

Supplement 5: Indicators' weights and value (benefit) calculations

Step 1 – Calculate the weight per participant for each indicator

For Patients and Prescribing physicians - ROC method (Barron & Barrett, 1996),

Table 1 – Example of calculation of indicator weights per participant

Benefit indicators - ACCESSIBILITY OF THE SERVICE		Rank by patient 1	From ROC table	Rank by patient 2	From ROC table	...	Rank by patient i (i=no. of patient)	From ROC table
A1	Appointments available for exams	4th	0.0625	1st	0.5208		...	...
A2	Time elapsed from the prescription until the exam is scheduled	3rd	0.1458	3rd	0.1458		...	...
A3	Percentage of tests scheduled and performed at a time and place that is the most convenient for the patient	1st	0.5208	2nd	0.2708	...	...	...
A4	Percentage of examinations and other complementary examinations scheduled for the same day	2nd	0.2708	4th	0.0625		...	...

For Radiographers and Administration – AHP (Saaty, 1987)

Table 2 – Example of calculation of indicator weights for Radiographer 1

Matrix of preferences using Saaty's scale

	A1	A2	A4	A5
A1	1	1/4	1/2	1/2
A2	4	1	3	1
A4	2	1/3	1	1/5
A5	2	1	5	1
SUM	9.00	2.58	9.50	2.70

	A1	A2	A4	A5	Arithmetic mean
A1	1/9 = 0.11	0.25/2.58 = 0.10	0.05	0.19	0.11
A2	4/9 = 0.44	0.39	0.32	0.37	0.38
A4	0.22	0.13	0.11	0.07	0.13
A5	0.22	0.39	0.53	0.37	0.38

Additionally, the consistency index was calculated and it was confirmed that it was lower than 0.1.

Step 2 – Calculate the weight (level of expertise) of each participant within its group – approach of Scala et al. (2016)

Table 3 - Level of expertise of the Radiographers

Indicator	Radiographer 1 (AHP preferences)	Log (Radiographer 1 preferences)	Log (Radiographer 2 preferences)	Log (Radiographer 3 preferences)	Log (Radiographer 4 preferences)	Log (Radiographer 5 preferences)	Log (Radiographer 6 preferences)
A1	0.11*	-0.953	-0.477	-0.699	0.000	0.000	0.000
A2	0.38*	-0.421	-0.778	-0.477	-0.602	-0.699	-0.301
A3	-	-	-	-	-	-	-
A4	0.13*	-0.877	-0.778	-0.845	-0.477	-0.778	0.000
A5	0.38*	-0.424	-0.778	0.000	-0.699	0.000	0.477
...	...	...	...	...	...	...	...
P7	0.10	-1.000	-1.700	-1.300	-1.520	-1.150	-1.400
Radiographer weights by principal components analysis (SPSS)		0.919	1.937	1.127	1.51	0.794	1.613
Standardized weights (Sum =1)		0.116	0.245	0.143	0.191	0.101	0.204

Notes: Use the log of all indicators preference of all participants to run principal components analysis in a statistical software (e.g., SPSS), and standardize the participants weights obtained; *Detail of the calculations in Table 2 as an example.

Step 3 – Calculate the weight benefit indicators: indicator weight × participant weight

For Patients and Prescribing physicians – Simple arithmetic mean

Example: Weight of A2 indicator for Patients = $\frac{\sum_{i=1}^{no_of_patients} weight_of_A2_i}{no_of_patients}$

Table 1 – Example of calculation of indicator weights

Benefit indicators - ACCESSIBILITY OF THE SERVICE		From ROC table	From ROC table	...	Arithmetic mean across all patients' preferences
A1	Appointments available for exams	0.0625*	0.5208*	...	0.3163
A2	Time elapsed from the prescription until the exam is scheduled	0.1458*	0.1458*		0.2064
A3	Percentage of tests scheduled and performed at a time and place that is the most convenient for the patient	0.5208*	0.2708*		0.2784
A4	Percentage of examinations and other complementary examinations scheduled for the same day	0.2708*	0.0625*		0.1989

Note: *Explanation of how to determine in Table 1.

For Radiographers and Administration – Weighted arithmetic mean

Example: Weight of A2 indicator for Radiographers = $\sum_{j=1}^{no_of_radiographers} (weight_of_A2_j \times level_of_expertise_j)$

= (0.38*×0.116[†]+0.10×0.245[†]+0.21×0.143[†]+0.10×0.191[†]+0.12×0.101[†]+0.32×0.204[†]) = **0.1952**

Notes: *Detail of the calculation in Table 2, as an example; [†]Detail of the calculation in Table 3.

Step 4 – Calculate the (benefit) indicators

Example:

Table 2 - Calculations of TOPSIS distance for Patients, Indicator A2

Indicator	Days			[0; 1]		Weighted	
	A ⁺	A ⁻	Observed	A ⁺	A ⁻	Ideal: A ⁺	Anti-ideal: A ⁻
A2: Average time between taking the exam and completing the report (MINIMIZE) Indicator ROC Weight: 0.2064	0	312	7	$\frac{7-0}{312-0} = 0.0224$	$\frac{312-7}{312-0} = 0.9776$	(0.0224×0.2064) = 0.0046	(0.9776×0.2064) = 0.2018

Table 3 - Calculations of TOPSIS distance for Patients, category A - ACCESSIBILITY TO THE SERVICE

Indicators	Data	Min/max	Department	
			Ideal: A ⁺	Anti-ideal: A ⁻
A1	3 806	MAX	0.2836	0.0327
A2	7	MIN	0.0046*	0.2018*
A3	0,679	MAX	0.0894	0.1890
A4	0,766	MAX	0.0465	0.1523
SUM			0.4241	0.5758
Category A Benefit = $\frac{A^-}{A^+ + A^-} = 0.5759$ (TOPSIS closeness coefficient)				

Note: *Detail of the calculations in Table 5 as an example.

Table 7 - Radiology value (benefit) assessment

Categories / Indicators		Patients		Physicians		Radiographers		Administration	
		Ideal A ⁺	Anti-ideal A ⁻	Ideal A ⁺	Anti-ideal A ⁻	Ideal A ⁺	Anti-ideal A ⁻	Ideal A ⁺	Anti-ideal A ⁻
ACCESSIBILITY OF THE SERVICE	A1	0.2836	0.0327	0.2241	0.0259	0.0902	0.0074	-	-
	A2	0.0046*	0.2018*	0.0103	0.4480	0.0044	0.1909	0.0191	0.8337

	A3	0.0894	0.1890	0.0501	0.1061	-	-	-	-
	A4	0.0465	0.1523	0.0317	0.1037	0.1027	0.2173	0.0472	0.0999
	A5	-	-	-	-	0.0906	0.2965	-	-
benefit [0; 1]		0.5759†		0.6837		0.7121		0.9336	
ADEQUACY OF EXAM PRESCRIPTION	B1	0.0806	0.2281	0.0951	0.2694	0.0540	0.1528	0.0965	0.2733
	B2	0.0506	0.1066	0.0503	0.1059	0.0732	0.1541	0.0633	0.1333
	B3	0.1362	0.0362	0.0658	0.0175	0.1414	0.0584	-	-
	B4	0.1302	0.2315	0.1425	0.2533	0.1318	0.2342	0.1561	0.2775
benefit [0; 1]		0.6024		0.6462		0.5996		0.6841	
EXAM PROCESS	C1	0.0124	0.1730	0.0107	0.1498	-	-	-	-
	C2	0.0623	0.0176	0.0574	0.0162	-	-	-	-
	C3	0.0309	0.1546	0.0349	0.1746	0.2689	0.0538	0.1469	0.0294
	C4	0.0001	0.0462	0.0001	0.0674	-	-	0.1968	0.0052
	C5	0.0306	0.1493	0.0206	0.1004	-	-	0.1993	0.0009
	C6	0.0026	0.0755	0.0046	0.1358	0.0321	0.1569	0.0421	0.2056
	C7	0.0290	0.1302	0.0261	0.1173	0.0039	0.1146	0.0057	0.1681
	C8	0.0402	0.0457	0.0393	0.0446	-	-	-	-
	C9	-	-	-	-	0.0673	0.3025	-	-
	C10	-	-	-	-	-	-	-	-
benefit [0; 1]		0.7921		0.8063		0.6278		0.4092	
REPORT	D1	0.0702	0.0683	0.0394	0.0383	-	-	-	-
	D2	0.0380	0.1964	0.0193	0.0997	-	-	-	-
	D3	0.0005	0.0452	0.0005	0.0404	0.0223	0.1151	0.0269	0.1392
	D4	0.0244	0.0988	0.0129	0.0521	-	-	-	-
	D5	0.0164	0.0589	0.0155	0.0555	-	-	-	-
	D6	0.0683	0.0387	0.0586	0.0332	-	-	-	-
	D7	0.0509	0.0150	0.1522	0.0450	-	-	0.0950	0.1942
	D8	0.0506	0.0506	0.0861	0.0861	0.0961	0.0284	0.0730	0.0216
	D9	0.0414	0.0673	0.0630	0.1023	-	-	-	-
	D10	-	-	-	-	0.0554	0.3101	0.0382	0.2139
	D11	-	-	-	-	-	-	-	-
	D12	-	-	-	-	-	-	-	-
	D13	-	-	-	-	0.0215	0.3513	0.0114	0.1866
benefit [0; 1]		0.6393		0.5526		0.8048		0.3829	
RESULTS	E1	0.0530	0.2720	0.0462	0.2372	-	-	0.0670	0.3443
	E2	0.1031	0.1436	0.1533	0.2134	0.2183	0.3039	-	-
	E3	0.0374	0.1638	0.0269	0.1176	-	-	-	-
	E4	0.0146	0.1159	0.0110	0.0870	0.2146	0.0794	0.4297	0.1589
	E5	0.0080	0.0478	0.0102	0.0613	0.0212	0.0926	-	-
	E6	0.0407	0.0000	0.0361	0.0000	0.0120	0.0582	-	-
benefit [0; 1]		0.7432		0.7164		0.5340		0.5032	
SAFETY	F1	0.0165	0.1249	0.0154	0.1165	-	-	0.0272	0.2050
	F2	0.0505	0.0642	0.0749	0.0953	-	-	0.0523	0.0052
	F3	0.0042	0.0451	0.0071	0.0753	-	-	-	-
	F4	0.0113	0.1454	0.0090	0.1161	0.0118	0.1524	0.0265	0.3417
	F5	0.0358	0.1415	0.0297	0.1173	-	-	-	-
	F6	0.0691	0.0259	0.0626	0.0235	-	-	-	-
	F7	0.0042	0.2189	0.0044	0.2275	0.0479	0.2212	-	-
	F8	0.0037	0.0386	0.0022	0.0231	0.2102	0.0028	-	-
	F9	-	-	-	-	0.0067	0.3469	0.0065	0.3357
benefit [0; 1]		0.8046		0.7947		0.7234		0.8875	
CONTRIBUTION TO THE INSTITUTION	G1	0.0267	0.0467	0.0472	0.0827	0.1722	0.0004	-	-
	G2	0.0965	0.0241	0.1216	0.0304	0.1996	0.0026	-	-
	G3	0.0505	0.0111	0.1549	0.0340	-	-	-	-
	G4	0.0750	0.0073	0.0788	0.0077	0.0478	0.1741	-	-
	G5	0.1775	0.0273	0.0904	0.0139	0.4002	0.0031	-	-
	G6	0.1906	0.0521	0.1404	0.0384	-	-	-	-
	G7	0.1573	0.0572	0.1171	0.0426	-	-	-	-
benefit [0; 1]		0.2259		0.2497		0.1802		-	
S+		2.6167		2.5502		2.8182		1.8269	
S-		4.3833		4.4490		4.1818		4.1731	
C-closeness		0.6262		0.6356		0.5974		0.6955	

Notes: *Detail of calculations in Table 6, as an example; †detail of calculations in Table 5, as an example.