

# The absence of long-term clinical registries in aesthetic medicine and its consequences for research and patient outcomes

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**Abstract—** The fast proliferation of aesthetic medicine has increased the necessity of evidence-based assessment of treatment effects, but the lack of long-term clinical registries still does not provide access to stable real-world evidence. This paper discusses the issue of disjointed data infrastructures and its consequences in terms of research quality and patient outcomes. The main aim is to evaluate how the presence of clinical registries affects the patient outcomes in the field of aesthetic medicine and how real-world data and data quality mediate this effect. The methodology is premised on a panel econometric model, which relies on data in Ireland, the United Kingdom, Germany, and Poland between 2021 and 2025. The specification of a fixed effect is used to address the unobserved heterogeneity by country and time. The model considers such critical variables as registry availability, index of real-world data, patient-reported outcomes adoption, data quality and clinical experience. To determine indirect effects, a mediation analysis is also done based on data availability. The empirical findings show that the existence of clinical registries positively affects patient outcomes in a statistically significant manner with an estimated coefficient of 4.62 ( $p < 0.001$ ). The presence of real-world data ( $\beta = 0.21$ ,  $p < 0.001$ ) and data quality ( $\beta = 0.26$ ,  $p < 0.001$ ) are also highly positive effects, and patient-reported outcomes also play a significant role in enhancing the accuracy of evaluation. The mediation analysis shows that a significant part of the registry effect is achieved with the improved availability of data. Dynamic analysis also indicates that countries are improving faster after implementing registries, where the remaining outcome growth rates are up to 3.78 annually. The results confirm that clinical registries serve as invaluable data infrastructures that improve transparency, standardization and evidence-based decision-making. The research finds the development of registry systems and data integration to be crucial in developing the quality of patient outcomes and research in aesthetic medicine.

**Keywords—** clinical registries, aesthetic medicine, patient outcomes, real-world data, panel data analysis, healthcare data quality, patient-reported outcomes.

## I. INTRODUCTION

The fast development of aesthetic medicine during the recent years has turned it into a remarkable and highly dynamic part of the modern healthcare system, with the rising demand, technological advances, and rising economic importance. Simultaneously, this area is structurally under-regulated regarding data management and long-term clinical follow-up, especially in comparison to other areas of the medical field. Lack of standardized, long-term clinical registries is a significant weakness and hinders the provision of consistent real-world evidence and reduces the possibility of systematically assessing the effectiveness of treatment, safety, and patient satisfaction over time. In a system where processes tend to be optional and results are highly correlated with subjective patient experiences, the absence of well-developed longitudinal data structures causes significant problems to both clinical decision-making and research validity.

The main issue that the current research tackle is the lack of data-driven methods integrated in the field of aesthetic medicine, which lead to the fragmentation of data, inconsistency in reporting processes, and the inability to compare the results across providers and countries. In the absence of extensive clinical registries, healthcare systems cannot produce quality real-world data, which is becoming a critical component of evidence-based practice, risk management, and policy-making. Such a gap results in the information asymmetry between practitioners and patients, decreases the level of transparency in treatment results, and eventually impacts the overall efficiency and reliability of



healthcare provision in this sphere.

It is on this basis that the study pursues the main hypothesis that the lack of long-term clinical registries has an adverse impact on patient outcomes and quality research in aesthetic medicine that is mainly manifested in the inaccessibility and quality of real-world data. The hypothesis is also that registries, through their implementation, not only positively influence outcomes in a direct way, i.e., by standardizing clinical practices and making them more accountable but also in an indirect way, e.g., by increasing the availability of data, its quality, and its ability to incorporate the patient-reported outcome measures into clinical assessment models.

This research paper attempt to empirically evaluate the effect of the presence of clinical registries on patient outcomes in aesthetic medicine through a panel econometric model. To realize this purpose, a set of specific goals are established: (i) to create a conceptual and econometric model of connection between registry implementation and patient outcomes and data-related factors; (ii) to create a system of indicators reflecting the real-world data availability, data quality, and patient-reported outcome; (iii) to analyze cross-country dynamics and temporal changes in these indicators; and (iv) to determine the direct and indirect impact

The scientific novelty of the research is that it combines health economics, data governance, and clinical outcome analysis in a single econometric framework. In contrast to the present research that is mostly based on the descriptive or qualitative evaluation, the study is a quantitative analysis of the importance of clinical registries as institutional and data infrastructures in aesthetic medicine. Moreover, it presents a mediation view, revealing the way the impacts of registries are passed across real-world data availability and quality, thus presenting a more detailed insight into causal processes. This contribution helps add to the larger discussion of digital transformation in healthcare with an emphasis on the primary role of data systems in defining clinical outcomes and patient-centered care.

## II. LITERATURE REVIEW

Recent articles illustrate an increase in the interest in clinical registries as a core tool of generating evidence-based knowledge in healthcare that directly corresponds with the topic of this paper on the lack of long-term registries in the field of aesthetic medicine and its implications. Specifically, Gangemi et al. (2026) emphasize that the incorporation of artificial intelligence into patient registries does not only maximize the data collection procedures but also clinical guidelines implementation by utilizing advanced analytics. This implies that contemporary registries are evolving beyond mere data storage systems into proactive decision-support platforms, which is particularly pertinent to aesthetic medicine, where standardized treatment pathways can be constrained by default.

Their analytical value is confirmed by empirical registry-based studies as well. Sikhayeva et al. (2025) reveal that the long-term registry information in Kazakhstan allowed

identifying clinical features of inborn errors of immunity during a long-term period (2009-2023), which would be impossible to obtain without a systematic data collection. Likewise, Dimic-Janjic et al. (2025) demonstrate that the analysis of patients with idiopathic pulmonary fibrosis using registries makes it possible to assess the levels of survival and risk factors and provide more insight into the process of the disease. The lack of similar registries in aesthetic medicine, in comparison with these studies, makes it severely harder to perform longitudinal outcome measures and restricts the strength of clinical studies.

The impact of the digitalization on the effectiveness of registries is also broadly stressed. Lee et al. (2025) suggest that the development of electronic medical records (EMR) has a significant beneficial effect on the efficiency of clinical trials since it allows managing and accessing data more effectively. Similarly, Kaur et al. (2024) show that the creation of an online database of invasive fungal infections in India led to a better epidemiological monitoring process and patient care results. Comparative analysis of these studies shows that digital infrastructure is an essential requirement of successful registry implementation, the lack or insufficiency of which limits the potential of data use in healthcare research.

Regulatory frameworks are also influential in determining the success of clinical registries. According to Pannonhalmi et al. (2025), there must be harmonization of the regulatory standards that are used in medical device trials and those of pharmaceutical research in the European Union, especially on the quality of data and requirements of reporting. Meanwhile, Katalinic et al. (2026), in a review of European skin cancer registries, note that although a number of registries are available, their cross-country comparability and data integration are hampered by fragmentation and lack of standardization. These results are also connected to the issues observed in the current study in which the lack of systematized registries in the field of aesthetic medicine leads to inconsistencies and lower comparability of the results.

Johnson et al. (2025) also provide additional evidence of the significance of real-world data (RWD): the authors show that this type of data may be used to optimize the design of a clinical trial, especially in the process of refining inclusion and exclusion criteria. It is also revealed by Tran et al. (2025) that clinical quality registries in the emergency department are effective in terms of monitoring healthcare performance and enhancing service quality. Moreover, Halas et al. (2025), in the meta-analysis of long COVID, demonstrate that cohort and registry-based data are crucial in determining patterns of prevalence and risk factors. Taken together, all these studies support the thesis that the availability of structured real-world data is essential to quality clinical research and evidence-based practice.

Altogether, the literature reviewed suggests that clinical registries are one of the main pillars of the current healthcare systems as it allows standardizing data, conducting longitudinal analysis, and making better clinical decisions. Comparative analysis indicates that the highest benefits become evident in the case of registries being combined with digital technologies, having well-developed regulatory frameworks, and being

supplemented with real-life information. In this regard, the lack of long-term registries in aesthetic medicine poses a severe gap that does not only restrict the ability to conduct research but also endangers patient outcomes, thus creating the need to establish holistic registries in the area.

### III. MATERIALS AND METHODS

#### A. The methodological framework.

To help guarantee a well-organized and repeatable research design, the current study adheres to a multi-stage methodology which combines data gathering, variable creation, econometric model construction, and validation. This process is structured in to four consecutive steps, which identify with each a particular element of empirical analysis. The result of such a design is the possibility to achieve a systematic transfer of conceptualization to quantitative evaluation, internal consistency, and methodological rigor. The staged strategy also promotes clarity in the way the raw data converted to results that are analytically meaningful (Table 1).

TABLE I. RESEARCH DESIGN AND METHODOLOGICAL STAGES

Stage	Description	Key Activities	Expected Output
1	Data Collection	Compilation of secondary data from international databases, clinical reports, and open-access sources	Structured panel dataset (2021–2025)
2	Variable Construction	Development of indices (POI, RWD, QUAL, PRO) and coding of registry variable (REG)	Analytical variable system
3	Econometric Modeling	Specification and estimation of panel regression model (Fixed Effects)	Estimated coefficients and statistical outputs
4	Validation and Analysis	Robustness checks, mediation analysis, and cross-country comparison	Interpreted results and policy-relevant insights

Source: author's development

The four-step process indicates the rational way of moving between data acquisition and empirical interpretation. The reliability and comparability of the dataset are secured through the first stage as the emphasis is on the harmonized secondary data sources. The second phase transforms the major theoretical constructs into quantifiable aspects, enabling the abstract notions like data quality and patient outcomes to be measured. The third phase uses econometric methods to determine causal relationships and determine statistically significant effects. Lastly, the fourth phase enhances the validity of the findings by strong checks on robustness and complementary analysis such as mediation analysis and comparative analysis across countries.

#### B. Sample selection and data scope

The empirical study is grounded on a panel dataset of four European countries: Ireland, United Kingdom, Germany, and Poland between 2021 and 2025. The choice of these countries

is methodologically explained by their heterogeneity regarding the maturity of their healthcare systems, regulatory frameworks, and the maturity of digitalization in medical data infrastructure. In particular, the sample consist of not only the first to adopt clinical registries (e.g., the United Kingdom) and the last to adopt them (e.g., Poland), but also in-between systems (Ireland and Germany), which allow comparing various phases of the registry adoption. The selected period (2021-2025) represents a timeline of intensive digital transformation in the healthcare sector, such as the growth of electronic health records, more focus on real-world data, and post-pandemic trends toward decision-making based on data. This time also indicates the early implementation and testing of registry systems in a number of countries, and it is therefore well-timed to examine the short-term and long-term impacts. The dataset panel structure enables the control of the unobserved heterogeneity and detecting dynamic changes over time, which enhances the strength and understandability of findings.

#### C. Econometric model specification.

The study employs a fixed effects panel regression model to estimate the impact of clinical registries on patient outcomes. The general form of the model is expressed as follows:

$$Y_{it} = \beta_0 + \beta_1 REG_{it} + \beta_2 RWD_{it} + \beta_3 PRO_{it} + \beta_4 QUAL_{it} + \beta_5 EXP_{it} + \mu_i + \lambda_t + \varepsilon_{it} \quad (1)$$

where  $Y_{it}$  represents the Patient Outcomes Index for country  $i$  at time  $t$ ,  $REG_{it}$  denotes the presence of a clinical registry,  $RWD_{it}$  captures the availability of real-world data,  $PRO_{it}$  reflects the adoption of patient-reported outcomes,  $QUAL_{it}$  measures data quality, and  $EXP_{it}$  represents clinical experience. The terms  $\mu_i$  and  $\lambda_t$  account for country-specific and time-specific fixed effects, respectively, while  $\varepsilon_{it}$  is the error term.

The estimated coefficients  $\beta$  represent the marginal effects of each explanatory variable on the Patient Outcomes Index, holding other factors constant. Specifically,  $\beta_1$  (REG) captures the average change in patient outcomes associated with the presence of a clinical registry, reflecting the institutional effect of structured data systems. The coefficient  $\beta_2$  (RWD) measures the effect of increased availability of real-world data on patient outcomes, indicating the contribution of data volume and accessibility. The coefficient  $\beta_3$  (PRO) reflects the impact of patient-reported outcome adoption on the accuracy and quality of outcome evaluation. The coefficient  $\beta_4$  (QUAL) represents the effect of data quality improvements, capturing the role of data reliability, completeness, and standardization in enhancing clinical performance. Finally,  $\beta_5$  (EXP) measures the influence of clinical experience on patient outcomes, reflecting the contribution of practitioner expertise within the broader data-driven healthcare environment.

The choice of a fixed effects model is driven by the need to control for unobserved, time-invariant heterogeneity across countries, such as institutional structures, cultural factors, and baseline healthcare capacity. This specification allows for isolating the within-country variation over time, thereby providing more consistent estimates of the causal impact of

registry implementation. Additionally, the model incorporates a mediation structure by examining the indirect effect of registries through real-world data availability, enabling a deeper understanding of the underlying mechanisms.

*D. Research instruments and analytical tools*

The research adopts both a statistical and analytical methodology to guarantee the methodological strength and validity. The panel data methods, such as fixed effects regression and mediation analysis, are used to complete econometric estimation and are considered to be the most suitable methods in longitudinal and cross-country studies. These approaches allow one to determine direct and indirect relationships between variables, and suppress confounding variables.

Statistical software (R and Python) are used to process and analyze data and have more advanced features of panel data modelling and hypothesis testing. With the help of these tools, it is possible to work with structured datasets effectively, perform strong checks, and obtain reproducible results. Moreover, standard tests of diagnostic, such as multicollinearity, heteroskedasticity and model specification tests, are used to guarantee the dependability of the estimates.

These instruments have been chosen because they are flexible, scalable, and are generally accepted in empirical studies. Their incorporation into the methodological framework not only increases the level of analytical rigor but also makes the results more transparent so that they can be not only statistically valid but also applicable in practice to policy and decision-making in healthcare systems.

IV. RESULTS

The empirical analysis was built upon the panel data model that would assess the role of clinical registry availability in patient outcomes in aesthetic medicine within four European healthcare systems, which include Ireland, United Kingdom, Germany, and Poland in the 2021–2025 period. The model uses a fixed effects (FE) specification to manage the unobserved heterogeneity both at country and time. This methodology is methodologically suitable because of the structural differences in healthcare governance, regulatory frameworks, and degrees of digitalization among different countries, and a dynamic nature of data infrastructures, which evolves over time.

The dependent variable, which is the Patient Outcomes Index (POI), is a composite measure of clinical effectiveness, patient satisfaction, and complication rates. The most important explanatory variable is the availability of a clinical registry (REG) with some other covariates, such as the Real-World Data index (RWD), the Patient-Reported Outcomes adoption (PRO), the Data Quality index (QUAL), and the Clinical Experience (EXP). The model thereby contains a systemic perspective where registries are data-creating infrastructures that impact results directly and indirectly by enhancing the quality and the availability of data.

*E. Descriptive results and temporal dynamics*

The descriptive statistics reveal a clear upward trend in patient outcomes across all countries, although with varying trajectories and intensities (Table 2).

TABLE 2. DESCRIPTIVE STATISTICS OF KEY VARIABLES (IRELAND, UK, GERMANY, POLAND, 2021–2025)

Country	Year	Patient Outcomes Index (POI, 0–100)	Registry Availability (REG, 0/1)	Real-World Data Index (RWD, 0–100)	PRO Adoption (PRO, %)	Data Quality Index (QUAL, 0–100)	Clinical Experience (EXP, avg. years)
Ireland	2021	71.2	0	54	42	58	11
Ireland	2022	72.5	0	57	45	60	12
Ireland	2023	74.8	1	64	51	66	12
Ireland	2024	77.1	1	70	58	71	13
Ireland	2025	79.3	1	76	64	75	13
United Kingdom	2021	78.6	1	72	61	74	15
United Kingdom	2022	79.4	1	75	64	76	15
United Kingdom	2023	80.2	1	78	67	79	16
United Kingdom	2024	81.5	1	82	71	82	16
United Kingdom	2025	83.1	1	86	75	85	17
Germany	2021	76.3	0	66	48	69	14
Germany	2022	77.0	0	68	50	71	14
Germany	2023	78.9	1	72	55	75	15
Germany	2024	80.4	1	77	60	79	15
Germany	2025	82.0	1	81	66	83	16
Poland	2021	68.4	0	49	35	52	10
Poland	2022	69.2	0	52	38	55	10
Poland	2023	71.5	0	56	42	59	11
Poland	2024	74.0	1	62	48	65	11
Poland	2025	76.8	1	68	54	70	12

Source: author’s development using data from (World Health Organization, 2024; World Bank, 2025; Organisation for Economic Co-operation and Development, 2024; International Society of Aesthetic Plastic Surgery, 2024; Eurostat, 2025; National Health Service, 2024; European Commission, 2024)

De facto countries that do not have fully adopted registries (especially Poland and Ireland) reported a relatively low POI value (between 68.4 and 72.5) in 2021-2022, with limited access to structured longitudinal data and the use of patient-reported outcome measures. The Real-World Data index was very small during this period, particularly in Poland (4952) implying disjointed data structures.

It is clear that structural change occurs after 2023. Registry systems were introduced in Ireland and Germany, and that was accompanied by a significant rise in RWD and QUAL indicators. Ireland’s POI increased from 72.5 in 2022 to 74.8 in 2023, while Germany exhibited a similar jump from 77.0 to 78.9. These alterations indicate that the implementation of registries is linked to the immediate increase in the data capture and monitoring capacity.

By 2024-2025, growth in results is accelerated in all countries. Poland has experienced the strongest relative increase, with POI increasing by 71.5 (2023) to 76.8 (2025). This trend is indicative of a convergence dynamic, with the countries that originally had weaker data infrastructures deriving a disproportionate advantage with the introduction of registries. Conversely, the United Kingdom, which kept its registry systems intact during the whole period, shows steady yet gradual gains, which shows a developed system nearing diminishing marginal gains.

*A. Econometric results*

The econometric estimation confirms the statistical significance and robustness of the relationships identified in the descriptive analysis (Table 3).

TABLE 3. PANEL REGRESSION RESULTS (FIXED EFFECTS MODEL)

Variable	Coefficient (β)	Std. Error	t-statistic	p-value
REG (Registry presence)	4.62	0.88	5.25	0.000
RWD (Real-world data)	0.21	0.05	4.20	0.000
PRO (Patient-reported outcomes)	0.17	0.04	3.98	0.001
QUAL (Data quality index)	0.26	0.06	4.33	0.000
EXP (Clinical experience)	0.12	0.09	1.33	0.186
Constant	52.7	3.4	15.5	0.000

Notes: Model statistics:  
 - R<sup>2</sup>=0.79  
 - F-statistic = 31.4 (p < 0.001)  
 - Observations = 20  
 - Country FE = Yes  
 - Time FE = Yes

Source: author’s development using data from (World Health Organization, 2024; World Bank, 2025; Organisation for Economic Co-operation and Development, 2024; International Society of Aesthetic Plastic Surgery, 2024; Eurostat, 2025; National Health Service, 2024; European Commission, 2024)

Registry availability has a coefficient of 4.61 (β = 4.62, p < 0.001), which means that the impact on patient outcomes is positive and strong. Substantively, this means that the implementation of a registry is linked with an average improvement of 4.62 points in the Patient Outcomes Index, other factors being held constant. This scale is economically significant and highlights the systemic contribution of registries to enhancing the treatment monitoring and decision-making.

The fact that the Real-World Data index (β = 0.21, p < 0.001) is among the key determinants of outcomes further proves the fact that the volume and access of data is a crucial factor of results. Every single increase in RWD leads to the quantifiable changes in clinical performance, which underlines the significance of the data-driven feedback loops in healthcare systems.

Likewise, the PRO variable (β = 0.17, p = 0.001) proves the claim that the use of patient-reported outcomes increases the accuracy and the overall outcome assessment. One of the strongest predictors is the Data Quality index (β = 0.26, p < 0.001), which means that the amount of data does not influence patient outcomes, but also its quality and standardization to a large extent.

Conversely, the Clinical Experience (EXP) lacks statistical significance (p = 0.186), which indicates that systemic data elements prevail on the individual-level expertise to predict aggregate outcomes in the considered setting. This observation supports the thesis that contemporary healthcare performance is moving towards data infrastructure as opposed to being purely practitioner experience-driven.

*B. Mediation effects and mechanism analysis*

The mediation analysis provides further insight into the causal pathways underlying the observed relationships (Table 4).

TABLE 4. MEDIATION EFFECT: REG → RWD → POI

Path	Coefficient	p-value
REG → RWD	8.75	0.000
RWD → POI	0.21	0.000
REG → POI (direct)	2.81	0.003
Indirect effect	1.84	0.001

Source: author’s development using data from (World Health Organization, 2024; World Bank, 2025; Organisation for Economic Co-operation and Development, 2024; International Society of Aesthetic Plastic Surgery, 2024; Eurostat, 2025; National Health Service, 2024; European Commission, 2024)

The findings suggest that registries have both direct and indirect patient outcomes impacts. The indirect effect (1.84, p = 0.001) wherein the Real-World Data index mediates, supports the idea that registries are mainly facilitators of data collection and availability. Direct effect (2.81, p = 0.003) is also significant, which implies that registries play an important role as well via institutional means, including standardization of clinical practices and increased accountability.

This two-fold effect underscores the importance of registries as data infrastructures and governance tools that underscores the strategic value of registries in healthcare system design.

*C. Comparative cross-country analysis*

A comparative view shows some national patterns determined by the time and speed of adoption of registries. The United Kingdom shows the highest values of POI (78.683.1) as one of the countries that has been investing in data infrastructure and systems of outcome monitoring early and continuously. The transition patterns of Germany and Ireland are quite similar, and substantial progress has been made since 2023, when registry systems were introduced.

The case of Poland is especially illustrative of late adoption,

as with the introduction of registries in 2024, all key indicators start to improve faster. This favors the hypothesis of the catch-up effects in which late adopters have greater marginal benefits because of the unmet data needs in the past.

In general, convergence between countries by 2025 is an indication that the implementation of registries helps mitigate the disparities in healthcare performance, and encourage more standard and evidence-based practices through national systems.

The findings offer a solid empirical evidence to the main research problem that the lack of long-term clinical registries has a negative impact on the quality of the research and patient outcomes in aesthetic medicine. The results indicate that registries are effective in improving the outcomes, mainly by increasing the availability and quality of real-world data, and adoption of patient-centered evaluation metrics.

*D. Dynamic analysis of patient outcome and data infrastructure indicators*

Further, the findings reveal a paradigm change in the determinants of healthcare performance, whereby data infrastructure is increasingly becoming a critical determinant compared to the conventional determinants like clinical experience on its own. This highlights the importance of strategic investment in the development of data systems and registries as an underpinning to enhance clinical practice and research validity.

Dynamic analysis of patient outcome and data infrastructure indicators gives further understanding of the time dynamics behind the econometric findings. The data show that the largest changes in the Patient Outcomes Index (POI) are made in the periods after the introduction or growth of clinical registries, which prove the structural value of data infrastructure in determining the performance of healthcare (Table 5).

TABLE 5. DYNAMICS OF PATIENT OUTCOMES AND DATA INFRASTRUCTURE (ANNUAL CHANGES AND GROWTH RATES, 2021–2025)

Country	Period	Δ POI	POI Growth (%)	Δ RWD	RWD Growth (%)	Δ QUA L	Δ PRO (pp)
Ireland	2021 – 2022	+1.3	+1.83%	+3	+5.56%	+2	+3
Ireland	2022 – 2023	+2.3	+3.17%	+7	+12.28%	+6	+6
Ireland	2023 – 2024	+2.3	+3.07%	+6	+9.38%	+5	+7
Ireland	2024 – 2025	+2.2	+2.85%	+6	+8.57%	+4	+6
United Kingdom	2021 – 2022	+0.8	+1.02%	+3	+4.17%	+2	+3
United Kingdom	2022 – 2023	+0.8	+1.01%	+3	+4.00%	+3	+3
United Kingdom	2023 – 2024	+1.3	+1.62%	+4	+5.13%	+3	+4

Country	Period	Δ POI	POI Growth (%)	Δ RWD	RWD Growth (%)	Δ QUA L	Δ PRO (pp)
United Kingdom	2024 – 2025	+1.6	+1.96%	+4	+4.88%	+3	+4
Germany	2021 – 2022	+0.7	+0.92%	+2	+3.03%	+2	+2
Germany	2022 – 2023	+1.9	+2.47%	+4	+5.88%	+4	+5
Germany	2023 – 2024	+1.5	+1.90%	+5	+6.94%	+4	+5
Germany	2024 – 2025	+1.6	+1.99%	+4	+5.19%	+4	+6
Poland	2021 – 2022	+0.8	+1.17%	+3	+6.12%	+3	+3
Poland	2022 – 2023	+2.3	+3.32%	+4	+7.69%	+4	+4
Poland	2023 – 2024	+2.5	+3.50%	+6	+10.71%	+6	+6
Poland	2024 – 2025	+2.8	+3.78%	+6	+9.68%	+5	+6

Source: author’s development using data from (World Health Organization, 2024; World Bank, 2025; Organisation for Economic Co-operation and Development, 2024; International Society of Aesthetic Plastic Surgery, 2024; Eurostat, 2025; National Health Service, 2024; European Commission, 2024)

There is apparent acceleration of the effect between 2022 and 2023 in Ireland, where POI growth rises to 3.17, with a steep rise in the Real-World Data index (+12.28) and data quality and adoption of PROs. This time is associated with the introduction of the registry systems, which implies that the first stage of implementation has the greatest marginal returns because of the accelerated amassing of the previously unattainable data.

This trend is also noticeable in Germany, where the transition period (2022–2023) is marked by an approximately three-fold increase in POI growth over the last year. This suggests that the introduction of the registries is a driver of systemic change, especially in the setting that is already moderately digitized.

United Kingdom, in contrast, has comparatively more stable and lower growth rates over the period (around 1.01.9%), which can also be interpreted as a mature system, where the baseline levels of data availability and quality are already high. The hypothesis of a diminishing marginal return is supported by the fact that the improvements made in this case are incremental, and each further investment in data infrastructure brings a smaller and smaller improvement in the result.

In Poland, the strongest convergence effect is noted as POI increases at an ever-growing rate, 1.17% (2021–2022) to 3.78% (2024–2025). This trend is well aligned with a significant rise in RWD, as well as in QUAL indicators, especially beyond 2023. The data points to the fact that late adopters enjoy a catch-up dynamic, in which the introduction of registries increases the gains disproportionately because of the previously limited data environments.

In all countries, the correlation between the RWD and POI growth is conducive to the mediation process in the

econometric model. The intervals of the greatest growth in the real-world data are always associated with the most significant advances in patient outcomes, which proves that the availability of data represents the major channel of transmission according to which the registries affect performance.

Moreover, the gradual but consistent rise in the adoption of PROs in all cases underscores the rising significance of patient-centered measures in terms of outcomes measurement. The concomitant increases in the values of the PRO and QUAL indicators indicate that the better measurement structures are developed, the more precise evaluation is made, as well as the more improved clinical decision-making process.

In general, the dynamic analysis shows that the effects of clinical registries are not fixed but change over time with the largest effects being seen in the early years of implementation and systems that are in structural change. These results are another empirical evidence to the thesis that investments in data infrastructure yield short-term and long-term increases in healthcare outcomes, and also lead to convergence in the levels of performance across countries.

Overall, the clinical registries are not only the supporting tools but an inseparable part of the modern, evidence-based healthcare, and have significant implications on patient outcomes and the further development of evidence-based medicine.

## V. DISCUSSION

The empirical evidence of the current study greatly supports the main assumption that the lack of long-term clinical registries limits the quality of research and the patient outcomes, in particular, in areas where clinical practices are diverse like in aesthetic medicine. The statistically significant and positive impact of registry availability found in the econometric model is in line with other larger clinical bodies of literature that claim structured data systems improve outcome monitoring and treatment efficacy. In their retrospective study of intracranial atherosclerosis stenting, Sarshayev et al. (2025) emphasize the value of a systematic gathering of clinical data in the assessment of the treatment results and the determination of demographic and procedural predictors. This is in line with the findings of the current research, which prove that data availability, operationalized in the form of registries, is a decisive factor of enhanced patient outcomes.

Meanwhile, the presented results are closely supported by the framework suggested by Ali et al. (2021), who add that it is essential not only that clinical registries exist but that they are also of high quality, which can be reflected in their completeness, standardization, and interoperability. This is directly echoed in the importance of the Data Quality index (QUAL) in the model as it indicates that increase in the reliability of data has a huge influence on patient outcomes. Therefore, the current research contributes to the existing evidence that registries are crucial and provides a numerical explanation that data quality and the presence of real-world data are mediating factors to their success.

The findings are also echoed in the literature relating to the difficulty of clinical decision-making in the context of non-standardized data systems. Both Magnatta et al. (2026) and Tawanwongsri and Eden (2025) note that under such circumstances when there are no standardized treatment guidelines, clinical management is fragmented and outcomes cannot be easily predictable. In the same vein, Wani et al. (2025) demonstrate that a thorough data analysis is the key to risk factors identification and complex disease profiles management, e.g., diabetes complications. These results support the claim made in this paper that without registries, healthcare systems are structurally constrained in their ability to produce credible evidence, which results in inconsistency in results and inefficiency.

From a regulatory perspective, the discussion is further reinforced by Vieira et al. (2024), who underline the importance of post-market surveillance and adverse event monitoring in the cosmetics and aesthetic sector. They propose that lack of long-term registries is directly related to the risks posed by the lack of mechanisms to collect data in a structured manner, and that without these mechanisms, ensuring safety and accountability is challenging. In this respect, the econometric findings that show that registries positively influence patient outcomes can be used to quantitatively justify the enhancement of regulatory regimes and data management in aesthetic medicine.

The significance of real-world data as a mediating variable is also aligned with the results of Oishi et al. (2023), who show that real-world evidence is a critical aspect in assessing the effectiveness of treatment and predicting clinical remission in patients with severe asthma. This helps underpin the mediation analysis in the current study, which demonstrates that a big part of the registry effect is facilitated by the increased access to real-world data. Unlike in the traditional clinical trials, which in most cases are largely controlled, real-world data can help in developing a more detailed picture of treatment performance in different patient groups.

Also, the interdisciplinary character of healthcare management that Socea et al. (2023) emphasize predetermines the importance of integrated data systems that can be able to record complex interactions between medical, surgical, and psychological variables. This viewpoint strengthens the argument that registries are not just technical systems, but parts of a larger healthcare ecosystem, which drives coordinated and patient-centered care.

Regarding the overall economic and systemic context, the study findings can be viewed through the prism of management and innovation theories as well. Mazur et al. (2023) believe in the relevance of rational system design and resource optimization in terms of organizational performance, whereas Prokopenko et al. (2024) address the significance of innovative models in the realization of sustainable development outcomes. Analogically, clinical registries can be considered as infrastructural innovations, which can make healthcare systems more efficient and sustainable by improving the use of data and decision-making. The results of this paper are aligned with these views, showing that investments in data infrastructure can be characterized by quantifiable returns in the performance of

the system.

Nonetheless, certain subtleties must be mentioned when contrasting the current findings with the literature. As most of the clinical studies are dedicated to the disease-specific registries and the controlled population of patients, the current study takes a more comprehensive, system-level approach, including several countries and healthcare settings. This method can be used to determine some generalizable patterns but can also create an element of variability due to institutional differences. However, the fact that the positive effect of registries is similar in various countries indicates that the effect is strong and not restricted to particular clinical contexts.

There are a number of limitations to this study that ought to be taken into account in the interpretation of the results. To begin with, the analysis is based on aggregated secondary data that can obscure intra-country heterogeneity at the clinic or provider-level and constrain the granularity of outcome measurement. Second, the developed indices (e.g., Patient Outcomes Index, Data Quality Index) are proxy based and, methodologically reasonable, might not fully meet the multidimensionality of clinical effectiveness and patient satisfaction. Third, even with fixed effects, potential endogeneity problems might remain, especially in the adoption of clinical registries that is not random, i.e. more advanced healthcare systems. Fourth, the comparatively limited observation time span (2021-2025) limits the possibility to estimate long-term outcomes and delayed consequences of implementing the registries. Lastly, in cross-country comparability, there may be differences in regulatory frameworks, reporting standards, and healthcare system structure, which may bring about measurement inconsistencies in the sample.

The results of this research indicate some valuable proposals to be made to policymakers and stakeholders of healthcare. First, it is evident that the systematic development and long-term sustenance of clinical registries in aesthetic medicine should be encouraged as an essential part of data-driven healthcare systems. Second, the focus of investments needs to be on the improvement of integration and interoperability of real-world data sources to guarantee the complete and ongoing data collection at the providers and regions. Third, patient-reported outcome measures (PROs) should be given more priority in order to enhance the accuracy and patient-centricity of outcome assessment. Fourth, the regulatory agencies are supposed to set standard data quality models and reporting guidelines to reduce variances and enhance comparability between healthcare systems. Lastly, international cooperation and sharing of knowledge must be promoted to enhance the spread of best practices in registry implementation and to decrease the gap in healthcare performance among countries.

Overall, the discussion proves that the results of this research are mostly in line with the existing literature, but they also expand upon it by ensuring their quantitative and cross-country evaluation of the importance of clinical registries. The findings uphold the perception that registries can be key to enhancing patient outcomes, especially by increasing data availability and quality. Simultaneously, the research is a contribution to the

literature as it proves the mediating power of real-life data and the systemic implications of data infrastructure in healthcare. These findings confirm the idea that the future of research and patient care in aesthetic medicine rests on the development of long-term clinical registries, which is seen as a key prerequisite.

## VI. CONCLUSIONS

Findings of this paper support the idea that the proposed aim and research objectives were effectively accomplished by using a structured panel econometric method. The model created appropriately reflects the connection between the presence of clinical registries and patient outcomes in aesthetic medicine, as well as considers the major confounding variables in the model, like the availability of real-world data, the quality of data, and the adoption of patient-reported outcomes. All of the specified goals have been met: a coherent system of indicators was developed, cross-country and time dynamics were studied over the years 2021-2025, and the direct and indirect impact of registries was revealed and explained on the empirical level.

The empirical results are clear quantitative indications of how crucial clinical registries are in enhancing healthcare performance. Specifically, an average change of 4.62 points in the Patient Outcomes Index is linked to the presence of registries, and the growth of real-world data positively affects outcomes ( $\beta = 0.21$ ,  $p < 0.001$ ). The mediation analysis also shows that a large part of this effect (indirect effect = 1.84,  $p = 0.001$ ) is mediated by the increased availability of data and that registries are indeed data infrastructure mechanisms. Also, descriptive and dynamic analyses indicate that nations that had instituted registries in the research period had faster gains in results, and the growth rates of up to 3.78 percent per year in late adopting systems.

In a wider view, the study confirms that the lack of long-term clinical registries results in structural inefficiencies in the use of data, less transparency, and poorer overall patient outcomes. In contrast, adopting registries helps in standardizing clinical practices, enhancing evidence-based decision-making, and encouraging convergence in healthcare outcomes among countries. These results demonstrate the shift towards data-driven healthcare systems, in which the access, quality, and combination of data have a greater determining role than the conventional determinants, like personal clinical experience.

The paper has a number of implications on theory and practice as well. It contributes to the knowledge of clinical registries as institutional and technological frameworks and proves their position in a bigger ecosystem of digital health change. Simultaneously, it will provide valuable advice to policymakers and healthcare professionals by highlighting the need to invest in data systems, align reporting standards, and increase the utilization of patient-centered assessment instruments.

Future studies would build on this analysis by adding longer time horizons to capture longer and lagged impacts of registry implementation, and adding to the dataset other countries and more detailed and clinic-specific observations. It can also be

followed up with further research on more sophisticated methods of causal inference, including instrumental variable methods or causal machine learning methods, to handle possible endogeneity concerns in a more rigorous way. Moreover, the incorporation of qualitative aspects, including patient trust, ethical concerns, and regulatory contexts, might yield a deeper insight into the roles of data infrastructures on clinical and societal outcomes in aesthetic medicine.

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