

## An Alternative and Complementary Approach to Interpreting the Regression on the Dependent Latent Variable in a MIMIC Model

To the Editor:

Building on the article by Grande Ratti et al., entitled “MIMIC Models: From Neuroscience to the Health Sciences”, we wish to highlight an alternative approach to interpreting results when the dependent variable is a factor composed of several indicators.

In this case, we consider a predictive MIMIC model in which three covariates (*genpac*: gender; *satisf*: satisfaction; *edapaci*: age) are regressed on the latent variable (*USO*: degree of service utilization). The coding was as follows: *genpac* was coded 0 for female and 1 for male; *satisf* was measured using a six-point Likert-type scale (0-5); and *edapaci* was expressed in years. *USO* was measured over the preceding 60 days using three indicators: scheduled appointments (*tu2*), pharmacy purchases (*fa2*), and diagnostic tests such as laboratory or imaging studies (*estu2*), all on six-point Likert-type scales (0-5).

Table 1 summarizes the results obtained after estimating the model with the lavaan package<sup>2</sup> available

in R<sup>3</sup>, using the WLSMV estimation method, as recommended in the literature for models with ordinal indicators<sup>4</sup>.

The usual way to interpret this linear regression (given that the latent variable is continuous and normally distributed) of *genpac*, *satisf*, and *edapaci* on *USO* is as follows:

A. The standardized coefficients (*Std.all*) are used to neutralize the impact of different measurement scales among the independent variables.

B. The magnitude, sign, and statistical significance ( $P(>|z|)$ ) of each coefficient are taken into account.

Regarding the gender effect, the standardized coefficient ( $-0.118$ ;  $p < 0.01$ ) indicates that men use outpatient hospital services less frequently than women. For satisfaction, the standardized coefficient ( $+0.585$ ;  $p < 0.01$ ) shows a positive influence on service utilization, while the effect of age was not statistically significant ( $0.035$ ;  $p = 0.33$ ).

**Table 1.** Results of the MIMIC Model: output from the statistical software

Latent Variables:						
	Estimate	Std.Err	z-value	P(> z )	Std.lv	Std.all
USO =~						
<b>tu2</b>	<b>1.000</b>				1.034	0.875
<b>fa2</b>	<b>0.459</b>	0.042	10.809	0.000	0.474	0.456
estu2	0.896	0.046	19.617	0.000	0.926	0.807
Regressions:						
	Estimate	Std.Err	z-value	P(> z )	Std.lv	Std.all
USO ~						
<b>genpac</b>	<b>-0.261</b>	0.084	-3.116	<b>0.002</b>	-0.252	<b>-0.118</b>
<b>satisf</b>	<b>0.494</b>	0.030	16.264	<b>0.000</b>	0.478	<b>0.585</b>
<b>edapaci</b>	0.003	0.003	0.968	<b>0.333</b>	0.003	<b>0.035</b>

Author for correspondence: [fernandoramon.vazquez@hospitalitaliano.org.ar](mailto:fernandoramon.vazquez@hospitalitaliano.org.ar), Vázquez Peña FR.

Received: 07/14/2025 Accepted: 07/24/2025

DOI: <http://doi.org/10.51987/rev.hosp.ital.b.aires.v45i4.1287>

**How to cite:** Vázquez Peña FR, Grande Ratti MF, Córdón Pozo E. An Alternative and Complementary Approach to Interpreting the Regression on the Dependent Latent Variable in a MIMIC Model. Rev. Hosp. Ital. B.Aires. 2025;45(4):e0001287

In a linear regression model, standardized coefficients represent the effect of an independent variable on the dependent variable in units of standard deviation, since they remove the original units of measurement. Thus, the classical interpretation would be: “Satisfaction level is the variable that most strongly and positively affects *USO*, holding all other variables constant.”

However, an alternative and complementary interpretation can be derived from the estimated (non-standardized) coefficients listed under the “Estimate” column. Many statistical software programs automatically fix the coefficient (factor loading) of the first indicator to 1 (see *tu2* in the upper left of Table 1). This procedure is applied because latent factors are scale-free constructs and therefore require a reference point to establish their metric. The fixed value serves as an anchor, and the remaining factor loadings are estimated relative to it. This approach sets the unit of measurement for the latent variable *USO* equal to that of the indicator.

This implies that a one-unit change in *USO* is associated with a one-unit change in *tu2* in the same direction (increase or decrease). The remaining estimated coefficients are interpreted similarly for the indicators: a one-unit increase or decrease in *USO* results in a corresponding increase or decrease of 0.459 units in *fa2* and 0.896 units in *estu2*.

Therefore, since the estimated coefficient for *genpac* on the latent variable *USO* was  $-0.261$ , it can be concluded that being male (*genpac* = 1) results, on average, in a *USO* value 0.261 units lower than the mean *USO* value for females (*genpac* = 0), controlling for the other variables in the model. This effect on the latent variable is transmitted indirectly to the observed indicators of *USO*, such that, compared with women, men have 0.261 ( $-0.261 \times 1$ ) units

less in *tu2*, 0.119799 ( $-0.261 \times 0.459$ ) units less in *fa2*, and 0.233856 ( $-0.261 \times 0.896$ ) units less in *estu2*.

Meanwhile, the estimated coefficient for *satisf* was  $+0.494$ , indicating that a one-unit increase in *satisf* raises *USO* by 0.494 units. This effect on the latent variable is indirectly transmitted to the observed indicators of *USO*, such that a one-unit increase in *satisf* results, on average, in an increase of 0.494 units in *tu2* ( $0.494 \times 1$ ), 0.226746 units in *fa2* ( $0.494 \times 0.459$ ), and 0.442624 units in *estu2* ( $0.494 \times 0.896$ ), while holding all other variables constant.

Fernando R. Vázquez Peña<sup>1</sup> 

María F. Grande Ratti<sup>2</sup>  and Eulogio Córdón Pozo<sup>3</sup> 

1. Servicio de Medicina Familiar y Comunitaria,  
Hospital Italiano. Argentina

2. Área de Investigación en Medicina Interna, Servicio de Clínica  
Médica, Hospital Italiano. Argentina

3. Departamento de Organización de Empresas II,  
Universidad de Granada. España

## REFERENCES

1. Grande Ratti MF, Pérez Manelli RY, Vázquez Peña FR, Córdón Pozo E. Modelos MIMIC: de la neurociencia a las ciencias de la salud. Rev. Hosp. Ital. B.Aires 2024 Oct; 10;44(4):e0000344. Disponible en: <https://ojs.hospitalitaliano.org.ar/index.php/revistahi/article/view/344>
2. Rosseel Y. lavaan: An R Package for Structural Equation Modeling. J Stat Soft 2012 May 24;48:1–36. <https://doi.org/10.18637/jss.v048.i02>
3. The R Project for Statistical Computing [cited 2025 Jul 9]. R Core Team. 2025. A Language and Environment for Statistical Computing. R Foundation for Statistical Computing, Vienna, Austria. Disponible en: <https://www.R-project.org>
4. Gana K, Broc G. Structural Equation Modeling with lavaan. John Wiley & Sons; 2019. 299 p. Disponible en: <https://play.google.com/store/books/details?id=QMOCDwAAQBAJ>