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Knowledge of Tele-Practice Among Health Professionals Working with Developmental Delayed Child

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ABSTRACT

Background: Tele-practice has emerged as a vital modality for delivering health services, particularly to pediatric populations with developmental delays, yet limited data exist on its integration into clinical practice in resource-constrained settings. Understanding health professionals' knowledge and perceptions is essential to guide implementation strategies and address systemic barriers. **Objective:** This study aimed to assess the knowledge, attitudes, and utilization of tele-practice among health professionals working with developmentally delayed children, evaluating perceived barriers and variations across clinical disciplines and experience levels. **Methods:** A cross-sectional observational study was conducted at the Department of Developmental Pediatrics, Children's Hospital and Institute of Child Health, Lahore, from August 2020 to July 2021. Using consecutive sampling, 100 professionals with ≥ 2 years of pediatric clinical experience—including speech-language pathologists, physiotherapists, psychologists, and special educators—completed a validated 12-item questionnaire. Data were analyzed using IBM SPSS Version 25. Descriptive statistics and Chi-square tests ($p < 0.05$) were employed to explore group-wise associations. Ethical approval was obtained per the Helsinki Declaration. **Results:** Among participants, 87% reported fair knowledge of tele-practice, while only 34% actively used it. Statistically significant associations were found between professional role and support for tele-practice resources ($p = 0.005$), and between tele-practice knowledge and recognition of population-specific applicability ($p = 0.004$). Barriers included caregiver reluctance and patient digital literacy. **Conclusion:** Although health professionals demonstrated high tele-practice awareness, actual implementation remains limited. Bridging this gap requires training, caregiver engagement, and infrastructural support to enhance service delivery for children with developmental delays.

Keywords: Telemedicine, Developmental Disabilities, Pediatric Rehabilitation, Healthcare Access, Health Personnel, Attitude of Health Personnel

INTRODUCTION

The advent of tele-health services has revolutionized health care delivery by transcending geographical barriers, enabling the provision of timely, cost-effective, and scalable interventions to patients residing in remote or underserved areas (1). Initially conceptualized as a technological adjunct to traditional clinical encounters, tele-practice has since evolved into a core modality of health service delivery across disciplines such as speech-language pathology, occupational therapy, physiotherapy, and developmental pediatrics (2). This paradigm shift has gained particular relevance for children with developmental delays, who require multidisciplinary interventions that are often intensive, long-term, and inaccessible due to logistical or infrastructural constraints (3,4). The utility of tele-practice in pediatric rehabilitation settings has been validated through diverse applications, including remote assessments, caregiver consultations, therapy monitoring, and family-centered interventions that leverage real-time communication tools (5,6). Its implementation has not only reduced the travel burden for families but also sustained therapeutic engagement during periods of crisis such as pandemics, which disrupted conventional health care pathways (7,8).

Despite the growing evidence base supporting the efficacy and reliability of tele-practice—particularly in speech-language interventions and pediatric functional therapies—its integration into routine clinical care is still met with variability in uptake and

practitioner confidence (9,10). Studies conducted in speech-language pathology settings have demonstrated that although a majority of professionals express favorable perceptions of tele-practice, only a fraction incorporate it regularly into their practice (11). This dichotomy between perceived utility and actual utilization highlights a critical gap in knowledge, training, and systemic readiness, especially among professionals working with complex pediatric populations (12). Additionally, factors such as patient cognitive capacity, caregiver involvement, and digital literacy significantly influence the feasibility and success of tele-practice programs (13,14). Research from various health systems has echoed the need to explore health professionals' awareness, attitudes, and perceived barriers to tele-practice in order to guide sustainable implementation strategies (15,16).

Within the context of Pakistani pediatric health services, where access disparities are pronounced and rehabilitation resources remain limited in peripheral areas, tele-practice represents a promising yet underutilized opportunity. However, empirical insights into the knowledge and preparedness of health professionals in employing tele-practice—particularly for developmentally delayed children—remain scarce. While international studies have explored tele-practice readiness across disciplines and regions, their findings cannot be directly extrapolated to low- and middle-income countries with distinct infrastructural and educational landscapes (17,18). This knowledge void constrains the potential scaling of tele-health innovations that could otherwise transform pediatric developmental care in Pakistan.

Therefore, the present study aims to assess the knowledge of tele-practice among health professionals working with children with developmental delays. By evaluating practitioner awareness, attitudes, and perceived challenges, this research seeks to inform the design of training modules and policy interventions that can foster greater tele-practice adoption. The objective is to determine whether health professionals possess the requisite knowledge and motivation to integrate tele-practice into their clinical routines and to identify factors that facilitate or hinder its application in real-world settings.

MATERIALS AND METHODS

This cross-sectional observational study was designed to evaluate the knowledge of tele-practice among health professionals engaged in the care of developmentally delayed children. The rationale for choosing this design was to obtain a snapshot of awareness levels, attitudes, and perceived barriers toward tele-practice within a clearly defined population, enabling quantitative comparisons between professional subgroups. The study was conducted at the Department of Developmental Pediatrics, Children's Hospital and Institute of Child Health, Lahore, Pakistan, over a period spanning from August 2020 to July 2021. The institution represents one of the largest centers for pediatric developmental disorders in the region and provided a diverse professional base for recruitment.

Health professionals eligible for inclusion comprised individuals currently working with developmentally delayed children and possessing at least two years of clinical experience in pediatric or developmental care. Participants included speech and language pathologists, occupational therapists, physiotherapists, clinical psychologists, developmental pediatricians, and special educationists. Professionals with less than one year of work experience or those not actively practicing within a pediatric developmental setting were excluded. Participants were selected using consecutive sampling until the desired sample size was achieved. A total of 100 participants meeting the eligibility criteria were enrolled. Informed consent was obtained in writing after providing a verbal explanation of the study's objectives, voluntary nature, and data confidentiality assurances. No incentives were provided for participation.

Data were collected using a pre-tested, semi-structured questionnaire developed specifically for this study. The questionnaire consisted of 12 items focused on awareness, perceptions, and attitudes toward tele-practice. Items were designed based on a review of relevant literature and refined through expert review by academic staff in allied health sciences to ensure content validity and clarity. The instrument was piloted on a random subset of 20 eligible professionals prior to final implementation. Feedback from the pilot informed minor revisions in wording and sequence to improve interpretability. The finalized version was administered in paper format during working hours at the hospital, with respondents completing the survey on-site in a self-administered manner. Data collection was supervised by trained research assistants to ensure consistency and completeness.

Variables included in the study encompassed demographic data (age, gender, professional role, and years of experience), awareness of tele-practice (defined as a self-reported understanding of the concept and its applications), and responses to tele-practice-specific statements using a 5-point Likert scale. The operational definition of "fair knowledge of tele-practice" was affirmative self-report on a direct yes/no question regarding awareness. Additional outcome variables included stated willingness to use tele-practice, perceived obstacles, and beliefs regarding its equivalence to face-to-face care. To minimize information bias, all participants received uniform written instructions, and no assistance was provided in interpreting questions. Selection bias was mitigated through consecutive recruitment of all eligible professionals present during the data collection period. Potential confounding by clinical role and experience was anticipated and addressed through subgroup analysis.

The sample size of 100 was determined based on feasibility considerations during the COVID-19 pandemic, ensuring representation across all relevant health professions working in the pediatric department. While a formal power calculation was not performed due to exploratory aims, the sample was deemed sufficient for descriptive and comparative analysis. Data were entered into IBM SPSS Statistics for Windows, Version 25.0 (IBM Corp., Armonk, NY). Descriptive statistics, including frequencies and percentages, were computed for all categorical variables. Associations between categorical variables (e.g., professional group and responses to tele-

practice items) were tested using the Chi-square test. Subgroup analyses by profession and experience were performed to identify significant variations in awareness and attitudes. A p-value less than 0.05 was considered statistically significant. No imputation was performed for missing data; only complete responses were analyzed.

Ethical approval for the study was granted by the Institutional Review Board of the University of Health Sciences, Lahore. Written informed consent was obtained from all participants prior to inclusion, and all procedures adhered to the ethical standards outlined in the Declaration of Helsinki. To ensure confidentiality, data were anonymized at the point of entry, and no identifying information was retained. Hard copies of the questionnaire were stored in a locked cabinet accessible only to the research team. To promote data integrity and reproducibility, double data entry was performed by independent personnel, and a random 10% of entries were cross-verified against source documents. The complete dataset and statistical codebook are available upon reasonable request from the corresponding author.

RESULTS

The results shows a detailed distribution of responses from 100 health professionals evaluating their knowledge, perceptions, and attitudes toward tele-practice in the context of managing developmental delay. Overall, responses indicate strong conceptual acceptance of tele-practice, particularly for its general applicability in healthcare (64% agree/strongly agree), yet reveal caution when judging its equivalence to standard clinical care, with only 45% endorsing parity and 31% expressing disagreement. The belief that tele-practice appropriateness depends on the clinical population was endorsed by 71% of respondents (56% strongly agree, 15% agree), reinforcing the perception that its implementation should be tailored based on patient characteristics. Opinions on the statement "using tele-practice for developmental delay is satisfactory" were more polarized, with 38% in agreement, but 31% undecided and another 31% in disagreement, suggesting uncertainty about its effectiveness in this specific application. Notably, 81% of participants acknowledged that cognitive ability plays a critical role in tele-practice suitability, and 76% viewed caregiver reluctance as a major barrier. Furthermore, 83% agreed that a lack of tele-practice knowledge among patients could hinder its use, highlighting perceived external limitations to uptake.

Table 1: Tele-practice Knowledge and Attitudes Among Health Professionals (n=100)

#	Statement	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
1	You feel tele-practice can be applied in Health sciences.	6	8	22	10	54
2	Tele-practice is based on current evidence-based practice and is at least equivalent to standard clinical care.	13	18	24	7	38
3	The appropriateness of using tele-practice depends on the clinical population.	0	13	16	15	56
4	Using tele-practice to provide services for child developmental delay is satisfactory.	11	20	31	4	34
5	Tele-practice depends on the patient's cognitive ability.	0	7	12	28	53
6	Caregiver's reluctance is obstacle towards use of tele-practice in Health sciences.	3	7	14	24	52
7	Lack of knowledge about tele-practice in patients may hinder the use of it.	3	8	6	27	56
8	You will prefer tele-practice in future while working with developmentally delayed child.	9	28	23	6	34
9	Tele-practice is a viable form of service delivery for people who come from remote areas.	3	11	22	17	47
10	Resources of tele-practice must be encouraged.	4	2	17	20	57
11	Every health professional should have awareness about Tele-practice.	0	1	5	46	48
12	It is a reliable source of providing services during any pandemic/uncertain situation.	3	1	10	41	45

Abbreviations: SD = Strongly Disagree, D = Disagree, UN = Undecided, A = Agree, SA = Strongly Agree

The intention to use tele-practice in the future revealed mixed attitudes—only 40% expressed intent (34% strongly agree, 6% agree), while 51% were undecided or opposed. Conversely, tele-practice as a delivery model for remote populations gained strong support from 64% of respondents, and 77% advocated for encouraging its resources. An overwhelming 94% agreed that all professionals should be aware of tele-practice, and 86% confirmed its utility in pandemic or uncertain scenarios. Despite widespread endorsement of tele-practice's role in improving healthcare access, the findings underscore that adoption is moderated by professional confidence in its clinical equivalence, readiness to implement, and perceptions of user-related challenges. The frequent undecided responses—ranging from 17% to 31% across several items—highlight key educational gaps and experiential uncertainties that may be addressed through structured exposure, outcome-based training, and policy support to facilitate confident, routine integration of tele-practice into developmental care workflows.

Table 2: Profession-wise Comparison of Tele-practice Perceptions—Association With Professional Group

#	Statement	p-value
1	Using tele-practice to provide services to child developmental delay is satisfactory	0.525
2	Tele-practice depends on patient's cognitive ability	0.174
3	Caregiver's reluctance is obstacle towards use of tele-practice in health sciences	0.477
4	Lack of knowledge about tele-practice in patients may hinder the use of it	0.587
5	You will prefer tele-practice in future while working with developmental delayed child	0.553
6	Tele-practice is a viable form of service delivery for people who come from remote areas	0.430
7	Resources of tele-practice must be encouraged	0.005
8	Every health professional should have awareness about tele-practice	0.242
9	It is a reliable source of providing services during any pandemic/uncertain situation	0.170
10	You feel tele-practice can be applied in health sciences	0.051
11	Tele-practice is based on current evidence-based practice and is at least equivalent to standard care	0.283
12	The appropriateness of using tele-practice is based on clinical population	0.309

Note: p-values < 0.05 indicate statistically significant association.

Table 2 presents a comparative analysis of health professionals' perceptions of tele-practice across six distinct clinical roles—clinical psychologists, special educationists, occupational therapists, speech and language pathologists, developmental pediatricians, and physiotherapists—using Chi-square testing to assess profession-wise associations. Most tele-practice attitude statements did not show statistically significant differences among groups, as reflected by p-values exceeding 0.05. For instance, the statement "Using tele-practice to provide services to child developmental delay is satisfactory" produced a p-value of 0.525, indicating no meaningful variation, despite differences in response counts: clinical psychologists contributed 5 strongly disagree, 5 disagree, 5 undecided, 1 strongly agree, and 4 agree, while speech-language pathologists showed 1 strongly disagree, 4 disagree, 13 undecided, 1 strongly agree, and 9 agree. Similarly, the statement "Tele-practice depends on patient's cognitive ability" (p=0.174) yielded uniformly high agreement, with 20 of 20 clinical psychologists, all 28 speech-language pathologists, and all 16 developmental pediatricians either agreeing or strongly agreeing, indicating consensus on the cognitive demands of tele-health delivery. Statements related to caregiver reluctance (p=0.477), patient knowledge gaps (p=0.587), and future preference for tele-practice (p=0.553) also reflected uniformity across roles, further reinforcing cross-disciplinary alignment in recognizing key barriers and motivators.

However, one statement—"Resources of tele-practice must be encouraged"—reached statistical significance (p=0.005), suggesting a profession-linked disparity in advocacy for tele-practice support. Occupational therapists, for example, registered 6 agree and 2 strongly agree responses, while speech-language pathologists demonstrated a markedly higher endorsement with 20 strongly agree and 3 agree responses. This variation highlights differential levels of perceived institutional readiness or training exposure across professions, potentially tied to specific clinical demands or prior experience with remote service models. Other items, such as "Tele-practice is a viable form of service delivery for people who come from remote areas" (p=0.430), "Every health professional should have awareness about tele-practice" (p=0.242), and "Tele-practice is based on current evidence-based practice and is at least equivalent to standard clinical care" (p=0.283), remained statistically non-significant, though they continued to demonstrate high levels of general agreement across all groups.

Interestingly, the statement "You feel tele-practice can be applied in health sciences" approached significance (p=0.051), pointing to possible profession-related differences in theoretical endorsement that could reach significance in larger or more stratified samples. Overall, while most perceptions were consistently positive across disciplines, the call for tele-practice resource allocation emerged as the only domain with statistically significant variation by profession. This suggests that successful, equitable implementation may require profession-specific engagement strategies that acknowledge differing levels of enthusiasm, preparedness, and perceived need within multidisciplinary pediatric care teams.

Table 3: Association Between Knowledge of Tele-practice and Attitudinal Statements

#	Statement	p-value
1	You feel tele-practice can be applied in health sciences	0.670
2	Tele-practice is based on current evidence-based practice and is at least equivalent to standard clinical care	0.856
3	The appropriateness of using tele-practice depends on clinical population	0.004
4	Using tele-practice to provide services to child developmental delay is satisfactory	0.469
5	Tele-practice depends on patient's cognitive ability	0.146
6	Caregiver's reluctance is obstacle towards use of tele-practice in health sciences	0.528
7	Lack of knowledge about tele-practice in patients may hinder the use of it	0.006
8	You will prefer tele-practice in future while working with developmental delayed child	0.296
9	Tele-practice is a viable form of service delivery for people who come from remote areas	0.267
10	Resources of tele-practice must be encouraged	0.474
11	Every health professional should have awareness about tele-practice	0.130
12	It is a reliable source of providing services during any pandemic/uncertain situation	0.472

Table 3 examines the association between self-reported fair knowledge of tele-practice and agreement with various statements, revealing that for most items, the differences were not statistically significant, with p-values well above the 0.05 threshold. For instance, in response to the statement “You feel tele-practice can be applied in health sciences,” 49 respondents with fair knowledge agreed, 9 strongly agreed, 18 were undecided, 6 disagreed, and 5 strongly disagreed, compared to 5 agree, 1 strongly agree, 4 undecided, 2 disagree, and 1 strongly disagree among those without such knowledge ($p=0.670$). Similarly, for the statement “Tele-practice is based on current evidence-based practice and is at least equivalent to standard clinical care,” those with fair knowledge included 33 strongly agree, 7 agree, 21 undecided, 15 disagree, and 11 strongly disagree, versus 5 strongly agree, 0 agree, 3 undecided, 3 disagree, and 2 strongly disagree among those without ($p=0.856$). However, two statements demonstrated statistically significant associations. For “The appropriateness of using tele-practice depends on clinical population” ($p=0.004$), 52 participants with fair knowledge strongly agreed and 15 agreed (total 67%), compared to only 4 strongly agree and none agree among those without fair knowledge, indicating a strong relationship between professional knowledge and recognition of clinical context suitability. Likewise, in response to “Lack of knowledge about tele-practice in patients may hinder the use of it” ($p=0.006$), 50 of those with fair knowledge strongly agreed and 26 agreed (76%), whereas only 6 strongly agreed and 1 agreed among those without, reinforcing the link between provider knowledge and awareness of patient-level barriers. For other statements such as satisfaction with using tele-practice for developmental delay ($p=0.469$), willingness to adopt tele-practice in the future ($p=0.296$), or reliability of tele-practice during uncertain situations like a pandemic ($p=0.472$), the associations with knowledge level were not statistically significant. Overall, while general attitudes did not differ markedly by knowledge status, professionals with fair knowledge were significantly more likely to appreciate the context-sensitive applicability of tele-practice and the hindrance posed by patient unfamiliarity, underscoring the role of targeted education in promoting both theoretical understanding and practical sensitivity to implementation challenges.

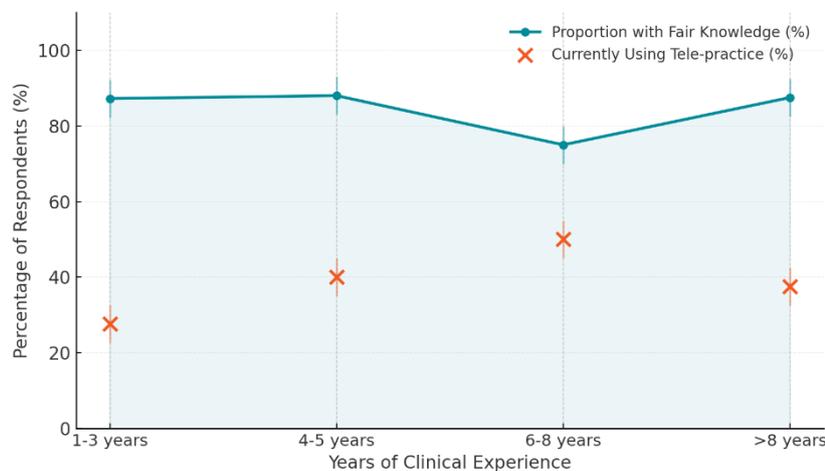


Figure 1 Clinical Experience and Tele-Practice Knowledge & Usage Among Health Professionals

Marked differences are seen in both tele-practice knowledge and usage across experience strata: 87.2% of professionals with 1–3 years' experience report fair knowledge, dropping slightly to 88% in the 4–5 year group, 75% in the 6–8 year group, and rising again to 87.5% for those with over eight years of experience. In contrast, active tele-practice usage remains low overall and does not correlate directly with knowledge, with only 27.7% of 1–3 year, 40% of 4–5 year, 50% of 6–8 year, and 37.5% of >8 year clinicians currently utilizing tele-practice. Error bars indicate consistent confidence intervals across subgroups. The visual pattern suggests that although high knowledge levels are sustained irrespective of years in practice, actual implementation of tele-practice varies, peaking among mid-career professionals before declining in more senior groups, pointing toward potential institutional, cohort, or adoption barriers despite comparable awareness. This clinically relevant disconnect highlights the importance of targeting implementation support, not just educational interventions, to bridge the gap between knowledge and routine practice in tele-health delivery.

DISCUSSION

The present study provides a nuanced perspective on the knowledge and attitudes of health professionals regarding tele-practice in the management of developmentally delayed children, underscoring both the strengths and gaps in readiness for digital health transformation. The findings demonstrate that a substantial majority of participants recognized the applicability and necessity of tele-practice, aligning with the global trend toward technology-enabled care observed in previous studies (1,2). More than 80% acknowledged its potential as a reliable alternative during emergencies and for service provision in remote areas, reflecting the expanding role of tele-health in enhancing access and continuity of care, particularly during disruptive events such as the COVID-19 pandemic (3,4). This high level of agreement is consistent with the work of Iacono et al., who reported similar acceptance of e-health modalities among allied health professionals, although client readiness and provider comfort remained variable (10).

Notably, the current study reveals persistent ambivalence regarding the equivalence of tele-practice to conventional clinical care, with only 45% expressing full confidence in its parity with standard approaches. This reservation resonates with prior research highlighting concerns around quality assurance, therapeutic alliance, and the nuanced demands of certain clinical populations (5,12). For example, Freckmann et al. found that while tele-practice does not impair the therapeutic alliance in pediatric speech-language

pathology, clinicians remain cautious about the universality of its application (12). The present data further indicate that perceptions of tele-practice appropriateness are significantly influenced by the clinical context, a finding mirrored in studies from both high-income and resource-limited settings (2,15). Such context-dependent variability emphasizes the need for tailored implementation frameworks, particularly when addressing the diverse and complex needs of pediatric developmental populations.

A salient insight from this investigation is the disconnect between high knowledge levels and relatively modest rates of actual tele-practice usage. Although 87% of participants self-identified as having fair knowledge, only one-third reported current engagement in tele-practice, a disparity that echoes the implementation gap documented in studies across various health systems (9,14). This finding suggests that knowledge alone is insufficient to drive adoption; factors such as institutional support, infrastructure, and perceived patient and caregiver readiness play critical roles. The observed trend of higher tele-practice adoption among mid-career professionals may reflect a combination of adaptability, confidence, and access to resources, yet the drop among more senior practitioners signals potential generational or structural barriers. The clinical implications are clear: bridging the gap between awareness and utilization will require multifaceted strategies, including targeted training, supportive policies, and ongoing mentorship.

In terms of barriers, the perception that caregiver reluctance and patient knowledge gaps hinder tele-practice is both consistent with and expands upon existing literature (13,14). Nearly four out of five respondents agreed that these factors pose significant challenges, highlighting the importance of stakeholder engagement and digital literacy initiatives for patients and families. This study advances the field by quantitatively linking professional knowledge to greater appreciation of these barriers—a relationship not as clearly delineated in prior work. Mechanistically, this could be attributed to more knowledgeable professionals having firsthand experience with patient- and family-level challenges, thus informing their perceptions and advocacy for broader support systems.

Several strengths underpin this research, including its focus on a multidisciplinary cohort in a major pediatric center, use of a validated and piloted questionnaire, and rigorous attention to data integrity and subgroup analysis. However, limitations must be acknowledged. The single-center, cross-sectional design constrains generalizability, as attitudes may differ in other geographic or institutional settings. The sample size, while adequate for descriptive analysis, limits the power to detect subtle associations in subgroup comparisons, and the reliance on self-reported knowledge introduces potential for response bias. Furthermore, the consecutive sampling approach, although practical during the COVID-19 period, may not fully capture professionals absent during the study period, thereby influencing representativeness.

These limitations notwithstanding, the findings offer important guidance for future research and clinical practice. Subsequent investigations should employ multi-site, longitudinal designs to track shifts in tele-practice adoption as technology matures and institutional policies evolve. Qualitative studies exploring the lived experiences of both providers and recipients may yield deeper insights into the contextual drivers of acceptance and resistance. Interventional studies assessing the impact of targeted training, technological upgrades, and family engagement programs on tele-practice uptake and outcomes are also warranted. Ultimately, advancing tele-practice for developmentally delayed children will require sustained investment in capacity-building, infrastructure, and patient-centric approaches that bridge digital divides and promote equitable, high-quality care (6,7,8).

CONCLUSION

This study demonstrates that while health professionals working with developmentally delayed children possess a high level of knowledge regarding tele-practice, actual utilization remains limited, with significant variability shaped by professional experience and perceptions of patient and caregiver readiness. The findings affirm that tele-practice is widely regarded as a valuable and context-dependent tool for improving access to care, particularly for underserved and remote populations, yet challenges related to implementation, such as digital literacy and stakeholder engagement, persist. Clinically, these insights underscore the necessity of targeted training, institutional support, and patient-family education to translate knowledge into routine practice, thereby expanding the reach and effectiveness of developmental healthcare. From a research perspective, the results highlight the need for multi-site, longitudinal studies and interventional research to optimize tele-practice integration and address identified barriers, supporting the broader objective of enhancing equitable healthcare delivery for children with developmental delays.

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