

AMOSTRAGEM COMPLEXA

Bases de Dados IAN-AF

Tutorial para análise ponderada recorrendo aos softwares SPSS e R



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Referências

- [1] R Core Team (2017). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. URL https://www.R-roject.org/.
- [2] T. Lumley (2017) "survey: analysis of complex survey samples". R package version 3.32.
- [3] T. Lumley (2004) Analysis of complex survey samples. Journal of Statistical Software. 9(1): 1-19



Nota Introdutória

No Inquérito Alimentar Nacional e de Atividade Física, IAN-AF 2015-2016, os participantes foram selecionados aleatoriamente por um processo de amostragem complexa bietápica, a partir do Registo Nacional de Utentes do Serviço Nacional de Saúde. O processo de amostragem desenvolveu-se da seguinte forma:

- i. Selecionou-se aleatoriamente Unidades Funcionais de Saúde (UFS) em cada Unidade Territorial para Fins Estatísticos (NUTS II), ponderada para o número de inscritos; o número de USF selecionadas foi 21 nas regiões do Norte, Centro e Área Metropolitana de Lisboa, 12 nas regiões do Algarve a Alentejo e seis nas Regiões Autónomas da Madeira e Açores.
- ii. Selecionou-se aleatoriamente indivíduos registados em cada Unidade Funcional de Saúde, com um número fixo de elementos por sexo e grupo etário.

Para calcular as estimativas do IAN-AF 2015-2016, a nível nacional e regional, a análise estatística assume uma ponderação dos dados amostrais. O peso amostral representa quantos indivíduos (em número) da população Portuguesa representa cada indivíduo da amostra em estudo. O cálculo dos pesos amostrais incluiu os seguintes critérios:

- i. ponderação inicial para compensar as diferentes probabilidades de seleção de cada Unidade Funcional de Saúde;
- ponderação para compensar as diferentes probabilidades de seleção de cada indivíduo em cada Unidade de Saúde, por sexo e grupo etário (considerando os indivíduos inscritos no RNU na onda de recrutamento mais próxima)
- iii. correção dos pesos iniciais para o viés de não-resposta.

No final, criaram-se dois ponderadores de forma a cobrir as diferentes dimensões analisadas, sendo que o primeiro ponderador, *Ponderador1*, corresponde às dimensões analisadas na primeira entrevista e o segundo, *Ponderador2*, corresponde às dimensões analisadas na segunda entrevista. Assim, todas estimativas referentes às dimensões Atividade Física e Estado Nutricional devem ser feitas recorrendo ao Ponderador1, enquanto que a dimensão Alimentação deve utilizar o Ponderador2.

Neste tutorial, exemplifica-se as etapas a seguir de forma a obter estimativas ponderadas de acordo com o desenho de amostragem complexo do IAN-AF 2015-2016, utilizando os softwares SPSS e R [1].

1. Software SPSS

De forma a obter estimativas ponderadas em SPSS de acordo com o desenho de amostragem complexo IAN-AF 2015-2016, é necessário, numa primeira fase, construir um ficheiro indicador do desenho da amostragem complexa.

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5	1-01-01-0-06-008		in uns pa	nel you select a metric	of the estimating star	idald enois.				2		0
6	1-01-01-0-06-050		The estin	nation method depend	ds on assumptions a	bout how the sample i	was drawn.			1		0
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8	1-01-01-0-06-109		_ ► M	Velcome						2		0
9	1-01-01-0-06-124		S S	tage 1 Design Variables	Which of the f	ollowing sample desig	gns should be assum	ed for estimation?		2		0
10	1-01-01-0-06-136			Estimation Method	OWP (cor	opling with coplace me	ot)			3		0
11	1-01-01-0-07-065		L	Summary	If you ch	opco this option you w	ill not be able to add a	ditional stages. Any	comple ctoppe offer	1		0
12	1-01-01-0-07-095		L > C	Completion	the curre	ent stage will be ignore	ed when the data are a	analyzed.	sample stayes alter	1		0
13	1-01-01-0-16-016					Use finite population c	orrection (FPC) when	estimating variance ur	nder	1		0
14	1-01-01-0-16-034				1	simple random sampl	ing assumption			2		0
15	1-01-01-0-16-035				© Equal W	OR (equal probability s	sampling without repla	acement)		2		0
16	1-01-01-0-16-036				The nex	t panel will ask you to	specify inclusion prob	abilities or population	sizes.	1		0
17	1-01-01-0-16-040									3		0
18	1-01-01-0-16-075				© <u>U</u> nequa	WOR (unequal proba	bility sampling without	t replacement)		2		0
19	1-01-01-0-17-096	_			Joint pro	babilities will be requi	ired to analyze sample	e data. This option is a	vailable in stage 1	1		0
20	1-01-01-0-18-089				only.					1		0
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4	1-01-01-0-05-125		You have	provided all of the in	formation peeded to a	reate a plan				3	3	0
5	1-01-01-0-06-008		Tou nave	provided all of the li	ionnation needed to c	reate a plan.				2	2	0
6	1-01-01-0-06-050		You can	use the plan file in a	y Complex Samples	analysis procedure who	en you are ready to an:	alyze the data.		1	1	0
7	1-01-01-0-06-093									3	3	0
8	1-01-01-0-06-109		_ ► V	Velcome						2	2	0
9	1-01-01-0-06-124			tage 1 Design Variables	What	do you want to do?				2	2	0
10	1-01-01-0-06-136		_	Estimation Metho	d as	ve your enecifications to	a nian file			3	\$	0
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Este ficheiro será usado para todas as análises estatísticas que terão de ser realizadas obrigatoriamente no menu Analyze >> Complex Samples.

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13		245 1-	00-01-0-07-04	Foreca	sting			1			1			1	1	1	1		2	-11
14		240 1-	00-01-0-15-00	Surviva	al		•	1		2	1		1 1	2	2	1	1			-11
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20		252 1-	08-01-0-16-09	Bimula	tion	00		Belec	t a Sample		- 1	1	1	2	2	- 3	1		1	-11
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27		259 1-	08-01-1-05-1	16		2	2	Logie	tic Regression		1	1	1 1	1	2	2	1		1	
28		260 1-	08-01-1-05-12	29		1	2	Crdin		·	1	1	1	2	2	2	1		2	
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	4							Cox R	egression											
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																		15-0/-	010	

ta baseAndreia03072018.say (DataSet1) - IBM SPSS Statistics Data Edi



1.1. Estimar frequências ponderadas

Para estimar frequências ponderadas, deve-se aceder a Analyze >> Complex Samples >> Frequencies e selecionar o ficheiro anteriormente construído.

1			1	
ta Com	plex Samples Plan f	or Frequencies	Analysis	×
Plan -				
<u>F</u> ile:	HE-FMUP\Andre	iaPadroesIAN\p	olan.csaplan	Browse
lf you use th Prepa the wi	do not have a plan e Analysis Prepar re for Analysis fror zard.	file for your con ation Wizard to m the Complex :	nplex sample, create one. Ch Samples men	you can loose u to access
_ Joint P	robabilities ——			
Joint p proba	orobabilities are re bility WOR estima	quired if the pla tion. Otherwise,	in requests un they are ignor	equal ed.
🔘 Use	default file (H:\/	ILTON\Docum	ents\SHE-FM	.\plan.sav)
🔘 An <u>(</u>	pen dataset			
	baseAndreia0307	72018.sav [Data	Set1]	
© <u>C</u> us	tom file			
File				B <u>r</u> owse
	Continue	Cancel	Help	

De seguida, seleciona-se a variável para a qual queremos estimar as frequências ponderadas e as respetivas estatísticas associadas.





	Complex Samples Plan for Frequencies Analysis	×
E	: Val 🔚 Complex Samples Frequencies: Statistics 🛛 🗙	
	Cells	
3	Statistics	
-	- 🛃 👿 Standard error 🔲 Unweighted count	
	Confidence interval Design effect	
	Level(%): 95 📃 Sguare root of design effect	
_	Coefficient of variation Cumulative values	
	Test of equal cell proportions	
-	Continue Cancel Help	
	OK Paste Reset Cancel Help	

Resultado:

	Sexo.x												
		Estimato	Standard Error	95% Confide	nce Interval								
		LStimate	Stanuaru LITU	Lower	Upper								
	0	4739432,770	145329,479	4450795,879	5028069,661								
Population Size	1	4449227,520	126039,458	4198902,276	4699552,764								
	Total	9188660,290	239273,706	8713442,056	9663878,524								
	0	51,6%	0,7%	50,2%	53,0%								
% of Total	1	48,4%	0,7%	47,0%	49,8%								
	Total	100,0%	0,0%	100,0%	100,0%								

1.2. Testar a independência/associação entre 2 variáveis categóricas

Para testar a independência/associação entre duas variáveis categóricas, deve-se aceder a Analyze >> Complex Samples >> Crosstabs e selecionar o ficheiro anteriormente construído.

De seguida, selecionam-se as variáveis a testar e as estatísticas desejadas.

3	2	1		1		1	3		1	
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1				_					1	
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2	ОК		Paste	Reset	Cancel	Help	D		1	
2									1	



ti Complex Samples Descriptives		×	
Variables:	M <u>e</u> asures:	Statistics Missing Values Options	
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× X3.3 × X3.4		t-test Test vajue	t-t <u>e</u> st Test v <u>a</u> lue
- & X4.1	Each combination of	Statistics	
💑 X4.3 🔽	subpopulation.	Standard error	Unweighted count
OK Paste	Reset Cancel Help	Confidence interval	Population size
Blymou		Level (%): 95	Design effect
51,6%		Coefficient of variation	Square root of design effect
48,4% 100,0%		Continue	Cancel Help

<u>5 Z 1 1 1 5</u>	1
Complex Samples Crosstabs	< 1
Variables: Complex Samples Crosstabs: Statistics X	1
Stics	1
Values	1
idade Dewoarrest Table accest	2
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Standard error Unweighted count	1
Escol	1
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Saudi Lever{%): 95	
Coefficient of variation Residuals	
Class Expected values Adjusted residuals	2
	1
Summaries for 2-by-2 Tables	2
PROT Odds ratio Risk difference	1
FATg Relative risk	1
CARE	1
CARE Test of independence of rows and columns	2
ALCO Continue Cancel Help	1
	4
	1
2 1 1 1 1	-1
2 1 1 1 1 1	1



Resultado:

Sexo.x * Desp							
	C	Desp					
	Sexo.x		0	1	Total		
	Deputation Circa	Estimate	2916200,750	1689662,870	4605863,620		
	Population Size	Standard Error	119981,932	104059,923	143375,307		
0	0/ within Covo v	Estimate	63,3%	36,7%	100,0%		
0	% within Sexo.x	Standard Error	1,9%	1,9%	0,0%		
	% within Deep	Estimate	53,4%	47,1%	50,9%		
% within Desp		Standard Error	1,3%	1,7%	0,7%		
	Dopulation Size	Estimate	2547897,160	1899139,430	4447036,590		
	Population Size	Standard Error	109990,959	108317,206	126295,420		
4	0/ within Covo v	Estimate	57,3%	42,7%	100,0%		
· ·		Standard Error	2,0%	2,0%	0,0%		
% within Desp	Estimate	46,6%	52,9 %	49, 1%			
	% within Desp	Standard Error	1,3%	1,7%	0,7%		
	Denvilation Cine	Estimate	5464097,910	3588802,300	9052900,210		
	Population Size	Standard Error	183758,461	173125,807	234706,467		
		Estimate	60,4%	39,6%	100,0%		
Total	% WITHIN Sexo.x	Standard Error	1,5%	1,5%	0,0%		
		Estimate	100,0%	100,0%	100,0%		
	% within Desp	Standard Error	0,0%	0,0%	0,0%		

Tests of Independence

		Chi-Square	Adjusted F	df1	df2	Sig.
Sexo.x * Desp —	Pearson	14,388	6,020	1	92	,016
	Likelihood Ratio	14,394	6,022	1	92	,016

The adjusted F is a variant of the second-order Rao-Scott adjusted chi-square statistic. Significance is based on the adjusted F and its degrees of freedom.

Measures of Association					
		Estimate			
Sexo.x * Desp	Odds Ratio	1,286			
Statistics are computed or	nly for 2-by-2 tables with	all cells observed.			

1.3. Estimar média ponderada

Para testar a independência/associação entre duas variáveis categóricas, deve-se aceder a Analyze >> Complex Samples >> Descriptives e selecionar o ficheiro anteriormente construído.

De seguida, selecionam-se a variáveis cuja média se deseja estimar e as estatísticas desejadas.

ti Complex Samples Descriptives		×	
Variables: \checkmark V1 \clubsuit IAN_ID \clubsuit X1.3 \clubsuit X1.5 \clubsuit X1.6 \clubsuit X10.1 \clubsuit X10.3 \clubsuit X1.1 \clubsuit X12.1 \clubsuit X2.1 \clubsuit X3.3 \clubsuit X4.1 \clubsuit X4.2 \hslash X4.3	Measures:	Statistics Sing Values Options Summaries Mean f-test Test value Statistics Statistics Statistics Statistics Statistics	tatistics × Sum t-test Test value
eignes Percent 51,6%	Reset Cancel Help	Confidence interval	Copulation size Design effect Sguare root of design effect
48,4%		Car Car	Help

Resultado:

onnanace statistics

	Estimate		Standard Error	95% Confidence Interval		
			Stanuaru LITU	Lower	Upper	
Mean	X1.1	2,14	,027	2,09	2,19	



1.4. Regressão Linear

Para fazer comparação de médias ponderadas ou regressão linear para os dados ponderados, deve-se aceder a Analyze >> Complex Samples >> General Linear Model e selecionar o ficheiro anteriormente construído.

De seguida, selecionam-se a variáveis dependente e as independentes assim como as estatísticas desejadas.



Resultado:

Parameter Estimates^a

Daramotor Estimato	Estimato	95% Confidence Interval		Hypothesis Test		
Farameter	LStillate	Lower	Upper	t	df	Sig.
(Intercept)	2,129	2,056	2,203	57,592	92,000	,000
[Sexo.x=0]	,020	-,068	,108	,456	92,000	,649
[Sexo.x=1]	,000 ^b	•				

a. Model: X1.1 = (Intercept) + Sexo.x

b. Set to zero because this parameter is redundant.

2. Software R



Para obter estimativas ponderadas em R de acordo com o desenho de amostragem complexo IAN-AF 2015-2016, recorre-se à biblioteca "survey" [2,3].

- > install.packages("survey")
- > library(survey)

Ao criar a base de dados a usar para realizar estimativas ponderadas é obrigatório ter presente as variáveis "PSU", "NUT" e a respetiva variável de ponderação, que se encontram na tabela de dados sociodemográficos. Assim, é sempre necessário juntar a base de dados sociodemográficos à base com as variáveis em estudo.

```
> base = read.csv2("Tabela_Ponderador_Sociodem.csv", stringsAsFactors = F)
> atvfis = read.csv2("Tabela_AFisica.csv", stringsAsFactors = F)
> b = merge(base, atvfis)
> svdx<-svydesign(id = ~PSU, strata = ~NUT, weights = ~Ponderador1, data = b)
> summary(svdx)
```

De seguida, exemplifica-se algumas análises possíveis recorrendo a este package. Mais informações sobre funções implementadas nesta biblioteca encontram-se disponíveis na respetiva documentação.

2.1. Frequência de variáveis categóricas e média de variáveis contínuas

O comando "svymean" calcula a média ponderada de uma variável de acordo com o desenho de amostragem complexo. Se a variável em questão for do tipo "factor", então esta função calcula a proporção ponderada de cada categoria da variável.

```
> svymean(~idade, svdx)
    mean SE
idade 42.686 0.3652
> svymean(~factor(Sexo), svdx)
    mean SE
factor(Sexo)0 0.51217 0.0064
factor(Sexo)1 0.48783 0.0064
```



2.2. Estatísticas em subconjuntos

Para estimar estatísticas em subconjuntos definidos por um fator, usa-se o comando "svyby".

```
> svyby(~idade, ~Sexo, subsvdx, svymean)
    Sexo idade se
0    0 42.22272 0.4738476
1    1 42.11595 0.4994525
```

É ainda possível definir isoladamente um subconjunto para posterior análise.

2.3. Testes de hipóteses

Teste t para comparação de médias:

Teste χ^2 para comparação de proporções:

> svychisq(~GE4+Sexo, svdx)
Pearson's X^2: Rao & Scott adjustment
data: svychisq(~GE4 + Sexo, svdx)
F = 4.4883, ndf = 1.9053, ddf = 175.2800, p-value = 0.01385



2.4. Modelos de regressão

Modelo de regressão linear:

```
> subsvdx = subset(svdx, IMC<700 & EscolClass_Prop!=9)</pre>
> m1=svyglm(IMC ~ Sexo + Idade + factor(EscolClass_Prop) , family=gaussian(), subsvdx)
> summary(m1)
Call:
svyglm(formula = IMC ~ Sexo + Idade + factor(EscolClass_Prop),
    family = gaussian(), subsvdx)
Survey design:
subset(svdx, IMC < 700 & EscolClass_Prop != 9)</pre>
Coefficients:
                          Estimate Std. Error t value Pr(>|t|)
                         24.445613 0.472124 51.778 < 2e-16 ***
(Intercept)
Sexo
                         -0.332601
                                     0.241667 -1.376
                                                      0.172
                          0.084928 0.007141 11.894 < 2e-16 ***
Idade
factor(EscolClass_Prop)2 -1.399916 0.272237 -5.142 1.63e-06 ***
factor(EscolClass_Prop)3 -2.057181 0.269839 -7.624 2.70e-11 ***
___
Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
(Dispersion parameter for gaussian family taken to be 20.84462)
Number of Fisher Scoring iterations: 2
```



Modelo de regressão logística:

```
> subsvdx = subset(svdx, Desp!=9)
> m1=svyglm(factor(Desp) ~ factor(GE4), family=binomial(link = 'logit'), subsvdx)
> summary(m1)
Call:
svyglm(formula = factor(Desp) ~ factor(GE4), family = binomial(link = "logit"),
    subsvdx)
Survey design:
subset(svdx, Desp != 9)
Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept) 0.44697 0.14980 2.984 0.00367 **
factor(GE4)2 -0.08235
                        0.18099 -0.455
                                        0.65023
factor(GE4)3 -0.83873 0.15511 -5.407 5.32e-07 ***
factor(GE4)4 -1.15278 0.18788 -6.136 2.30e-08 ***
___
Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
(Dispersion parameter for binomial family taken to be 1.000187)
Number of Fisher Scoring iterations: 4
```

