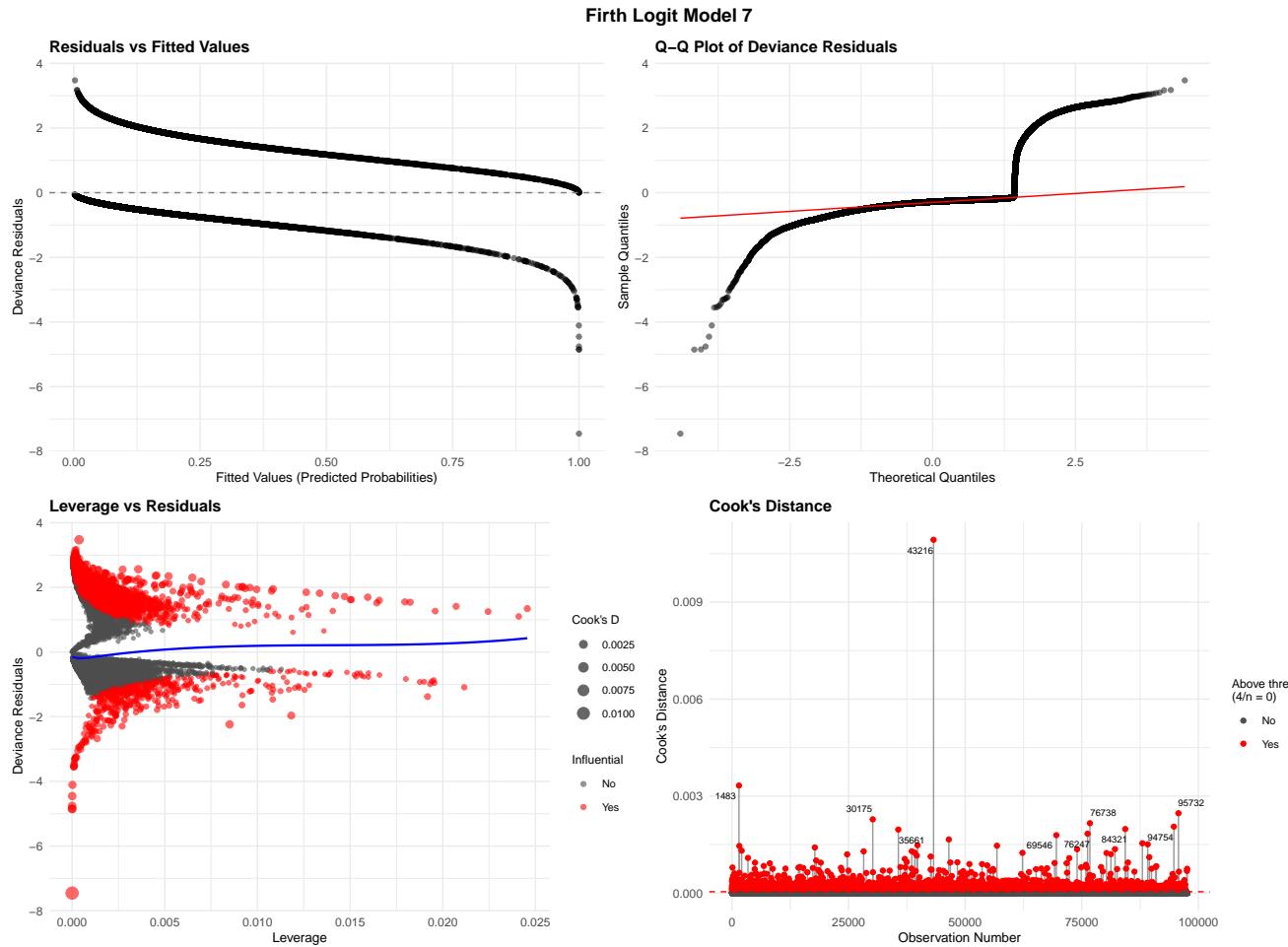


Figura 4: Gráficos de diagnóstico para evaluar los supuestos del modelo e identificar observaciones influentes en las variantes del Modelo 7. Cada fila representa un método de estimación diferente (logit estándar, probit y logit ajustado de Firth). La visualización de cuatro paneles incluye: (1) Residuos de desviación frente a valores ajustados para evaluar la linealidad y la homocedasticidad, (2) Gráficos Q-Q para evaluar la dsitribución de los residuos, (3) Laverage frente a residuos para identificar valores atípicos y puntos de altos de leverage, y (4) Distancia de Cook para detectar observaciones influyentes que puedan afectar indebidamente las estimaciones del modelo.

## 4 Discusión y Conclusiones

### 4.1 Marco teórico planteado y resultados obtenidos

### 4.2 Limitaciones del estudio