



MANAGEMENT AND PERFORMANCE FEATURES OF CANCER CENTERS IN EUROPE: A FUZZY-SET ANALYSIS

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Healthcare management and benchmarking

- Current **concerns** of healthcare managers:
 - “how to measure and control costs,”
 - “how to innovate”
 - “how to best deliver innovation,”
 - “how to finance,”
 - “how to sustain profitability”
- **Benchmarking**, is a useful technique for establishing patterns, measuring performance and performing a comparative analysis, such as in the service industries.
- Research needs to produce **more studies** that examine these variables in greater detail regarding their significance and usefulness in these comparisons

Motivation

- Assessing performance in healthcare management is becoming more complex, asking for more research applications and imposing methodological challenges
- Cancer is the second leading cause of death in Europe accounting for 1.75 million deaths in 2012*
- Cancer centres are a particular, highly valued, arrangement for providing care that, if well organized and in order to be self sustained, should provide a high productivity level at scale-reduced costs
- A variety of features both internal and external to a center, such as available resources, level of professional training or size, can be used as explanatory conditions for high performance**

* Ferlay et al. 2013; ** Merkow et al. 2014

Objective

Objective: To explore the use of the fsCQA to study the association between pre-selected explanatory conditions and financial performance outcomes based on data from the BENCH-CAN project

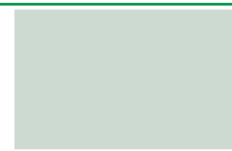


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The general objective of BENCH-CAN is to benchmark comprehensive cancer care & yield best practice examples in a way that contributes to improving the quality of interdisciplinary patient treatment.

To achieve this, the project addresses 6 specific objectives:

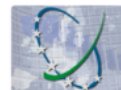
1. To collect, compare and align by consensus formation the standards, recommendations and accreditation criteria of comprehensive cancer care in selected European countries.
2. To review and refine a benchmarking tool that can be applied to comprehensive cancer care through interdisciplinary patient treatment.
3. To pilot the benchmark tool with particular attention to operations management and best clinical practice.
4. To maximise knowledge exchange and sharing of best practice between providers of comprehensive cancer care in member states and regions.
5. To ensure compatibility of the benchmarking tools with existing cancer care resources and services.
6. To ensure the sustainability and longer-term benefits of the project.



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Objective

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- Providing cancer care is expensive. With the fast increase in state of the art technologies and cancer drugs bearing a high cost, achieving a high net income and high productivity become a far more relevant target.
- A previous study suggests that larger cancer centers show better financial performance than smaller centers
- R&D is a costly function that the leading centers should have as part of their mission and should actively explore, as a means to develop more promising technologies for future patients

Preposition: A large budget, substantial size, and significant involvement in research and development (R&D) are important conditions for highly productive and financially sound and profitable centers.

Fuzzy-set Qualitative Comparative Analysis (fsQCA)

- Qualitative Comparative Analysis (QCA) is systematic, transparent, and exhaustive analytical approach for the identification of patterns that hold across cases
- Cases are represented as a combination of causal and outcome conditions, which are then compared and logically simplified through a bottom-up process of paired comparison
- Causality between explanatory and outcome conditions in terms of necessity and sufficiency
- Causal complexity (Multi-causation, Equifinality, Asymmetric causality)
- A fuzzy-set is a continuous set that has been calibrated to indicate degrees of membership

Methods – Data

Centre	Output measures		Independent measures				
	Prod	Income	RD	Budget	Size	Public	CCC
A	736,69	7.48 €	17%	99,476,158.92 €	157	1	1
B	1271.57	36.93 €	1%	129,296,290.15 €	319	1	1
C	392.57	-32.30 €	0%	31,579,912.32 €	351	0	1
D	1892.97	72.04 €	1%	22,507,394.78 €	347	1	1
E	471.58	-16.93 €	0%	57,725,727.32 €	535	1	0
F	674.90	198.56 €	5%	87,829,272.29 €	98	1	1
G	1804.40	-5.23 €	5%	87,220,239.04 €	110	1	1

Prod – level of productivity; **Income** – net income;
RD – level of dedication to R&D; **Budget** – annual budget;
Size – size of center based on the number of beds;
CCC – comprehensive cancer center; and **Public** – public center

Methods – Fuzzy-set calibration

Centre	Output measures		Independent measures				
	Prod	Income	RD	Budget	Size	Public	CCC
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Anchor points - membership:

- percentile 0.95 – 0.95 (full membership)
- Median - 0.5 (maximum ambiguity)
- percentile 0.05 – 0.05 (full non-membership)

* Score manually assigned 0.51

Methods – Fuzzy-set calibration

Centre	Output measures		Independent measures				
	Prod	Income	RD	Budget	Size	Public	CCC
A	0.51*	0.51*	0.98	0.75	0.1	1	1
B	0.81	0.64	0.43	0.98	0.51*	1	1
C	0.04	0.03	0.07	0.06	0.64	0	1
D	0.96	0.78	0.51*	0.04	0.63	1	1
E	0.08	0.11	0.04	0.19	0.98	1	0
F	0.36	0.98	0.73	0.51	0.05	1	1
G	0.94	0.26	0.72	0.51*	0.05	1	1

Anchor points - membership:

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- Median - 0.5 (maximum ambiguity)
- percentile 0.05 – 0.05 (full non-membership)

* Score manually assigned 0.51

Methods – Analysis

- Model
 - Presence: Income, Prod
 - Absence: ~Income, ~Prod
- Necessity analysis
- Sufficiency analysis
 - Table of truth (consistency cutoff =0.73)
 - Counterfactual analysis (logical remainders)
 - Identification of core and peripheral conditions based parsimonious and intermediate solutions*

* Fiss *et al* 2011

Results – Necessity analysis

Outcome condition	High Productivity (Prod)		Low Productivity (~Prod)	
	consistency	coverage	consistency	coverage
CCC	0.98	0.60	0.72	0.40
~CCC	0.02	0.08	0.28	0.92
Public	0.99	0.61	0.71	0.39
~Public	0.01	0.04	0.29	0.96
R&D	0.71	0.75	0.46	0.44
~R&D	0.47	0.50	0.74	0.69
Budget	0.64	0.77	0.47	0.51
~Budget	0.59	0.56	0.79	0.66
Size	0.39	0.49	0.60	0.67
~Size	0.74	0.68	0.55	0.45

RD – high level of dedication to R&D; **Budget** – high annual budget; **Size** – high number of beds; **CCC** – comprehensive cancer center; and **Public** – public center; “~” negation

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Results – Necessity analysis

Outcome condition	High Net Income (Income)		Low Net Income (~Income)	
	consistency	coverage	consistency	coverage
CCC	0.97	0.53	0.76	0.47
~CCC	0.03	0.11	0.24	0.89
Public	0.99	0.55	0.74	0.45
~Public	0.01	0.03	0.26	0.97
R&D	0.76	0.72	0.52	0.55
~R&D	0.53	0.50	0.74	0.77
Budget	0.63	0.69	0.45	0.55
~Budget	0.59	0.49	0.75	0.69
Size	0.45	0.50	0.62	0.77
~Size	0.79	0.65	0.60	0.55

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Public	0.99	0.55	0.74	0.45
~Public	0.01	0.03	0.26	0.97
R&D	0.76	0.72	0.52	0.55
~R&D	0.53	0.50	0.74	0.77
Budget	0.63	0.69	0.45	0.55
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Size	0.45	0.50	0.62	0.77
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RD – high level of dedication to R&D; **Budget** – high annual budget; **Size** – high number of beds; **CCC** – comprehensive cancer center; and **Public** – public center; “~” negation

Results – Sufficiency analysis

		Configurations for High Productivity (Prod)			Configurations for Low Productivity (~Prod)	
	Configuration	1	2	3	1	2
	Centers	B	D	A, F, G	E	C
Causal conditions	RD		+	+	--	--
	Budget	+		+	--	--
	Size	+	+			
	CCC	++	++	++	-	+
	Public	++	++	++	+	-
	Consistency	1.00	1.00	0.83	1.00	1.00
	Raw coverage	0.20	0.31	0.50	0.25	0.28
	Unique coverage	0.02	0.13	0.32	0.25	0.28
	Overall solution consistency	0.86			1.00	
	Overall solution coverage	0.65			0.53	

++ or -- core conditions, + or - peripheral conditions

Results – Sufficiency analysis

		Configurations for High Net Income (Income)			Configurations for Low Net Income (~Income)		
	Configuration	1	2	3	1	2	3
	Centers	B	D	A, F, G	E	C	B
Causal conditions	RD		+	+	--	--	--
	Budget	+		+	-	-	
	Size	+	+				
	CCC	++	++	++		+	+
	Public	++	++	++	+		+
	Consistency	1.00	1.00	0.78	0.72	0.74	0.55
	Raw coverage	0.23	0.34	0.53	0.37	0.40	0.24
	Unique coverage	0.02	0.14	0.33	0.22	0.25	0.09
	Overall solution consistency	0.82			0.78		
	Overall solution coverage	0.69			0.72		

++ or -- core conditions, + or - peripheral conditions

Discussion

- Three alternate causal patterns associate centers with high performance:
 - High level of at least two of the explanatory conditions, dedication to R&D, annual budget, or size, is associated with high net income and high productivity.
 - Financial capital will be an important attribute but, in order to explain best performance one has to look on how that money is spent
- R&D and annual budget seem to be key features
 - Their presence is associated with high performance; and their absence lead to low performance.
 - Again it can be important connection with other variables and managerial options, but clearly the commitment with R&D are a distinctive characteristic of better performing centers.

Discussion

- Robustness: centers A, F, and G are located in three different geographic regions and share the same causal pattern (high level of R&D and annual budget)
- Limitations:
 - Lack of variability in some causal conditions due to a small sample size – convenience sample, data from a benchmarking exercise among European cancer centers.
 - This study does not address the association of high productivity as a causal condition for high financial performance.
 - Opportunities for future research: by considering more hospitals, by moving into longitudinal analysis and by exploring new relationships between variables, more insight will come on the question of what drives performance through European cancer centers.

Conclusions

- Despite limitations, this study shows that fsQCA is a powerful approach for health service research.
- Managerial implications: these variables are likely to be actionable from the point of view of the hospital's management or from the perspective of the healthcare system, at least in the longer run.
- So there are actual choices, regarding these variables, that enable performance improvement for healthcare providers.



THANK YOU FOR YOUR ATTENTION!

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