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Innovative Application of O.R.

Using simulation to test ideas for improving speech language pathology services

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ABSTRACT

Speech language programs aim to prevent and correct disorders of language, speech, voice and fluency. Speech problems in children can adversely affect emotional, educational and occupational development. In the past several years, a particular health region in Saskatchewan, Canada has experienced an increase in the number of preschool children referred for speech language therapy. Indeed, current wait times from referral to first appointment are well in excess of one year and one-tenth of patients do not receive any service before entering school. In an effort to demonstrate successful operational research (OR) practice through improving patient flow, we developed a discrete-event simulation model to test change ideas proposed by speech language therapists. These change ideas involved increasing the percentage of group treatments (rather than having a majority of patients treated individually), using a paraprofessional to complete many of the routine tasks currently covered by the therapists, standardizing appointment durations, hiring additional therapists and incorporating block treatment scheduling. We also tested combinations of the above strategies in order to determine the impact of simultaneously adopting different change ideas. Some strategies showed considerable promise for improving patient flow and are now being used in actual practice.

1. Introduction and literature review

Analysts use simulation models to measure system performance, understand the impact of random variation, improve operations or design facilities. By developing models that successfully imitate reality, decision-makers can better understand how a system really works and – perhaps more importantly – make predictions about overall performance when particular variables are changed or different policies enacted in the actual system. Indeed, this "what-if" capability demonstrates the eventual likely effects of different courses of action when it would be overly expensive or completely impossible to physically transform the system. The inherent flexibility of simulation methods has led to their successful use in a number of industries, including manufacturing plants, banking operations, airport security, distribution networks, freeway systems and entertainment theme parks (Kelton, Sadowski, & Zupick, 2014).

In this paper, we report on an actual project to develop a simulation model to test ideas for improving access to speech language pathology (SLP) services for children under the age of five in the Prairie North Health Region (PNHR), one of 13 health authorities in the Canadian province of Saskatchewan. This particular region serves a population of nearly 80,000. Situated in the northwest part of the province, it is home to three hospitals and several other health facilities. The main communities in this health region include North Battleford, Meadow Lake and Lloydminster (Prairie North Health Region, 2013).

Speech language programs aim to prevent and correct disorders of language, speech, voice and fluency. Speech problems in children can adversely affect emotional, educational and occupational development. This health region provides SLP services to children under the age of five. The typical patient pathway for these SLP clients is to initially be referred for such services, usually in the form of a referral from the patient's family physician. Patients consequently enter a first-come, first-served queue for SLP services. Their first contact with a therapist involves an assessment – usually a single appointment is sufficient – to diagnose speech and language problems. After their assessment, patient treatment then takes place. These are different exercises done to help

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address speech and language problems and are repeated as often as needed. Treatments may occur individually or in a group setting (if therapists deem that patients with similar problems would benefit from interaction with other children).

In the past several years, this health region has experienced a steady increase in the number of referrals received for SLP services. With this increase in referrals, the wait time for these services has climbed (the average wait time from referral until first assessment is 398 days). Should this current trend persist without any process improvement, wait lists and times will undoubtedly continue to escalate.

Waiting lists are a concern, because studies suggest that the sooner the speech problems in children are corrected, the better the chance of successful treatment (Jacoby, Lee, Kummer, & Levin, 2002). Excessive waiting also results in many patients not completing treatment before they start school at age five. When this happens, children may enter a learning environment with an underlying disorder not being corrected. This could halt educational progression. Furthermore, responsibility for correcting the disorder in this particular health region is then transferred to therapists in the school system, which introduces a discontinuity in care.

Consultations with speech language professionals revealed four principal objectives with respect to improving SLP patient flow

- Ensure that every child that is referred for services has at least one assessment. By so doing, this will minimize the number of patients who become too old for service while waiting, renege or decline service, or are discharged without receiving any service.
- Minimize unnecessary waiting. This includes time from referral to the patient's first assessment.
- Deliver all the "feasible treatments" that each patient requires in the time between their referral and their fifth birthday.
- Maximize the proportion of patients who are discharged because they have completed all the service they require. Health professionals wanted to avoid instances where a patient still in need of services is discharged because he or she has reached his or her fifth birthday.

To the best of our knowledge, there have been no previous attempts to apply simulation modeling to speech language pathology services. Our demonstration of efficacious operational research (OR) practice is a novel application for a few reasons. First, we exclusively focus on the health care needs of preschool children. Second, the earlier these patients receive required services, the better the resulting chances for treatment success. Excessive waiting, therefore, induces anxiety for patients (and their parents) and shrinks the likelihood of eventual recovery. Finally, health care professionals have established a milestone benchmark (the patient's fifth birthday) by which care plans ought to completed. This makes proper decision-making in apportioning vital speech language services even more critical.

Simulation modeling continues to enjoy a rich history in health care, perhaps due to its natural flexibility to effectively describe actual systems. Fetter and Thompson (1965) were early contributors, using models to simulate a maternity ward, outpatient clinic and surgical suite.

System-wide patient flow and capacity analysis have also received some attention. For example, Brailsford, Lattimer, Tarnaras, and Turnbull (2004) developed a stock-flow model for emergency and on-demand health care in Nottingham, England. They determined that admissions from general practice constituted the most substantial impact on system occupancy. Zhu, Hen, and Teow (2012) explored the appropriate levels for intensive care unit (ICU) bed capacity for a hospital treating critically acute patients. Fewer ICU beds could precipitate surgical cancellations, while an oversupply could produce resource wastage. Other ICU capacity management analyses include Litvak, van Rijsbergen, Boucherie, and van Houdenhoven (2008) and Kim, Horowitz, Young, and Buckley (1999). Harper and Shahani (2002) modeled bed capacity decision-making for the Royal Berkshire and Battle Hospitals Trust in Reading. Vasilakis and Marshall (2005) constructed a discrete event simulation model to predict length of stay values for different groups of patients (short, medium and long-stay) and how different capacity levels would affect each patient group.

In an innovative application, Viana, Brailsford, Harindra, and Harper (2014) developed models to address healthcare decision-making and analysis involving Chlamydia, a sexually transmitted infection. The researchers deployed a discrete-event simulation model to analyze hospital outpatient clinic flow and a systems dynamic model to investigate the infection process in the larger population.

The analysis and improvement of emergency department (ED) patient flow represent key applications of simulation model-building. For instance, Zeng, Ma, Hu, Li, and Bryant (2012) explored various quality of care indicators, including length of stay, waiting times and patient premature departures in a community hospital's ED. They determined that deploying a team nursing policy could lead to substantial improvements in the hospital system's key indicators. Pallin and Kittell (1992) used a GPSS/H model to explore the benefits of initiating a policy to refer return visit patients to a private physician, rather than having them come back to the ED. This would serve to limit the number of patients in the system and could ease congestion. Utilizing a simulation-based decision support system, Abo-Hamad and Arisha (2013) investigated ED patient flow improvement initiatives in a hospital in Ireland. The authors remarked that increasing the ED's physical capacity (to provide flow amelioration) was an inferior strategy compared to unclogging the ED through better in-patient bed management. Badri and Hollingsworth (1993) simulated an ED to determine how changes in staff scheduling practices and priority rules for serving patients would improve overall performance. Deploying a model built with the Arena software package, Samaha, Armel, and Starks (2003) discovered that the main problems in the ED were related to inefficient processes, rather than a lack of overall resources. Ceglowski, Churilov, and Wasserthiel (2007) built a discrete event simulation model to identify particular bottlenecks in the important flow problem of patients admitted to hospital beds from the ED.

Besides the ED, researchers have analyzed other health care applications using simulation. These include walk-in centers (Ashton, Hague, Brandreth, Worthington, & Cropper, 2005), outpatient appointment clinics (Klassen & Rohleder, 1996), renal services (Davies & Davies, 1987), liver transplants (Thompson, Waisanen, Wolfe, & Merion, 2004), phlebotomy and specimen collection centers (Rohleder, Bischak, & Baskin, 2007), bioterrorist attack response (Miller, Randolph, & Patterson, 2006), outpatient orthopedic clinics (Rohleder, Lewkonia, Bischak, Duffy, & Hendijani, 2011), HIV/AIDS epidemics (Rossi & Schinaia, 1998) and surgical care processes (Kumar & Shim, 2005).

To document and synthesize overall themes, several researchers have prepared extensive reviews of simulation in health care. These include Fone, Hollinghurst, Temple et al. (2003), Gunal and Pidd (2010), and Jun, Jacobson, and Swisher (1999). Eldabi, Paul, and Young (2007) used an analysis of literature to identify critical themes for future work, while Jahangirian, Naseer, Stergioulas et al. (2012) illustrated lessons from commerce and defense that could inform simulation applications in health care.

The remainder of our paper proceeds as follows. The next section discusses the development of our simulation model to explore SLP service delivery improvement. We then provide model results, after which we conclude the paper with some summary comments and directions for further study.

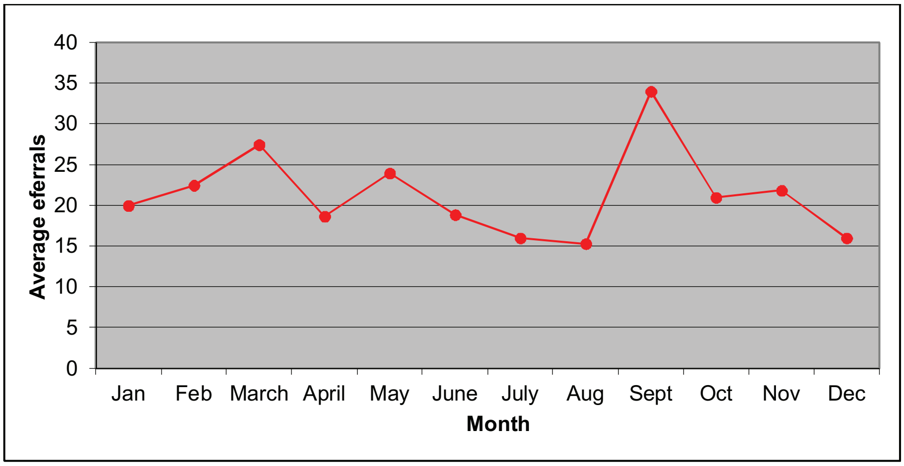

Fig. 1. Average SLP referrals per month.

2. Simulation model

Developing a simulation model to test different ideas for improving SLP service delivery is especially compelling, given the specific circumstances germane to this health care environment. As described earlier, speech problems may worsen if conditions are not treated early. Emotional and learning difficulties are associated with speech problems. Finally, within this health region, children unable to complete all their required treatment by age five are subsequently transferred to therapists within the school system. Unless a seamless transfer is in place, this may introduce a discontinuity in care.

We began our analysis by mapping patient flow processes. This involved identifying the major steps associated with the delivery of patient care, the sequence of those steps, and any variations in the sequences. The second step was to gather data on current system performance. Our main data sources were the region's information systems and patient chart abstraction. The health region extracted de-identified chart details on 837 SLP patients. Where key information was unavailable from either of these sources, we confidently relied on best estimates from SLP staff.

To describe this queuing system, we required information on specific patient and service characteristics. These are described in the following sections.

2.1. Patient characteristics

We needed details on both patient demand and age at time of referral. Both were obtained from health region databases. Patient demand reflected the volume of incoming new patients entering the queue who require services, and was described by referral rates (number of patients arriving per month). On average, there are just over 20 referrals per month in this health region. Fig. 1 shows seasonal variation in the referral rate. September is generally the busiest time for referrals in the region, since this is the month is which many children start preschool and thus have increased interactions with other children. For each month, the values for the minimum, most likely, and maximum number of referrals received over a five-year range were used to compile a triangular distribution for each community. This distribution was then used as the arrival rate in the simulation model to ensure that we incorporated the effects of seasonality.

Fig. 2 shows the distribution of patient age at time of referral. This information was vital to our simulation model since preschool patients referred at an older age may have a greater likelihood of being unable to successfully complete treatments. Peaks in referrals occur at two points; namely, one around age 18 months and another at just over four years (48 months). As we learned from the speech therapists, many speech and language problems are detected at 18 months of age during a routine immunization visit that includes public health language screening. The case of the peak at age four is not clear, but could occur because a child at this age begins to initiate more verbal communication. Consequently, problems become more obvious to preschool teachers, physicians, public health nurses or parents.

Table 1
Distribution of appointment durations.

Appointment type	Appointment duration (in minutes)		
	Minimum	Most likely	Maximum
Assessment	60	90	120
Individual treatment	30	45	60
Group treatment	60	60	90

2.2. Service characteristics

We needed information on the required number of assessments and treatments per patient, the "hands-on" service time for each care episode, the time between appointments, and particular details about group treatments.

Since the required eventual number of assessments and treatments is not known until the therapist initiates service with a patient, we had to rely on therapists' best estimates for these values. Based on their experience, they estimated that 80 percent of patients would have one assessment, 15 percent would have two, 4 percent would have three, and 1 percent four. Therapists also estimated a maximum number of treatments per patient of 250, based on the extreme case where a patient begins treatment at age one month and has one weekly session - the treatment norm for children in this health region – up to age five. The required number of treatments per patient was "roughly" bell-shaped, with a sizable number of children needing between 110 and 150 treatments in order for difficulties to be successfully remedied.

Therapists estimated that the amount of time required for different appointments followed a triangular probability distribution as provided in Table 1. Group treatments took longer than individual treatments in order to ensure all patients in the group receive sufficient service. These therapists estimated the number of patients per group as following a triangular distribution with minimum, most likely and maximum values of two, two and

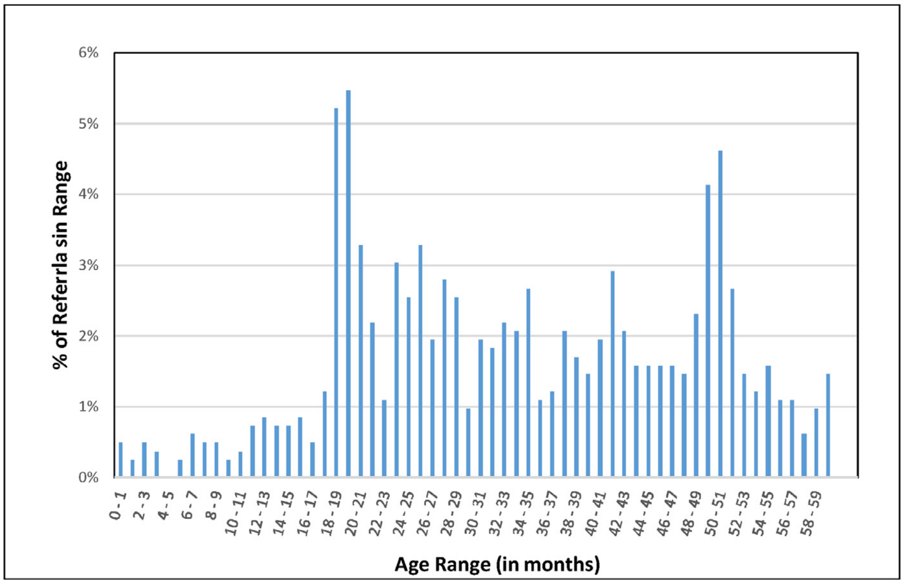

Fig. 2. Distribution of patient age at time of referral.

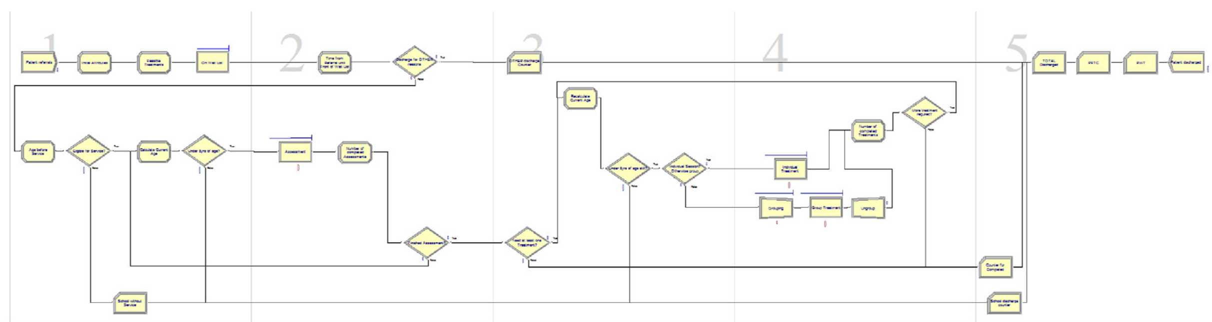

Fig. 3. Simulation model screenshot.

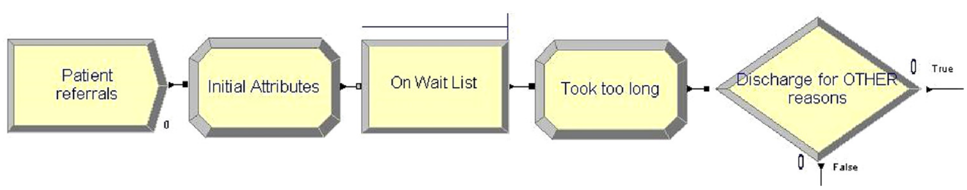

Fig. 4. Simulation model (arrivals section).

four, respectively. Chart abstraction indicated that 8.77 percent of treatments were currently performed in a group setting. Finally, we assumed – based on therapist estimates – that a single professional could accommodate a maximum of 50 patients in an active caseload and that therapists had 4.5 hours of direct patient care time available per day. The remaining hours in a professional's day would be consumed with report-writing and travel to outlying communities.

We constructed our simulation model using Arena, a discrete event simulation software package (Kelton et al., 2014). Simulation modeling allowed us to test various change strategies – prior to actually making the changes – that could address the current wait list problem. By investigating staff suggestions for process improvement and describing critical tradeoffs, these models permitted key insights into this service environment. Fig. 3 provides a screenshot of our entire simulation model, while Figs. 4–6 offer specific model sections.

The referral rates in the actual system constituted the arrival rate. In our simulation model, each arriving patient was assigned a unique set of attributes, including age at the time of referral and required number of assessments and treatments. These attributes were based on the distributions described earlier. The patient then moved onto a wait list (if all therapists had 50 patients in their caseloads). Once a patient left active service, the next patient on the wait list moved forward and began required service. As the model ran, a simulated clock aged the patients accordingly. There were checks throughout the model that verified a patient's eligibility for service based on their age. If the patient reached one of those checks and was thus over five years old, the patient would be discharged from the system.

Patients next proceeded to the assessment part of the simulation model. Patients continually looped around in this section having assessments until they either completed all they required, or were discharged because they reached age five.

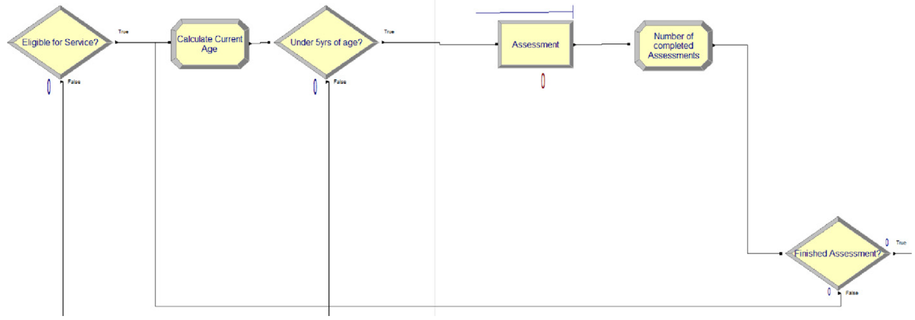

Fig. 5. Simulation model (assessments section).

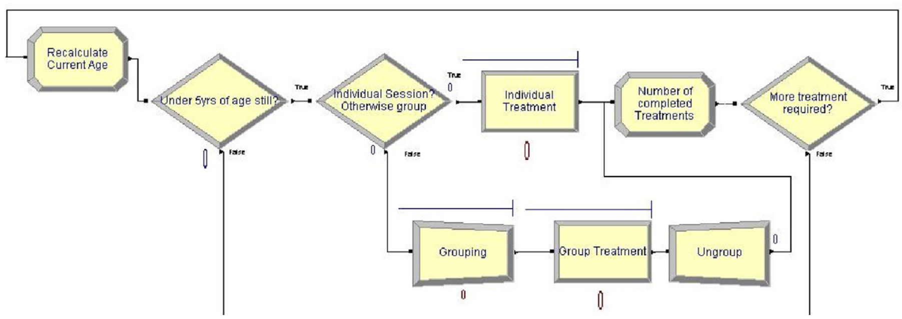

Fig. 6. Simulation model (treatments section).

Patients who finished all their required assessments, and were still under the age of five moved into the treatment block portion of our model. Again, patients continually looped around, receiving treatments until they completed as many as required, or until they were discharged because of ineligibility due to age. Patients were randomly assigned to either individual or group treatments.

Our model recorded various statistics on all patients exiting the system. This helped to determine the indicator performance in the simulation model. Indeed, we selected a few main indicators to evaluate different improvement ideas. According to the SLP therapists, the most important indicator was the Patient Wait Time (PWT). This represents the average time a patient spends on the wait list for service, from the moment of patient referral to the first assessment. Obviously, lower PWTs are desirable.

A second indicator is the Percentage of Patients Receiving at least One Assessment (PROA). This is the number of patients receiving at least one assessment divided by the total number of discharged patients. Patients not receiving at least one assessment were those who reached age five while waiting for an assessment and thus became ineligible for therapy. The desired effect would be for this indicator to be 100 percent, as that would suggest all patients were seen at least once.

The Percent of Feasible Treatments Completed per Patient (PFTC) is our third indicator. It measures the number of treatments the system is capable of delivering prior to patients turning five years of age. Typically, patients have one appointment per week. Therefore, the feasible number of treatments that a patient could have is determined by taking the minimum of the following two values: the number of weeks remaining until the patient reaches five years old, and the number of treatments the patient requires. As an example, if a patient requires 100 treatments but is 40 weeks from being five years old, the feasible number of treatments is 40. If the patient only requires 20 treatments and is 40 weeks from turning five years old, the feasible number of treatments is 20.

The PFTC is the total number of treatments a patient receives divided by the number of feasible treatments for that patient. The desired effect would be for this indicator to be 100 percent, as it measures how close patients get to receiving all their feasibly required services. Even if a patient is referred late and requires years of treatment, it is still possible for this patient to have a PFTC of 100 percent, as long as the wait time to first contact is minimal.

Our final indicator is the Percentage of Patients Discharged due to Completion (PDC). This is computed by dividing the number of patients discharged because they completed treatment by the total number of patients who left the simulation model (for any reason whatsoever). Of course, the desired effect would be for this indicator to increase.

We note that our analysis does have some limitations. For example, our simulation model described the system structure in this particular health region. Although much of the theory in this study can be applied to other SLP systems, the actual model and data analysis may not be generalizable. In addition, we had to rely on therapist estimates for several model parameters – albeit confidently provided – for which data were unavailable.

3. Model results

We selected a model run time of 1360 days with a warm-up period of 730 days. Further, we conducted 10 replications of each run to reduce the impact of outliers that may have been generated in any particular run.

The simulation model was first run under current system conditions to determine a base case for the four main indicators. Where available, we compared the simulation model to actual data as shown in Table 2. In general, the simulation model reflected actual performance reasonably well. Differences between simulated and actual results may occur because SLP therapists estimated several parameters.

We tested several ideas for improving wait times and system efficiency, including

- Increasing the percent of group treatments. Group treatments could enable patients to interact with one another, make treatment sessions more engaging for the children, and save time.

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Table 2
Base case performance indicators.

Performance indicator	Simulation model result	Actual result
Patient Wait Time (PWT) in days	458	398
Percent Receiving ≥ 1 Assessment (PROA)	89	82
Percent of feasible treatments completed (PFTC)	24	Not currently captured
Percent discharged due to completion (PDC)	8	12

(Notwithstanding these potential benefits, therapists must exercise caution about which children are assigned group treatments since not all patients may positively react to such a practice environment). The current proportion of treatments done in group settings was 8.77 percent. We tested the effect of increasing this proportion to 25 percent, 50 percent and 75 percent while allowing caseload to increase (as group visits allow more patients to be seen at the same time). We also tested a scenario of including more patients per group. Instead of the current triangular distribution of 2 (minimum), 2 (most likely), and 4 (maximum) patients per group session, a triangular distribution with 3, 4, and 5 patients respectively was used.

- Use of a paraprofessional. Such a person has clinical capabilities but not the full training of a therapist. A paraprofessional could be delegated routine tasks such as preparing clinical material for group treatments, assisting in calling patients' families, sending information to patients, and providing clinical advice. Currently, these duties are performed by SLP therapists. Therefore, a paraprofessional could free up valuable therapist time so that more hours of direct patient care could be provided. Rather than adding a resource to explicitly represent a paraprofessional in the simulation model, we simply increased the available therapist hours. For example, we tested the effect of increasing SLP therapists' available time for patients to as much as 6.5 hours per day, from the current value of 4.5.
- Standardizing appointment durations. Currently, assessment and treatment duration vary in length. Under this proposed scenario, assessments would be 60 minutes, individual treatments 30 minutes, and group treatments 60 minutes. This standardization could lead to smoother processes by reducing variation. One disadvantage of this proposed change is that it assumes all patients need the same appointment duration. Learning capacity may vary among individuals, and some patients may benefit more from multiple short appointments, whereas others would benefit more from longer, but less frequent, appointments.
- Increasing resources. Each community currently has a single SLP therapist. We tested the impact of increasing the number of SLP therapists available in a community to two, three, and four.
- Block scheduling. Currently, when patients reach the front of the wait list, they will have their assessment(s) and, if required, begin treatment. Treatments continue periodically until they are no longer needed or the patient reaches school age. With block scheduling, patients only have 10 treatments successively. They then return to the end of the wait line, allowing another patient to begin his or her block of ten treatments.

We also tested several combinations of the above individual strategies in order to demonstrate potential improvement of simultaneously adopting different change ideas.

Table 3 lists the effect of various change strategies on quality indicators. As listed in the first row of the table, the base case patient wait time from referral to first assessment as determined in the simulation model is well over one year. Only 8 percent of patients complete all their required treatments and one-tenth of preschool patients do not even get assessed due to waiting.

Our model showed particular benefits associated with each change idea. For example, increasing the percentage of treatments performed in a group helped reduce the average wait time from referral to first assessment by close to 47 percent. Using a paraprofessional more than doubled the percentage of patients who completed all their required treatment.

Standardizing appointment durations helped reduce variability and almost tripled the percent of patients discharged because of finishing all their required treatment. However, this strategy may not be optimal for all patients, as not all patients have the same learning capacity.

Adding one extra SLP therapist generated major improvements. The percentage of patients being discharged due to completion nearly doubled, and patient wait time decreased to 218 days. We note that PWT could be almost eliminated by quadrupling the number of SLPs.

Block scheduling increased the number of patients that received at least some service prior to entering school. From the base case performance, this improved to 95 percent. Nonetheless, block scheduling was the only change strategy which decreased system performance as measured by PFTC and PTC. This occurred since this change idea advocates spreading appointments among the preschool children, rather than isolating treatment on a caseload of patients until successfully remedied.

Although these change strategies showed improvements within the system, there was no single change that eradicated wait lines completely. We tested the combined change strategies and discovered that the strategy of having two SLPs, one paraprofessional, and maximizing group visits (75 percent of visits done in groups

Table 3
Improvements from various change strategies.

Single change strategy	PWT (days)	PROA (percent)	PFTC (percent)	PDC (percent)
Current system performance	458	89	24	8
Increased group treatments (75 percent)	244	92	27	5
SLP at 6.5 patient-hours per day (by using a paraprofessional)	421	89	32	18
Standardized appointment duration	401	91	35	22
2 SLPs	218	92	41	15
3 SLPs	67	97	63	28
4 SLPs	4	100	89	55
Block scheduling	415	95	21	3
Combined change strategies	PWT (days)	PROA (percent)	PFTC (percent)	PDC (percent)
2 SLPs, block scheduling, 50 percent group, with 2–4 in group	97	99	50	11
2 SLPs, 1 paraprofessional, 75 percent group, with 3–5 in group	0	100	94	68
3 SLPs, 1 paraprofessional, 50 percent group, with 2–4 in group	0	100	96	73

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with 3–5 per group) resulted in a virtual elimination of wait times and ensured that all referred patients had an assessment. A large majority of feasible treatments (94 percent) were completed using this strategy.

4. Conclusions

This paper investigated an actual healthcare system in which patients experienced difficulty accessing SLP services. Current wait times were well in excess of one year, and one-tenth of patients did not even get assessed due to waiting. Only one-quarter of the treatments that could be feasibly delivered to patients prior to their fifth birthday were completed.

Simulation gave us a valuable, structured approach by which to analyze patient flow and system capacity issues. We were able to demonstrate how different strategies would most likely play out in the real system before physically making the changes. Our modeling predicted that providing treatments to more patients in groups would lead to substantial improvement. This measure is especially favorable since it does not require additional resources to the system, a particularly troublesome issue within this health region. The most intensive option for group treatment that we tested assumes that 75 percent of patients are treated in a group, and the group has 3–5 patients. While SLP therapists were confident that this was possible, it would have to be field tested to verify that patients progress as well as if they had individual treatments.

If the goal of quality improvement is to eliminate waiting time and ensure that all patients are adequately assessed, then our analysis showed that additional change strategies requiring more resources will be required. Quadrupling the number of SLPs could accomplish this goal. However, an alternate, less resource intensive strategy would be to add one SLP, deploy paraprofessionals, and maximize use of group visits as described above.

We note that this paper is directly relevant to practice since we tested strategies for improving service delivery, with many such change ideas proposed by SLP therapists themselves. Moreover – based in large part on the results of this analysis – this health region has subsequently adopted specific improvement strategies. For example, they are now using 10-week block scheduling and employing more group treatments. They have also hired a paraprofessional to permit SLP therapists more direct patient care time.

We are aware of some future possibilities for our modeling efforts. In particular, we noted that when patients are referred for SLP services within this health region, they are placed at the bottom of the wait list, regardless of their age and the severity of their problem(s). Health region personnel may want to consider dynamic priority-based scheduling in which each patient would be assigned an urgency score according to their particular condition. Higher patient scores would imply greater urgency. Their score would be allowed to increase over time as they waited for an appointment. When the next available slot is open in the caseload, the patient with the highest score would be contacted for an appointment.

Moreover, we could model patient-specific appointment cycles. This would comprise some speech language clients receiving a more frequent set of shorter appointments, while others would be provided intermittent, longer appointments. Another possibility could include analyzing adult SLP patient flow. Given the scope of the current project, we restricted our attention to preschool patients. However, adult patients experiencing speech difficulties (say, those recovering from strokes) are also subject to lengthy wait lists and flow problems.

A further opportunity may involve modeling the interface between pre-school speech language services delivered by the health region professionals and the treatments offered to school-aged children by school therapists. Speech language clients and their families could benefit through a more seamless, unified transition of services between these two practice environments. As depicted earlier in the paper, the current process introduces a discontinuity in care.

This model provided information to assist planners in making program design and resource allocation decisions. It is based on the most recent available information. However, the practice environment may change quickly; new practice standards may evolve, or patient demand may shift upwards or downwards. It is important that users of this analytical approach recalibrate the model as new information becomes available, so that it can continue to be a useful resource for planning purposes.

Contributions

Glennys Uzelman, Vice-President of Primary Health Services. Karen Kenny, Director of Population and Health Services. Randy Pritchard, Manager of Rehabilitation Services. Carol Lahey-Wiggs, Speech Language Pathologists.

Pamela Lamon, Speech Language Pathologist. Jennifer Lamarre, Speech Language Pathologist. Bernadette Ostapiw, Administrative Assistant. Betty Puff, Administrative Assistant.

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