Preplanned Studies

Effect of Telehealth Follow-up Consultation in Pediatric Acute Otitis Media — Shenzhen City, Guangdong Province, China, 2023–2024

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Summary

What is already known about this topic?

Between 50% and 85% of children experience at least one episode of acute otitis media (AOM) by age three. Since the coronavirus disease 2019 (COVID-19) pandemic, numerous hospitals across China have integrated telehealth solutions into their pediatric care services.

What is added by this report?

Our study found patients with ear pain relief was 84% in the telehealth follow-up group compared to 81% in the in-person follow-up group, showing no statistically significant difference (*P*=0.57). Hearing loss was documented in 21 cases from the telehealth group and 23 cases from the in-person follow-up group (*P*=0.73). Patient satisfaction scores were comparable between groups, with mean scores of 4.47 for telehealth and 4.49 for in-person follow-up (*P*=0.87). Multivariate regression revealed no significant difference in patient satisfaction between telehealth and in-person follow-up (*P*=0.21).

What are the implications for public health practice?

Telehealth services can effectively bridge geographical healthcare disparities while optimizing pediatric care delivery systems

ABSTRACT

Introduction: Between 50% and 85% of children experience at least one episode of acute otitis media (AOM) by age three. Since the coronavirus disease 2019 (COVID-19) pandemic, numerous hospitals across China have integrated telehealth solutions into their pediatric care services. Our research team introduced the Telehealth and Autonomous Mobile Clinic Framework, which was published in the Bulletin of the World Health Organization in September 2022.

Methods: The investigation employed a retrospective cohort design. The study population comprised 200 pediatric patients diagnosed with AOM who received either telehealth follow-up consultation or traditional in-person clinic visits. Bivariate analyses examined relationships between telehealth follow-up consultation and patient outcome in ear pain, hearing loss, and patient satisfaction between telehealth and in-person AOM follow-up groups. Multivariate regression analysis evaluated associations between ear pain (a primary clinical outcome) and telehealth utilization, hearing loss, and patient satisfaction, with adjustments for age and gender.

Results: Ear pain relief was reported by 84% of patients in the telehealth follow-up group compared to 81% in the in-person follow-up group, showing no statistically significant difference (*P*=0.57). Hearing loss was documented in 21 cases from the telehealth group and 23 cases from the in-person follow-up group (*P*=0.73). Patient satisfaction scores were comparable between groups, with mean scores of 4.47 (range: 2.47–4.92) for telehealth and 4.49 (range: 2.72–4.94) for in-person follow-up (*P*=0.87). Multivariate regression revealed no significant difference in patient satisfaction between telehealth and in-person follow-up (*P*=0.21).

Conclusion: This retrospective study provides compelling evidence for the effectiveness and feasibility of telehealth follow-up consultations in pediatric otitis media management. Our findings demonstrate that telehealth consultations achieve comparable outcomes to in-person follow-up visits for AOM patients.

Acute otitis media (AOM) is the most frequently diagnosed pediatric acute care condition, with 50% to 85% of children experiencing at least one episode of AOM by the age of three (AAFP). Clinical manifestations include otalgia (indicated by ear rubbing, tugging, or holding), fever, irritability,

otorrhea, anorexia, and, in some cases, vomiting or lethargy (*1*–*2*). The diagnosis of AOM in children is established by the symptomatic presentation of moderate to severe tympanic membrane bulging, new-onset otorrhea not attributable to acute otitis externa, mild tympanic membrane bulging accompanied by recent-onset ear pain (within 48 hours), or intense tympanic membrane erythema (*3*). Management include pain control combined with either watchful waiting or antibiotic therapy. The strategy selection is determined by the patient's age, severity of symptoms, and whether the condition is unilateral or bilateral (*4*).

Telehealth has transformed pediatric care delivery (*5*). A technical report from the American Academy of Pediatrics indicates that telehealth can enhance patient access to pediatric expertise while facilitating improved clinician communication, ultimately leading to more efficient, higher-quality, and cost-effective care (*6*). Evidences support the efficacy of telehealth in pediatric consultations. Research by Davis from the University of California demonstrated high satisfaction rates among both patients and providers during pediatric telehealth consultations (*7*). Additionally, a study by the University of Rochester Medical Center revealed correlations between telehealth consultations for pediatric asthma patients and enhanced symptomatic management and decreased hospitalization rates (*8*). These findings support telehealth as an effective tool for enhancing pediatric healthcare delivery.

This retrospective cohort study evaluated pediatric AOM patients who received either telehealth follow-up consultation or traditional in-person clinic visits between September 1, 2023, and March 31, 2024, at the Shenzhen United Family Hospital. The study population comprised 200 patients equally distributed between the telehealth (n=100) and in-person (n=100) groups over a 2-week period. All telehealth consultations were conducted through the United Family Hospital teleconsultation application. Primary outcomes included patient satisfaction, ear pain, hearing loss, and the Ear-Nose-Throat (ENT) specialists' recording and evaluation of symptoms during the telehealth consultations.

Patient satisfaction scores showed no significant statistical differences between the telehealth (mean 4.47, range: 2.47–4.92) and in-person follow-up groups (mean 4.49, range: 2.72–4.94; P=0.87). Multivariate regression analysis, adjusting for age, gender, ear pain, and hearing loss, further confirmed no significant differences in patient satisfaction between the two groups (P=0.21). This study demonstrates that telehealth consultations achieve comparable outcomes to in-person visits in terms of patient satisfaction and clinical outcomes of AOM patients. Further research examining the cost-effectiveness and health policy implications is necessary to enhance the accessibility and efficacy of pediatric telemedicine services.

The investigation employed a retrospective cohort design. The study population comprised pediatric patients diagnosed with AOM who received either telehealth follow-up consultation or traditional in-person clinic visits between September 1, 2023, and March 31, 2024, at Shenzhen United Family Hospital. Patient records were identified through electronic health records (EHRs) based on the following criteria: age below 18 years at diagnosis, confirmed AOM diagnosis, receipt of telehealth follow-up consultation, and documented treatment for AOM. Exclusion criteria encompassed a history of chronic otitis media, tympanic membrane perforation, or other ear-related conditions.

The study population consisted of 200 children with confirmed AOM diagnoses, equally allocated between telehealth consultation (n=100) and in-person clinic follow-up (n=100) groups for a 2-week period. Data extraction was performed from the hospital's outpatient routine database within the EHR system. Patient assignment to either telehealth or in-person follow-up groups was randomized using a computerized numerical generator process, with odd numbers designated for telehealth and even numbers for in-person follow-up. Hospital nurses with appropriate record access privileges conducted data retrieval while remaining blinded to the study design and anticipated outcomes.

The data collection encompassed routine demographic information from EHRs, including patient characteristics, treatment details, and relevant outcomes. All data were extracted from existing routine documentation rather than being specifically collected for this study. Patient outcomes were evaluated based on symptom resolution, recurrence, and AOM persistence following treatment completion. The assessment of telemedicine services' feasibility and accessibility incorporated both patient and provider satisfaction metrics.

All telehealth consultations were conducted using the United Family Hospital teleconsultation mobile application platform, accessible to both healthcare providers and patients. Following AAFP guidelines, ear pain and hearing loss were identified as primary clinical

indicators for AOM evaluation, with patient satisfaction serving as the key patient-reported outcome (PRO). As AOM typically shows symptomatic improvement within 2 weeks of appropriate treatment, follow-up assessments were scheduled at this interval (*9*). During ear, nose, and throat (ENT) specialist-led telehealth consultations, ear pain and hearing loss were systematically evaluated based on patient reports. Patient satisfaction scores were similarly assessed during these consultations. Given the pediatric population, parents facilitated all interactions during both telehealth and in-person follow-up visits.

Patient selection utilized a systematic random sampling approach from hospital outpatient department records to ensure an equal probability of inclusion and minimize selection bias. Patient recruitment occurred continuously throughout the specified study period to maintain the target sample size and account for potential attrition or exclusions based on eligibility criteria. To prevent selection bias, researchers conducting follow-up assessments were blinded to the recruitment process. Patient demographics, baseline characteristics, follow-up information, and patient-reported outcomes were summarized using descriptive statistics.

Bivariate analyses examined relationships between telehealth follow-up consultation and patient outcomes, specifically employing two-sample t-tests to compare mean differences in ear pain, hearing loss, and patient satisfaction between telehealth and in-person AOM follow-up groups. Multivariate regression analysis evaluated associations between ear pain (a primary clinical outcome) and telehealth utilization, hearing loss, and patient satisfaction, with adjustments for age and gender.

The sample size was determined using the web-based Sample Size Estimation software developed by John Eng and Russell H. Morgan at Johns Hopkins University School of Medicine (*10*). To detect a minimum difference of 1 unit in patient satisfaction scores, with 80% statistical power and a two-tailed significance level of 0.05, a minimum of 71 subjects was required. Our sample size of 200 achieved 93% power. STATA (version 16 for Windows, By StataCorp LLC. 2024, Texas, United States) was used to conduct all analyses.

Our evaluation focused on three primary indicators for AOM, which were patient satisfaction, ear pain, and hearing performance. Patient satisfaction assessed the quality of telehealth consultation services, while ear pain and hearing performance measured clinical outcomes. As shown in Table 1, the demographic characteristics were comparable between groups. The mean age was 5.66 years in the telehealth group and 5.53 years in the in-person visit group. The gender distribution was balanced, with male patients comprising 51% (51/100) of the telehealth group and 53% (53/100) of the in-person group.

After 2 weeks of treatment, ear pain relief was reported by 84% of patients in the telehealth follow-up group compared to 81% in the in-person follow-up group, showing no statistically significant difference (P=0.57). Hearing loss was documented in 21 cases from the telehealth group and 23 cases from the in-person follow-up group (P=0.73). Patient satisfaction scores were comparable between groups, with mean scores of 4.47 (range: 2.47–4.92) for telehealth and 4.49 (range: 2.72–4.94) for in-person follow-up (P=0.87).

Multivariate regression analysis, presented in Table 2, examined the relationship between consultation method and patient satisfaction while adjusting for covariates including ear pain, hearing loss,

TABLE 1. Comparison of telehealth and in-person AOM follow-up outcomes.

Variables	Telehealth (*N*=100)	In-person (*N*=100)	t value	*P*
Age (years)	5.66 (3.25–9.12)	5.53 (3.01–8.89)		
Gender				
Male	51	53		
Female	49	47		
Ear painful relief	84	81	1.97	0.57
Hearing loss	21	23	0.73	0.73
Patient satisfaction	4.47 (2.47–4.92)	4.49 (2.72–4.94)	0.87	0.87

Note: Data shown in table sessions Telehealth and In-person are subject numbers (*n*), with the mean and (SD) of subjects, respectively. The t value and *P* are using two-tail t and *P* performance.
Abbreviation: AOM=acute otitis media; SD=standard deviation.

TABLE 2. Multivariate regression on AOM patient satisfaction 2 weeks follow-up.

Variables	Coefficients	Standard Error	t Stat (two tail)	*P* (two tail)	Lower 95% *CI*	Upper 95% *CI*
Telehealth	−0.07	0.062	−1.23	0.21	−0.201	0.045
Ear pain	−1.66	0.154	−10.77	<0.01	−1.973	−1.362
Hearing loss	−0.38	0.126	−3.04	<0.01	−0.637	−0.136
Age	0.01	0.018	1.56	0.55	−0.026	0.048
Gender	0.09	0.062	0.76	0.12	−0.025	0.221

Note: The multivariate regression analysis in this study is adjusted R square of Model (R^2) = 0.76. Patient satisfaction using PSQ-18 scoring, ranging from 1–5. All results have already been adjusted for each covariate, e.g. Telehealth results have been adjusted for ear pain, hearing loss, age, and gender. Other results were yielded after adjusting related covariates and confounders.
Abbreviation: AOM=acute otitis media; *CI*=Confidence Interval.

age, and gender. The analysis revealed no significant difference in patient satisfaction between telehealth and in-person follow-up (P=0.21). However, patient satisfaction scores were negatively associated with both ear pain (t=−1.23, P<0.01) and hearing loss (t=−3.04, P<0.01). Neither age nor gender showed statistically significant associations with patient satisfaction (P>0.05). Given the demonstrated equivalence between telehealth and in-person follow-up for AOM patients, healthcare providers' expansion of teleconsultation services to other suitable conditions should be considered to reduce wait times and improve healthcare delivery efficiency.

DISCUSSION

This retrospective study provides compelling evidence for the effectiveness and feasibility of telehealth follow-up consultations in pediatric otitis media management. Our findings demonstrate that telehealth consultations achieve comparable outcomes to in-person follow-up visits for AOM patients. Furthermore, telehealth shows significant potential to revolutionize pediatric care delivery by expanding access across geographic boundaries, optimizing pediatric workforce utilization, and addressing disparities in healthcare accessibility.

While our study offers valuable insights, several limitations warrant consideration. First, our analysis focused primarily on patient satisfaction and select clinical outcomes, leaving the cost-effectiveness of teleconsultation unexplored. Additionally, as a retrospective cohort study, the evidence level does not match that of a randomized controlled trial. Moreover, the implementation of telehealth technology requires more than just clinical outcome validation. The development of evidence-based best practices and comprehensive policies specific to pediatric telemedicine is essential for widespread adoption.

A critical consideration is the establishment of appropriate reimbursement mechanisms for remote services across various payment models, including fee-for-service, capitation, and value-based plans. Rigorous research and metric development are fundamental to creating evidence-based best practices and policies for these emerging care delivery models.

Our findings demonstrate that telehealth consultations achieve equivalent outcomes to in-person follow-up visits for AOM patients in terms of satisfaction and clinical outcomes. However, additional research examining cost-effectiveness and health policy implications is necessary to optimize the accessibility and efficacy of pediatric telemedicine. As pediatric healthcare transitions from traditional fee-for-service models to alternative payment methods, telehealth presents unique opportunities to establish sustainable, value-based population health models. This study was conducted under a retrospective design utilizing routine outpatient datasets from existing patient databases. The hospital's Institutional Review Board approved the study protocol and ensured data privacy compliance.

Conflicts of interest: No conflicts of interest.

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