

Impact of Digital Platform Engagement by Healthcare Professionals on Patient Adherence to Recombinant Human Growth Hormone Therapy

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Abstract. The Growzen® Connect digital ecosystem has been developed to support treatment for patients on recombinant human growth hormone (r-hGH) therapy. This ecosystem includes electronic injection devices with adherence data transmitters and a platform for healthcare professionals (HCPs) to monitor real-time patient adherence. This study aimed to investigate whether HCPs' engagement with this platform influences adherence to r-hGH therapy in patients from Spain in Argentina. Adherence data (optimal [$\geq 85\%$] versus suboptimal [$< 85\%$]) in the first four years of treatment at the patient level and three clinic-level metrics were extracted from the platform in the year 2024. Patients from Spain and Argentina were selected. We defined three metrics for digital engagement: frequency of monitoring adherence, height data entry, and reported dose changes. Adherence data were obtained from 4,544 patients in 186 clinics in Spain, and 1,550 patients in 184 clinics in Argentina. The proportion of patients with optimal adherence was higher in clinics where HCPs digitally monitored patient adherence data more often, entered more height data in the platform, and more often reported a change in dose. Our research revealed that HCPs' engagement with a digital adherence monitoring platform positively influenced patient adherence to r-hGH therapy in Spain and Argentina.

Keywords. Adherence monitoring, growth hormone therapy, digital platform

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1. Introduction

Adherence to a therapeutic regimen is an important determinant of treatment success, particularly in chronic conditions requiring long-term management [1]. In recent years, the emergence of digital health solutions has transformed how adherence is monitored and supported, enabling more timely interventions and improved clinical outcomes [2].

In addition to digital health solutions that help address adherence barriers, the active involvement of healthcare professionals (HCP) through ongoing support, clear communication, and trust building further strengthens patients' ability to maintain treatment adherence [3]. For patients undergoing recombinant human growth hormone (r-hGH) therapy, adherence is essential to achieve optimal outcomes [4]. Digital ecosystems that facilitate real-time monitoring of treatment adherence have shown promise in improving HCP–patient engagement and supporting personalised care strategies [5].

The Growzen® Connect digital ecosystem (see Figure 1) was developed to address these needs by providing several digital tools including a platform for adherence monitoring [5]. It integrates electronic injection devices with adherence data transmitters and a secure digital interface that allows HCPs to track patient adherence in real time. This platform empowers clinicians to make timely, data-informed decisions and promotes a more proactive approach to managing r-hGH therapy [6].

This study investigated the impact of HCP's engagement with this platform on patient adherence to r-hGH therapy in Spain and Argentina, aiming to understand how digital engagement can influence therapeutic outcomes.



Figure 1. Growzen® Connect digital ecosystem.

2. Methods

This study included patients from Spain and Argentina, selected based on a sufficient sample size and varying levels of engagement with the platform across clinics. To assess the impact of HCPs engagement with the platform, three clinic-level metrics categorised as low, medium and high from the year 2024 were extracted from the platform (see Table 1). These metrics were analysed both individually and as a composite sum score to determine the overall engagement score, which was categorised as low (0–1), medium (2–3), and high (4–6). Adherence data for 2024 were extracted from the platform and calculated per patient as the ratio of injected to prescribed r-hGH, classified as optimal ($\geq 85\%$) or suboptimal ($< 85\%$), and used as a proxy for optimal growth [7]. Multi-level logistic regression analyses with clinics as the clustering level were conducted, with adherence as the outcome, and each metric or the composite score as the input. All models were adjusted for standardised log-transformed age at treatment start and

standardised log-transformed treatment duration, country and the interaction between the metric or composite sum score and country, if significant.

Table 1. Metrics to define HCP’s engagement

Metric	Definition	Stratification
Frequency monitoring adherence	Total number of connections per clinic during a year divided by the number of treatment days over all patients per clinic during a year	High: ≥ 1 connection/patient/year Medium: $>0 < 1$ connection/patient/year Low: 0 (no connections)
Data entry	Total number of height data entries per clinic during a year divided by the total number of patients per clinic during a year	High: ≥ 1 measurement/patient/year Medium: $>0 < 1$ measurement/patient/year Low: 0 (no measurements)
Dose changes	Total number of dose changes per clinic during a year divided by the total number of patients per clinic during a year	High: ≥ 2 dose changes/patient/year Medium: $\geq 1 < 2$ dose changes/patient/year Low: < 1 dose change/patient/year

3. Results

Table 2 shows the characteristics of the study population.

Table 2. Characteristics of the data from Spain and Argentina

Characteristic	Spain	Argentina
Number of patients	4,544	1,550
Number of clinics	186	184
P50 (P25-P75) age at treatment start as of Jan 2024 (years)	11.4 (8.8-13.3)	10.1 (8.4-13.3)
P50 (P25-P75) time on treatment as of January 2024 (months)	10 (1-35)	18 (1-43)

Figure 2 shows the proportion of patients with optimal adherence by three engagement levels for the metrics (see Table 1) in Spain (A) and Argentina (B).

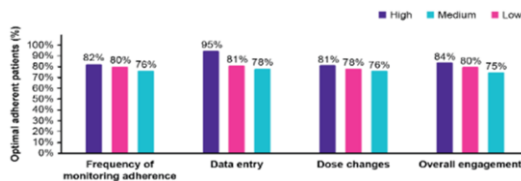


Figure 2A. Proportion of patients with optimal adherence by engagement levels in Spain

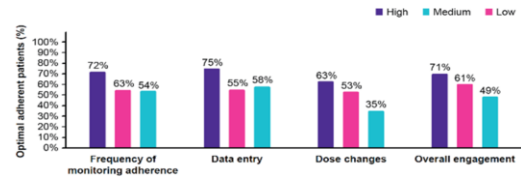


Figure 2B. Proportion of patients with optimal adherence by engagement levels in Argentina.

3.1 Frequency of monitoring adherence

The proportions of Spanish patients with optimal adherence were 82% (n=150/183), 80% (n=2,395 /2,986), and 76% (n=1042/1,375) in clinics with a high (n=25), medium (n=62), and low (n=99) number of connections per patient per year, respectively.

Within Argentinean patients, these numbers were 72% (n=67/93), 63% (n=334/528, p=0.09) and 54% (n=501/929) in clinics with a high (n=15), medium (n=36), and low (n=133) number of connections per patient per year, respectively.

Overall, the proportions were higher in clinics with a high (adjusted odds ratio (aOR), 95% confidence interval (CI): 1.3 (0.8-1.9), not significant) and medium (aOR 95%CI: 1.3 (1.1-1.6)) compared to clinics with a low number of connections per patient per year.

3.2 Data entry

The proportions of Spanish patients with optimal adherence were 95% (n=36/38), 81% (n=703/971), and 78% (n=2,848/3,635) in clinics with a high (n=2), medium (n=10), and low (n=174) number of measurements per patient per year, respectively.

Within Argentinean patients, these numbers were 75% (n=52/69), 55% (30/55) and 58% (820/1,426) in clinics with a high (n=6), medium (n=3), and low (n=175) number of measurements per patient per year, respectively.

Overall, the proportions were higher in clinics with a high (aOR 95%CI: 2.3 (1.2-4.5)) and similar in clinics with a medium (aOR 95%CI: 1.0 (0.7-1.5)) compared to clinics with a low number of measurements per patient per year.

3.3 Dose changes

The proportions of Spanish patients with optimal adherence were 81% (n=1,220/1,506), 78% (n=2,114/2,707), and 76% (n=253/331) in clinics with a high (n=62), medium (n=106), and low (n=18) number of dose changes per patient per year, respectively.

Within Argentinean patients, these numbers were 63% (572/907), 53% (313/594) and 35% (n=17/49) in clinics with a high (n=86), medium (n=82), and low (n=16) number of dose changes per patient per year, respectively.

There was a country-specific moderation effect, where there was positive impact of dose changes per patient per year on adherence in Argentina (aOR 95%CI: 2.4 (1.1-5.0) for high and 1.9 (0.9-3.9) (not significant) for medium versus low) and no effects in Spain.

3.4 Overall engagement

The proportions of Spanish patients with optimal adherence were 84% (n=381/456), 80% (n=2,368/2,975), and 75% (n=838/1,113) in clinics with high (n=15), medium (n=97), and low (n=74) overall engagement, respectively.

Within Argentinean patients, these numbers were 71% (65/91), 61% (636/1,045) and 49% (n=201/414) in clinics with high (n=11), medium (n=102), and low (n=71) overall engagement, respectively.

Overall, the proportions were higher in clinics with high (aOR 95%CI: 1.5 (0.98-2.2), not significant) and medium (aOR 95%CI: 1.3 [1.04-1.6]) compared to clinics with low overall engagement.

4. Discussion

In this study, we defined three metrics to quantify HCP engagement to the Growzen[®] Connect digital platform: frequency of adherence monitoring, height data entry, and dose changes. Using these metrics, we observed that greater HCP interaction with the platform was associated with higher adherence to r-hGH therapy among patients in both Spain

and Argentina. These findings support the role of digital health ecosystems in improving adherence outcomes in long-term endocrine care.

In Spain, differences in adherence across engagement levels were modest but consistent, while in Argentina the associations were more pronounced, particular for dose changes. This may reflect the lower overall adherence in Argentina, providing more room for improvement. The country-specific differences may further reflect variations in clinical practice, digital infrastructure, or healthcare system organisation. Despite these variations, the direction of effects was consistent across both countries, supporting the potential of digital platforms to enhance adherence. This aligns with evidence that electronic adherence monitoring improves adherence compared with usual care [2]

This study demonstrates that the three defined metrics can be used to systematically capture and quantify real-world HCP engagement to digital solutions, offering a practical way to explore how digital interaction patterns relate to treatment adherence in clinical settings.

Study limitations included fewer clinics with high engagement and the study design that did not allow for causal conclusions. Randomised controlled trials could help clarify the causal relationship between digital engagement and adherence. Further research is needed to explore barriers to platform use, develop strategies to enhance engagement, and perform external validation and sensitivity analyses to confirm the stability of the observed associations.

5. Conclusions

This study developed metrics for measuring HCP engagement using data from the Growzen® Connect digital ecosystem. The metrics were related to digital engagement. Results from Spain and Argentina highlight the value of these metrics in evaluating and improving engagement, which in turn contributes to improved adherence to r-hGH therapy.

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