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Evaluation of Health Service Outcomes for an Audiology First Point of Contact Retrocochlear Clinic: A 6-year Retrospective Cohort Study

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ABSTRACT

Objective:

Although existing studies of audiology first point of contact clinics which screen for retrocochlear pathology have demonstrated positive clinical outcomes, they have provided limited information regarding service impacts. Thus this study aimed to evaluate both the clinical and health service outcomes of an audiology first point of contact (FPOC) Clinic for adults referred to ENT services with suspected retrocochlear pathology.

Design:

Retrospective cohort study.

Study sample:

All 1123 patients referred to the clinic over a 6-year period (2013 -2019).

Results:

Most (73.7%) of the 1123 patients referred to the Retrocochlear Clinic were managed and discharged by the audiologist and did not require ENT appointment. Almost half (43.1%) were directly referred for MRI imaging, of which 4 (1.1%) were diagnosed with Vestibular Schwannoma. Waiting times for first appointments significantly ($p<0.001$) reduced from a median of 748 days to 63.5 days over the 6-year period. Attendance rates also significantly ($p<0.001$) improved over this time (from 52.2% to 90%). There were no adverse events reported. Of those discharged without attending an ENT appointment, 1.8% were re-referred to ENT within 12 months of discharge.

Conclusions: This audiology FPOC Retrocochlear Clinic was shown to be a safe and effective alternative service model.

INTRODUCTION

Due to increasing pressure on public healthcare systems, wait times for medical and surgical specialist appointments have increased, with many patients waiting longer than clinically recommended[1,2]. As such, clinicians and administrators have been evaluating various alternative strategies to help maximise the capacity of services, while still maintaining high quality patient care[3].

One strategy to address this issue has been the implementation of allied health professional (AHP)-led, or AHP first point of contact (FPOC) clinic models[4,5,6]. In these clinics, AHPs assess, manage and discharge appropriate (low risk) patients on medical and surgical outpatient waitlists with minimal input from medical specialists[7]. The term “first point of contact” is used to denote that the AHP is the first person seen by the patient and is usually case-managed by them, but many iterations of these models exist. Many of these models require AHPs to operate under an extended or expanded scope of practice, for which they must have appropriate training, governance and credentialing. Many allied health disciplines have successfully implemented and evaluated AHP FPOC clinics utilising extended scope of practice roles[4,6,8,9,10,11]. AHP FPOC models of care have been shown to be a safe and effective way to increase public health service capacity and meet service demands[7].

The Ear Nose and Throat (ENT; otherwise known as otolaryngology) specialty is among those experiencing significant demand, compounded by a shortage in specialists and wide variation in referral urgency[12,13]. There has been a range of evidence to support the use of extended or expanded scope of practice audiology

FPOC clinics to complement both paediatric and adult ENT specialist outpatient services. In the United Kingdom, the National Health Service implemented direct referral audiology clinics to allow general practitioners to refer patients directly to audiologists for assessment and provision of hearing aids, rather than to an ENT specialist first. This change in service model significantly reduced the number of patients needing to see ENT specialists[14]. In paediatrics, audiology FPOC triaging of children with middle ear or hearing concerns has also been reported as a safe and effective way to independently manage these patients, with studies showing the potential to increase capacity within the paediatric ENT specialist outpatient service by up to 77%[8,9].

Recent work has also highlighted the potential for audiology services to provide a proactive role in the evaluation of patients with suspected retrocochlear pathology (e.g. Vestibular Schwannoma, also known as an Acoustic Neuroma). In many countries, patients who present with symptoms associated with retrocochlear pathology, such as asymmetrical sensorineural hearing loss and unilateral tinnitus, are referred directly to an ENT specialist. However, as only 1-2 percent of these patients will be diagnosed with retrocochlear pathology[15], the number of potentially unnecessary ENT consultations is significant[16]. To help reduce the burden on ENT specialist services, alternate audiology FPOC clinical models have been used to manage this population[16,17,18,19,20,21]. In these models, patients are referred to an audiologist as the first point of contact, who completes further testing against set protocols, and based on those findings refers appropriate patients for a magnetic resonance imaging (MRI) scan of the internal auditory meatus (IAM), which is considered the 'gold standard' for the diagnosis of Vestibular Schwannoma[17].

Research on audiology FPOC models for detecting retrocochlear pathology mostly reports on general direct referral audiology clinics which see patients with a range of issues, rather than clinics which are focused on suspected retrocochlear pathology exclusively. The existing studies also have a primary focus on detection rates of retrocochlear pathology, and unfortunately provide limited information about the service level outcomes of the clinical model itself[16,17,18,20]. Of the service data that has been reported, Wong and Capper[20] noted that having a direct referral audiology clinic avoided the addition of over 300 patients to the ENT clinic list over 3.5 years, and discussed the potential cost savings of the model. In Abbas et al[17], both outcomes and costs of an audiology first point of contact model were examined, and findings revealed that 97.6% of patients were managed by the clinic without need for an ENT appointment, with an overall cost saving of £164,850.

Most recently, Payten et al[19] reported on some outcomes of an audiology FPOC clinic specifically for patients with suspected retrocochlear pathology who were referred from ENT waiting lists. Their retrospective study showed that the clinic was able to manage and discharge 53.5% of patients without referral back to ENT, and that there was a significant reduction in waiting times and a small cost saving after introduction of the service[19]. However, the study was based on only 60 patients who attended during the clinic's first 12 months of operation. Furthermore, the study reported the evaluation of 5 different AHP FPOC models, and as such had limited information specific to the Retrocochlear Clinic.

While there has been some research on audiology FPOC models with a role in screening for retrocochlear pathology, there has been limited description of the clinical models used, and it is not known how they impact aspects of service evaluation that are typically reported in evaluations of AHP first point of contact clinic models, such as patient flow, wait times, rates of nonattendance and rereferral rates[6]. Considering the potential widespread benefits for both patients and health services from this type of audiology FPOC clinical model, further systematic evaluation of this type of service model is needed. Hence the aim of the current study was to examine both the clinical and service outcomes of an audiology first point of contact clinic designed specifically for individuals with suspected retrocochlear pathology, referred to herein as the Retrocochlear Clinic. This included describing the characteristics of patients referred to the Retrocochlear Clinic, measuring the impact on waiting times, and outlining patient pathway and outcomes, including rereferrals within 12 months.

MATERIALS AND METHODS

The study utilised a retrospective cohort study design and was conducted in the ENT outpatient department of a large secondary hospital in Queensland, Australia. All patients over the age of 18 whose referral was redirected by the ENT department to the Retrocochlear Clinic between 1st December 2013 and 30th November 2019 were included in this study.

Audiology First Point of Contact Retrocochlear Clinic Model and Protocols

The Retrocochlear Clinic was developed as an alternative service referral pathway for patients who were referred to ENT with symptoms of asymmetrical sensorineural

hearing loss, unilateral tinnitus and/or dizziness. This alternate, advanced scope of practice audiologist FPOC model was intended to exclude retrocochlear pathology as the cause of patients' symptoms while limiting demand on ENT specialists. Safety was central to the design and implementation of this clinic model, supported through extensive training of the clinic audiologists, strict inclusion criteria, and an evidence-based assessment protocol using specific audiometric criterion[22,23]. Active ENT engagement was also central to the clinic model. ENT specialists determined if patients were appropriate for diversion to the clinic, countersigned all referrals for MRI (IAM), reviewed all MRI (IAM) results and were available on-site for discussion of more complex cases if required. Referrals were also triaged by the ENT specialist and prioritised as urgent (Category 1 – see within 30 days), semi-urgent (Category 2 – within 90 days) or routine (Category 3 – within 365 days) according to Queensland Health clinically recommended timeframes[24]. Following assessment by the audiologist, patients attending the clinic ultimately ended up in one of two possible outcome groups: (1) patients able to be managed and discharged by the Retrocochlear Clinic, and (2) patients who required further ENT consultation and were returned to the ENT waiting list. The full details of the clinic model can be found in Supplementary file 1.

Data Collection and Service Evaluation

All patients who were referred to the Retrocochlear Clinic since its inception in December 2013 through to November 2019 were identified from an existing clinical database. Data was collected on all patients referred to the clinic and entered into this database, including: 1) patient demographics; 2) referral information such as referral source, referral date and reason for referral; 3) appointment dates and

requests for medical imaging; and 4) clinical outcomes and results of investigations. The database used a coding system to record final patient outcomes, coding patients who were discharged from the Retrocochlear Clinic without needing ENT intervention, patients who required ENT intervention and patients who were discharged without completing the regular patient management protocol (e.g. did not attend appointments, unable to be contacted, self-discharged from the clinic).

Rereferral data was also collected for all patients who were assessed in the Retrocochlear Clinic and discharged without the need for ENT intervention between December 2013 and November 2018 (allowing 12 months post discharge for collection of rereferral data in November 2019). Rereferral rates within 1 year of discharge has been used in prior studies as an indicator of successful management of patients[24,25]. Rereferral information was manually extracted from individual patient records to determine if they had been rereferred to the ENT clinic within 12 months of the date of discharge, the reason for rereferral, and whether this reason differed from the original referral reason. The public hospital where this study was undertaken has a geographical catchment area from which all referrals are received. Hence it is unlikely that any of these participants would be referred elsewhere, unless they had relocated to another facility's geographical catchment area or if they sought care through private medical services.

Finally, in order to further assess the safety of the Retrocochlear Clinic, local risk management reporting software (Riskman and Prime) were accessed, and reports for patients who attended the Retrocochlear Clinic during the study period were collated, to determine if any adverse events had occurred. Adverse events referred

to any patient harm caused as a result of the procedures and/or care provided as part of the Retrocochlear Clinic.

Data analysis

Results were analysed descriptively using group frequencies, percentages, medians and interquartile ranges (IQR). Data were tested for normality using Shapiro-Wilk tests. Chi-square and Mann-Whitney U-tests were used to compare differences in demographics between those that were referred to the Retrocochlear Clinic, and those that actually attended. Attendance rates and wait times from the beginning of the clinic to the final year were also compared using Chi-square and Mann-Whitney U-tests. Significance was set at $p<0.05$. All statistical analyses were performed using IBM SPSS Statistics for windows version 24 (IBM Corp., Armonk, N.Y., USA).

RESULTS

Participant demographics

A total of 1123 patients met the inclusion criteria over the study period. These patients accounted for approximately 4% of the total adult ENT outpatient referrals for this period. Participant demographics for all referred patients are shown in Table 1. Of those referred to the clinic, there were slightly more males (53.0%, n= 595) than females (47.0%, n= 528), and the median age was 60 (IQR= 46-70). The most frequently listed reason for referral was asymmetrical hearing loss (71.2%, n= 800), followed by unilateral tinnitus (17.0%, n= 191) and other/multiple symptoms (11.8%, n= 132).

[Insert Table 1 near here]

Non-attendance rates

Figure 1 shows a diagram of patient flow through the service, from initial referral through to discharge or referral back to ENT. Of the 1123 patients referred to the Retrocochlear Clinic over the 6-year study period, 25.8% (n= 290) did not attend their appointment at the clinic. Demographics of those who did and did not attend are detailed in Table 1. There were no statistically significant differences in gender or reason for referral between those who attended and those who did not attend (p>.05). However, the group that did not attend was significantly younger than the group that attended (54 vs 60 years; U=104733.5, p=0.001).

There were a median of 31 clinic attendees per quarter year (IQR=21-42). There was a statistically significant improvement in attendance rates from 66.4% in the first full year of data (2014), rising steadily to 90% in the final year of the study (X^2 (1, N = 251) = 20.1, p<0.001) (also see graph in Supplementary file 2).

Waittimes

There was a statistically significant (U= 261, p<0.001) reduction in waittimes from referral to first appointment from a median of 748 days for patients who were seen in the 12 months, down to 63.5 days in the final year of the study. Figure 2A shows the median wait times per quarter, illustrating a sharp decrease after 4 years of the clinic's operation. Figure 2B shows the proportion of patients who were seen within Queensland Health clinically recommended timeframes for routine (within 365 days), and semi-urgent priority (within 90 days) referrals. Most routine patients were seen within the clinically recommended timeframe within the first 3 years of the clinic's existence (92.6% and above), and semi-urgent within the first 4 years (81.5% and above).

[Insert Figure 2 near here]

Failure to attend rates

The failure to attend rate over the 6 year period was 25.8%. Cancellations by the patient made up the largest proportion of reasons for not attending (45.2%, n= 131; Figure 1), of which 3 patients asked to be kept on the ENT waitlist rather than attend the Retrocochlear clinic while the remainder declined any care. The next most common was inability to contact the patient in order to schedule the appointment (33.4%, n= 97), followed by failure to attend a scheduled appointment (16.6%, n= 48) and 'other' reasons, for example death or cancellation by the clinic due to a change in the patient's status (4.8%, n= 14). The proportion of failure to attend, inability to contact and 'other' were fairly stable over the study period, however the proportion of cancellations by the patient steadily decreased from 21.6% of all appointments in the first year to 2.5% the final year of the study period (data not shown).

[Insert Figure 1 near here]

Review appointments

Of the 833 (74.2%) patients who attended their initial appointment, 28 were scheduled review appointments with the audiologist 3-12 months after initial appointment. Seven patients did not attend this review appointment, and 2 patients were waiting to attend their review at time of data collection.

Management pathways

A total of 824 patients attended both their initial and any review appointments and were managed through three main management pathways shown in Figure 1. These included Pathway 1: those who do not meet criteria for MRI (IAM) and have no other

ENT symptoms; Pathway 2: those meeting criteria for MRI (IAM); and Pathway 3: those not meeting criteria for MRI (IAM) but who do report other ENT symptoms that require ENT appointment (Figure 1).

Pathway 1: Pathway 1 included patients who did not require medical imaging and reported no other significant ear nose and throat symptoms. Of the patients attending the Retrocochlear Clinic, 337 (40.9%) fell into this category and were managed entirely by the audiologist and discharged back to General Practitioner (GP) care without any requirement for medical imaging or ENT appointment.

Pathway 2: Pathway 2 included patients who met the criteria for MRI investigation and were therefore referred for an MRI (IAM) scan by the audiologist, with the referral co-signed by the ENT specialist. Three hundred and fifty-five patients (43.1%) were referred for MRI (IAM) (Figure 1) and 330 of these patients attended the diagnostic imaging appointment. Of these patients, 7 received a CT scan due to contraindications for MRI (such as claustrophobia and having a pacemaker in situ).

All diagnostic imaging results were reviewed by an ENT specialist, and significant clinical findings requiring on-referral to ENT services were reported in 6.4% of patients (n= 21). Four of these patients were diagnosed with Vestibular Schwannoma, representing 0.5% of the total attendees of the clinic, and 1.1% of those who were referred for diagnostic imaging. Demographic and clinical details of these patients are shown in Supplementary file 3. Seventeen patients had other significant findings on diagnostic imaging (such as anterior inferior cerebellar artery

(AICA) vascular loop, pituitary macroadenoma, arachnoid cyst, and pineal cyst) which indicated further review was required by an ENT specialist.

The remaining 309 patients either had no significant findings on diagnostic imaging, or had other significant incidental findings that were not appropriate for ENT review, and were discharged by the Retrocochlear Clinic back to the care of a GP.

Pathway 3: Pathway 3 included patients who did not meet the criteria for medical imaging, but were determined on assessment by the audiologist to have other significant ear, nose or throat symptoms outside of the scope of the Retrocochlear Clinic but requiring review by an ENT specialist (e.g. sinus issues, middle ear dysfunction etc.) (Figure 1). One hundred and thirty-two patients (16.0%) were managed under this pathway, and were thus on-referred back to the regular ENT outpatient clinic.

Clinic outcomes

Discharged from Retrocochlear Clinic

In total, 73.7% (n= 589) of the patients who attended the clinic were managed entirely by the Retrocochlear Clinic and discharged without need for the patient to attend an ENT appointment. Analysis year by year revealed this rate remained relatively stable over the duration of the study (data not shown). This total consisted of all 337 patients who were managed under Pathway 1 (discharged with no imaging required), and 252 patients who were managed in Pathway 2 (required diagnostic imaging), but had no relevant pathology/symptoms and were also able to be discharged directly from the clinic (Figure 1).

Referred back to ENT

Of the patients who attended the Retrocochlear Clinic, 26.3% (n=210) were referred back to ENT services. This included all patients from Pathway 3 (n=132), aka those who did not meet the criteria for imaging but had other significant symptoms and were referred directly to ENT. It also included those from Pathway 2 (required diagnostic imaging) who either had significant findings on MRI (n=21) or did not have significant findings on MRI but did have other significant symptoms (n=57). Most of the referrals back to the ENT waiting list were due to additional middle ear issues (n= 100), but other ENT symptoms, predominantly sinus issues, were also common (n= 85). 26.2% of these 210 patients were referred at the same priority level as their original ENT referral, and 73.8% had an upgraded priority reflecting an expedited pathway to ENT specialist assessment. As only 210 patients of the 824 Clinic attendees required ENT appointments, this represents a total of 614 saved ENT appointments across the 6 year period (approximately 102 appointments per year).

Rereferral rates and adverse events

Of the 589 patients discharged by the audiologist without requiring ENT appointment, 14 patients (2.4%) were rereferred to the ENT outpatient clinic within 12 months of discharge. Only 1 of these patients was rereferred for the same reason as the original referral (unilateral tinnitus) due to subjective deterioration of symptoms. Subsequent investigations showed no significant findings on diagnostic imaging and the patient was discharged back to GP care. There were no adverse events recorded in risk management software for patients of the Retrocochlear Clinic throughout the study period.

DISCUSSION

The 6-year evaluation of this audiology FPOC Retrocochlear Clinic model has demonstrated that the majority of patients were able to be managed by this service without the need for an ENT specialist appointment, and addresses a gap in the literature concerning health service outcomes of this model. Benefits for patients and the health service were realized within the first few years of the service, through significant reductions in wait times. Rereferral rates were very low and no adverse events were reported. Overall, the clinical and service data indicates that this model is a safe and effective alternative service model for ENT patients referred for investigation of suspected retrocochlear pathology. While this research investigates a specific clinic design, it provides promising evidence for a model that may be modified for different clinical contexts. At a more global level, the findings of the current study support the idea that alternate models of care can be implemented, and achieve positive clinical efficiencies for both patients and the service while maintaining high levels of safety and rigor.

Examining the final outcome of all attending patients revealed that this particular form of an audiology FPOC Retrocochlear Clinic model was able to manage 73.7% of patients without need for referral to an ENT specialist. This is higher than the 53.5% reported by a similar Retrocochlear Clinic model, however that study reported on only 60 patients[19]. The proportion is similar however to other types of extended and expanded scope AHP FPOC clinics which report figures between 70-80% of patients discharged without referral to medical and surgical specialists[10,11,26,27].

However, whilst over 70% of patients referred to the clinic were able to be successfully managed without the need for separate ENT specialist appointment, it is important to note that only 40.9% of these patients were managed independently by the audiologist with no ENT specialist input. For the remainder, there was ENT specialist involvement through informal discussion to determine appropriate patient flow pathways, co-signing of MRI referral forms, and review and interpretation of MRI findings, which was facilitated by the co-location of the clinic with ENT specialist clinics. This ENT specialist involvement outside of direct patient consultations needs to be acknowledged as this was a crucial part of the clinical governance and safety of this model and required time from ENT services. Nevertheless, this study demonstrated that the Retrocochlear Clinic model investigated here has the potential to provide an alternative service pathway and ultimately reduce the number of unnecessary referrals to ENT services.

This clinic used widely recognised audiometric criterion[22] and a specific protocol to screen for retrocochlear pathology, with the aim of reducing the rate of unnecessary MRI referrals. Just over 40% of patients in this study met MRI inclusion criteria and were referred for diagnostic imaging. On initial review, this figure appears substantially higher than the 11.7% of patients referred for MRI assessments reported in another audiology FPOC model[20]. However, this difference is expected when comparing the referral criteria for both clinics. The clinic in that study accepted referrals for a broad range of otologic symptoms, whereas referrals to the Retrocochlear Clinic in the current study are triaged by the ENT specialist and only those listing retrocochlear symptoms are redirected and therefore a larger number of referrals for medical imaging is expected in our study.

Of the patients referred for diagnostic imaging, 1.1% were diagnosed with Vestibular Schwannoma. This is in agreement with the percentage of patients referred for MRI who were diagnosed with Vestibular Schwannoma in similar models, which ranged from 1.5 - 2.22%[17,18,20]. A slightly higher proportion was found in Dawe et al.[16] at 4.0%, however this may be due to use of stricter criteria for referral, as only patients with asymmetrical hearing loss were referred for MRI, while those with unilateral tinnitus were referred directly to the ENT. This is reflective of the literature which suggests that asymmetrical hearing loss is the primary complaint reported by patients diagnosed with Cerebellar Pontine Angle (CPA) tumors, while tinnitus is a less common symptom[28]. The current study found that all four patients diagnosed with Vestibular Schwannoma met the AAO-HNS audiometric criterion for asymmetrical hearing loss, however one of these patients had been originally referred for unilateral tinnitus as the primary complaint. It was only on audiometric testing that the asymmetrical sensorineural hearing loss was detected, which met the criteria for asymmetry and referral for medical imaging. There were no patients in the current study who were diagnosed with Vestibular Schwannoma who would have been missed had the criteria been less conservative. A further 4.8% of patients referred for diagnostic imaging had a variety of significant incidental findings other than Vestibular Schwannoma. There is only limited explanation of what was included as “incidental findings” in other studies, hence it is difficult to make direct comparisons, however some report similar rates of 3-5%[16,18,20].

This study also demonstrated the safety and effectiveness of the Retrocochlear Clinic with a low rereferral rate and no adverse events reported. The 12-month

rereferral rate has been used as an indicator of successful management of patients[25,26], as rereferral within 12 months for the same symptoms suggests either inappropriate discharge or a deterioration in symptoms that would now warrant further investigation. Over the course of the study period, only 2.4% of the 589 patients who were discharged by the audiology FPOC Retrocochlear Clinic were rereferred to the ENT outpatient waitlist within 12 months of the date of discharge. This is significantly lower than other AHP FPOC clinics which report 12-month rereferral rates of 6.5-10%[25,26,29]. Additionally, the majority of re-referred Retrocochlear Clinic patients were re-referred for symptoms which differed from their original referral reason. These low rereferral rates may be attributable to risk management strategies which were integral to the Retrocochlear Clinic protocol, including use of strict referral and triage criteria; detailed and well-established clinical protocols; co-location of clinical service provision with specialist ENT outpatient clinics; and co-signatory requirements on all MRI referrals.

Importantly for health services looking to implement this model, both waiting times and attendance significantly improved over the study period. While causality cannot be determined with this research design, these improvements are most likely due to introduction of the clinic, as there were no other service developments at the time that would have accounted for these changes. The median waiting time in the first 3 months since the inception of the clinic was 997 days, reflective of a significant backlog of patients who had been referred to ENT outpatient services up to 3 years prior. By the fourth year of the clinic, the service had cleared this backlog and was able to maintain stable median waiting times of 74.5 days and under, and see over 90% of patients within clinically recommended timeframes[24]. A similar Australian

Retrocochlear Clinic model also demonstrated a significant reduction in wait times from a mean of 468 days (from referral to ENT appointment), to 99 days (from referral to audiology FPOC Retrocochlear clinic) approximately 12 months after audiology FPOC service implementation[19]. Similar reductions in waiting time have been reported in other types of AHP FPOC clinics[9,10]. This improvement in waiting times has positive implications for the safety and efficiency of the health service, as well as the experience of patients on the waiting list.

The rate of attendance to the clinic at the start of the study was 52.2%, which increased to 90% by the end of the study period. This is likely linked to the decrease in wait times noted over the same period of time, as longer waiting times increase the likelihood patients will seek alternative services elsewhere, move health service districts, change contact details, pass away or have a resolution of symptoms. Overall, about a quarter of those referred did not attend over the 6-year study period, which is consistent with the non-attendance rates reported by the speech pathology FPOC ENT clinic in the same health service[10]. As high non-attendance rates impact on service efficiency and overall wait times for other patients, there is incentive for healthcare services to maximise attendance rates. As the process for collecting information about these patients was administrative, there is no data to understand the outcomes of these patients, or their reasons for cancellation. Further investigation could occur to determine whether improved attendance rates were due to reduced waiting times or there were other factors involved.

While economic outcomes were not captured in this study, previous research on allied health FPOC clinics has shown promising cost-benefits[6]. However studies

investigating a retrocochlear FPOC model specifically have to date only calculated direct costs, and estimated savings to be between £150-234 per patient in the UK[16,17], and $54 per patient in Australia[19]. Using the same calculations as Payten et al[19] (which is in the same geographic area as this study), preventing 102 ENT appointments per year translates to $5,500 in direct cost savings for the health service. More importantly however, there are other benefits to retaining these 102 appointments. This includes possible reductions in wait times for other patients, and improved conversion to surgery rates for the ENT service. It is also important to consider the impact that the extensive ENT wait time could have had on the 21 patients who were diagnosed with clinically significant disease through the audiology FPOC service, (including four with Vestibular Schwannoma). Also relevant is the fact that only 43.1% of patients screened by the audiologist required MRI- a potential cost saving for services which order MRIs for all patients prior to ENT review. These benefits would have to be weighed with a thorough cost calculation inclusive of the significant costs associated with training the FPOC clinic audiologists and non-appointment related ENT costs, for example reviewing MRIs and MRI referrals. Thus to fully understand the impact and value of this audiology FPOC model from a health service perspective, future research should seek to measure the cost-benefit of the model compared to the standard medical pathway.

Given the positive outcomes of this model, there may be value in extending the inclusion criteria to include other low risk referrals with symptoms within the scope of practice of audiologists, as piloted elsewhere[21]. This may include patients who are referred to the ENT outpatient waitlist for more generalised low risk otological symptoms such as presbycusis, sensorineural hearing loss and/or bilateral tinnitus.

Using this clinic model and further utilising audiologists' diagnostic skills would enable these additional patients to be appropriately screened and/or managed. This has the potential to further increase the capacity for ENT specialists to see more complex patients.

Limitations

Although the current study provides data that suggests positive service improvements for patients, it is acknowledged that no direct consumer input was sought and patient outcomes such as quality of life were not measured, and as such the consumer perspective is missing from this study[30]. Only 3 patients declined referral to the clinic in favour of remaining on the ENT waitlist. A recent pilot of an audiology FPOC clinic which accepted a broader range of referrals found high levels of satisfaction[21], but it is unclear if those findings would be reflected in the current model.

There was also no baseline data collected prior to the implementation of the Retrocochlear Clinic to compare to the standard ENT service with regards to attendance, wait times, time until diagnosis and clinical outcomes. There is an assumption made that the excessive waiting times measured at the start of the study period reflect the waiting times experienced by patients waiting for standard ENT care for this patient group. As the study was retrospective, some data that may have been useful in evaluating this model was unable to be reported on. This included frequency and length of time of informal case discussions between the audiologist and ENT and other data required for a robust economic analysis. In addition, data was not collected from the standard ENT clinic's operations, meaning that any

impacts on surgical conversion rates and wait times for other patients were unable to be captured.

Another limitation is that this study was not able to access data related to rereferral rates outside of Logan Hospital ENT Department between 2013 and 2017 and Metro South Health between 2017 and 2019. Despite this, the likelihood of a public health patient in the hospital's catchment area seeking ENT review outside of their local public hospital is considered low. It is however, acknowledged that relevant ENT pathologies may have been later investigated by patient's GP and again, this data is not accessible and is therefore a further limitation of the current study.

It is also recognised that this model may only be applicable to implement within certain settings, given differences in the nature of health services offered globally. However, the authors believe that this work is relevant to a broad audience of ENTs, audiologists, and health service administrators who face the challenge of increasing pressures on health services, within the context of specialist shortages. This model is presented as one alternate option which may help address these issues, which could be implemented alongside other strategies.

Conclusion

The audiology FPOC Retrocochlear Clinic was a safe and effective alternative service model that was able to manage the majority of its referrals with significantly reduced ENT involvement, appropriately triage patients for MRI imaging and identify patients who require further ENT intervention. This model resulted in reduced waiting times for low-risk patients referred to the ENT outpatient waiting list with

asymmetrical hearing loss and/or unilateral tinnitus and concurrently was observed to have improved attendance rates. This research further supports AHP extended scope clinics as effective alternative models of care with positive impacts on health service delivery.

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DECLARATIONS AND ETHICS STATEMENTS

Ethical standards

The authors assert that all procedures contributing to this work comply with the ethical standards of the relevant national and institutional guidelines on human experimentation (NHMRC National Statement on Ethical Conduct in Human Research) and with the Helsinki Declaration of 1975, as revised in 2008. Ethical approval, including for a waiver of consent, was sought and obtained by the Metro South Human Research Ethics Committee within Queensland Health (HREC/2020/QMS/63625).

Data availability statement

The data that support the findings of this study are available from the corresponding author, AH, upon reasonable request.

Competing interests

The author(s) declare none.

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None.

TABLES

Table 1: Participant demographics

	Referred to clinic N= 1123	Analysis by attendance		
		Referred but did not attend N= 290	Attended clinic N= 833	Significance (p value) +
Age (years)	Median= 60 (IQR= 46-70)	Median= 54 (IQR= 48-70)	Median= 60 (IQR= 40-69)	0.001
Gender				0.178
Male	N = 595 (53.0%)	N= 164 (56.6%)	N= 431 (51.7%)	
Female	N = 528 (47.0%)	N= 126 (43.4%)	N= 402 (48.3%)	
Reason for referral	N= 800 (71.2%)	N= 206 (71.0%)	N= 594 (71.3%)	0.688
Asymmetrical hearing loss			N= 138 (16.6%)	
Unilateral tinnitus	N= 191 (17.0%)	N= 53 (18.3%)	N= 101 (12.1%)	
Other/multiple*	N= 132 (11.8%)	N= 31 (10.7%)		

**'Other' includes a combination of symptoms, vestibular issues +/- HL & Tinnitus and Bilateral hearing loss or other hearing concerns identified by the ENT as suitable for the clinic*

+ Chi- square for proportions, Mann-Whitney U-test for medians

FIGURES

Available as separate files

Figure legends

Figure 1. Patient Journey Through the Audiology-led Retrocochlear Clinic

Figure 2. Display of (A- top graph) the median wait times (in days) per quarter, across the 6-year period, and (B – bottom graph) Percent of patients who were seen within clinically recommended timeframes for each priority level, per year

Figure 1. Patient Journey Through the Audiology-led Retrocochlear Clinic

ENT = Ear, Nose & Throat specialist; aSNHL = asymmetrical sensorineural hearing loss; PTA = Pure Tone Audiometry

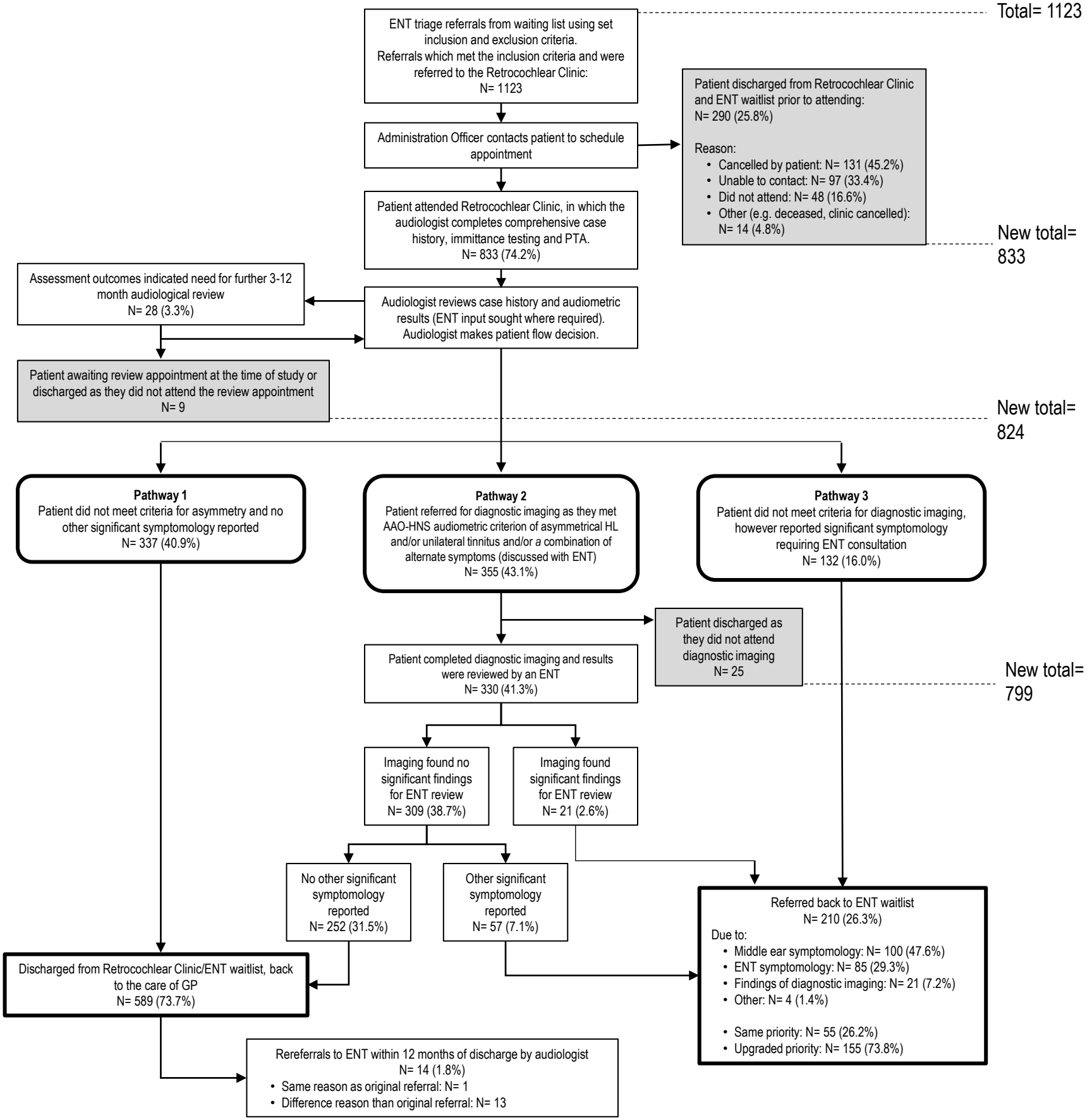

Figure 3. Display of (A- top graph) the median wait times (in days) per quarter, across the 6-year period, and (B – bottom graph) Percent of patients who were seen within clinically recommended timeframes for each priority level, per year