International Journal of Speech-Language Pathology, 2014; Early Online: 1–11

informa
healthcare

The development of a feeding, swallowing and oral care program using the PRECEDE-PROCEED model in an orphanage-hospital in Guatemala

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Abstract

Purpose: The purpose of this study was to evaluate a long-term on-going international academic service-learning (I-ASL) intervention. Its goal was to improve swallowing, feeding and oral care technique of medical staff in an orphanage in Guatemala to children who are medically complex and have special needs.

Method: The PRECEDE-PROCEED model was used as the conceptual framework of the program. Five major target areas were identified during the diagnosis, assessment, implementation and evaluation phases of the model: knowledge and skills, feeding equipment, feeding and oral care technique, positioning and communication. Verbal instruction, modelling and small group training was provided by the research team across all visits. A five-day intervention designed to increase feeders' knowledge of feeding and oral care technique, signs and symptoms and complications of dysphagia and to improve their feeding, positioning and oral care technique was implemented and evaluated.

Results: Statistical analyses showed significant increases in knowledge and appropriate feeding, positioning and oral care technique.

Conclusion: As a consequence of the intervention, a trusting and mutually supportive relationship was built between the I-ASL team and the host organization.

Keywords: *International academic service-learning, PRECEDE-PROCEED model, feeding, swallowing, oropharyngeal dysphagia, oral care, learning communities, workplace learning*

Introduction

Successful feeding enables normal growth and development and assists infants and children in achieving developmental milestones. Feeding begins *in utero* and develops until a child is 3 years old (Arvedson & Brodsky, 2002). Swallowing involves an intricate inter-play of several oral, pharyngeal and laryngeal muscles, five cranial nerves, lower and upper motor neuronal pathways, as well as brainstem, cortical and subcortical regions of the brain (Cichero & Murdoch, 2006). Normal swallowing requires integration of oral sensorimotor functioning, posture and muscle tone and synchronization of the respiratory, neurologic and gastrointestinal systems (Arvedson & Brodsky, 2002).

There are four distinctive phases of swallowing: oral preparatory, oral, pharyngeal and oesophageal (Logemann, 1988; Prasse & Kikano, 2009). Disruption in any or all of the oral and pharyngeal components of swallowing may result in oropharyngeal dysphagia (OPD) or impaired swallowing. OPD occurs in varying degrees of severity and can be life threatening. Cerebral palsy, neurodevelopmental disabilities, premature birth, gastroesophageal reflux, craniofacial malformations and associated complex medical conditions are some of the common aetiologies related to OPD (Lefton-Greif & Arvedson, 2008; Rogers & Arvedson, 2005). Some major paediatric clinical signs and symptoms of dysphagia include cough, wet breathing, wet vocal quality, changes in respiration, gagging and choking during feeding and food refusal (Arvedson & Brodsky, 2002; Prasse & Kikano, 2009; Weir, McMahon, Barry, Masters, & Chang, 2009).

Disorders related to OPD occur worldwide; however, there is a paucity of studies available on paediatric swallowing and feeding problems in developing countries. The purpose of this study is to present a long-term on-going international academic service-learning (IAS-L) intervention designed to improve swallowing, feeding and oral care technique of medical staff in an orphanage in Guatemala to children who are medically complex and have special needs. Children with OPD are challenged with

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ISSN 1754-9507 print/ISSN 1754-9515 online
Published by Informa UK, Ltd.
DOI: 10.3109/17549507.2014.927924

developing normal growth patterns and are at risk for numerous health complications such as dehydration, malnutrition, pneumonia and airway obstruction (Matsuo & Palmer, 2008).

The prevalence of OPD in the general paediatric population is not well known (Arvedson, 2008). What is known, however, is that children with cerebral palsy and neurodevelopmental disabilities are at high risk for OPD and present with poorer health outcomes (Rogers & Arvedson, 2005). Andrew and Sullivan (2010) found that 30–40% of children with neurologic impairment had feeding difficulties and 68–70% of children with severe disabilities presented with aspiration. Weir, McMahon, Taylor, and Chang (2011) discovered that 28% of the children with neurological problems exhibited silent aspiration.

Recent studies indicate the need for dysphagia intervention in countries worldwide. In an analysis of state hospital records in South Africa, Fourie and Barratt (2011) found that 65% of infants were diagnosed with dysphagia secondary to a systemic illness. The authors concluded that reducing poverty and improving healthcare and nutrition would improve health outcomes and reduce the number of infants challenged with dysphagia. Rempel, Borton, and Kumar (2006) found that aspiration was associated with recurrent lower respiratory infections in seven typically-developing children of the First Nations and Inuit in Canada. Borton (2012) found a significant relationship with videofluoroscopic documented aspiration and pneumonia confirmed by X-ray in 67 Canadian indigenous children with lower respiratory tract infections.

Barratt and Ogle (2010) examined the medical records of 100 children in an outpatient neurodevelopmental clinic in South Africa. Twenty-nine per cent of the records indicated feeding difficulties and only 14% of the total sample were referred for an assessment of feeding. The authors stressed the need for dysphagia screening and intervention measures as well as multidisciplinary collaboration for this medically complex population. Adams, Khan, Begum, Wirz, Hesketh, and Pring (2011) assessed the implementation of a low-cost feeding intervention that focused on dietary alterations, caregiver training of appropriate feeding technique and administering proper food consistency in children with moderate–severe cerebral palsy in Bangladesh. Significant improvements were observed in nutritional status, child feeding skills, chest health and child mood following the intervention.

Children in developing countries are at risk for constraints to normal growth, specifically from 6–18 months of life and later (Pelto, Levitt, & Thairu, 2003). Forty-eight per cent of Guatemalan children under the age of 5 years suffer from stunted growth and 13% are underweight, the highest prevalence in Latin America (World Health Organization, 2012). In addition to nutritional deficits, children in developing countries are also at risk for infectious diseases and other associated medical conditions (Walker et al., 2007). Lindblade et al. (2011) found that the prevalence of pneumonia in a Guatemalan rural community was 110 per 1000, compared to 35–40 per 1000 in developed countries. The mortality rate for children under 5 years in Guatemala is 32 per 1000 live births; 12% of deaths are attributable to pneumonia (World Health Organization, 2012).

A large proportion of the population in Guatemala is indigenous (43%) and live in rural areas, with only 11% having accessibility to healthcare (Gragnolati & Marini, 2003; Lindblade et al. 2011). Children living in developing countries are at greater risk for disabilities and developmental delays (Walker et al., 2007). These children are at risk for OPD, which may exacerbate malnutrition and other associated medical conditions (Andrew & Sullivan, 2010; Yousafzai, Filteau, & Wirz, 2003).

There are inadequate Speech-Language Pathology services and training programs in Guatemala (The World Report on Disability, 2011). One avenue for providing services and specialized training in a developing country like Guatemala is through IAS-L. Service-learning is defined as a form of experiential learning that combines classroom instruction with community service activities (Crabtree, 2008; Hunter & Brisbin, 2000). IAS-L programs promote global awareness, social justice, civic responsibility, intercultural communication and understanding and community service (Crabtree, 1998, 2008; Kaf, 2012).

One of the challenges facing academic institutions for community Academic Service-Learning (AS-L) and IAS-L programs is the lack of research and formal program evaluation for communities and institutions they serve (Ferrari & Worrall, 2000; Schmidt & Robby, 2002). Although the benefits of service learning for teaching, faculty research and student learning have been well documented, there is significantly less information available regarding the impact of service-learning programs on the host institutions and communities (Ferrari & Worrall 2000; Worrall 2007). There are often no formal goals and objectives, methods of assessment or follow-up. As a result, the host institutions may receive inadequate or disjointed services and may not receive reciprocal and mutual benefit (Crump & Sugarman, 2010). In addition, the creation of a long-term trusting relationship necessary for a sustainable program with the recipient poses an additional challenge (Pechak & Thompson, 2009).

It is important to view host communities and institutions as service-learning partners and not as recipients' of services (Keith, 2005). Reciprocity in a service-learning context connotes a server–served role and an asymmetrical power relationship. Sustainability can only be achieved with mutual understanding, respect and the inter-dependence of partners.

The creation of a "learning community" or people engaged in activities of an intellectual nature to

improve knowledge and the application of specific skills is necessary for an IAS-L partnership. Learning communities in healthcare have been successfully applied in other contexts (Butler & Dawkins, 2007). One of the major goals in learning communities in the healthcare arena is to foster an environment that emphasizes evidence-based information, communication exchange and competency-based skills. The goal of workplace learning is to establish a climate in which workers become self-directed and problem solve on their own (Rowden, 2007; Walden & Bryan, 2011).

The program was implemented at a large, charitable, non-profit, non-governmental institution in Guatemala. The intervention was structured using the phases of the PRECEDE (Predisposing, Reinforcing and Enabling Constructs in Educational Diagnosis and Evaluation)–PROCEED (Policy, Regulatory and Organisational Constructs in Educational and Environmental Development) model (Green & Kreuter, 2005). Westby (2012) advocated use of the model in developing cross-cultural programs and services for individuals with communication disorders. The model has six phases and has been used widely in health education and health promotion to provide a framework for program development, implementation and evaluation. An outline of the model is presented in Table I, which includes the phases, suggested activities to fill the requirements for each phase, the actual activities

Table I. Phases of the PRECEDE-PROCEED model.

Phase	PRECEDE-PROCEED requirements	Suggested activities to fulfil requirements	Activities conducted	Data sources/instrumentation
PRECEDE (Predisposing, Reinforcing, and Enabling Constructs in Educational Diagnosis and Evaluation)				
1	Social assessment	Assessment of quality-of-life and social circumstances of the population.		Professional literature on swallowing physiology, OPD and positioning and feeding.
2	Epidemiological assessment	Identification of specific health goals and problems.	Collection of baseline medical information. Identification of areas for intervention.	Observations of feedings and oral care. Photographs of feeding and oral care sessions. Student reflection papers. Staff interviews.
3	Predisposing, reinforcing and enabling factors	Assessment of knowledge, values, perceptions and cultural practices that hinder change. Examining resource availability, access, referrals, the legal system and skill pools. Assessing factors that provided rewards for adopting new behaviours.	Identification of the following constraints: limited supplies, staff shortages, time constraints and scheduling problems. Building a positive relationship between organizational staff and intervention team.	Observations. Inventories of supplies.
PROCEED (Policy, Regulatory and Organizational Constructs in Educational and Environmental Development)				
4	Development of project objectives	Process evaluation that aligns priorities with program components.	Recommendations for intervention based upon evaluation results. Identification of five target areas for intervention.	On-going formative and process evaluation.
5	Implementation	Action plan.	Provision of necessary supplies. Staff training and intervention.	Observations and staff interviews. Student reflection papers. Knowledge assessments.
6	Summative evaluation	Summative evaluation of the extent to which the innovation met its objectives and goals. This phase analyses the innovation in terms of which processes worked and which did not, unanticipated consequences, the impact it had on the organization and its environment and its outcomes.	Collation of data. Presentation of findings.	Interviews. Videotapes. Photographs. Assessments.

conducted in this study to meet the requirements of each phase and the data sources used to validate the activities of the study participants.

The study represents an evaluation of a 5-year program using a mixed methods (i.e. qualitative and quantitative) longitudinal research design. To increase the validity of the findings, multiple sources of data were collected and the results were triangulated (Patton, 2002) from observations of patients and caregivers, interviews of caregivers and supervisors, reflection papers written by student volunteers and knowledge assessments. In addition, process and formative evaluations were conducted on site. Specifically, we present the initial comprehensive needs analysis to identify goals of the intervention in the specific context of this orphanage, the method applied to address each goal and an evaluation of the swallowing, feeding and oral care technique of medical staff and volunteer feeders at the orphanage before and after implementation of a 5-day focused action plan.

As the PRECEDE and PROCEED stages of the process required different methodology, we present the methods and results of two stages separately below. All study procedures were approved through the Institutional Review Board at St John's University. In addition, written permission was granted by the administration of the facility under study, who acted *en loco parentis* for the children in the study. All adult participants voluntarily provided verbal consent to participate.

Stage 1: PRECEDE

Methods

Participants. Participants included 56 speech-language pathology (SLP) graduate students, 103 children (aged 0–18), 40 auxiliary nurses (AN), two trained nurses (TN), a physical therapist, a director of nurses (DON), a part-time nutritionist and a medical doctor (MD). The ANs train on the job, have between a fifth to ninth grade education and can read and write on a fifth grade level. The TNs have five weeks of training that certifies them to give medication and perform basic medical procedures (i.e. wound care, suctioning). The DON has similar training as a registered nurse in the US. The MD supervises the paediatric units.

The children present with complex conditions such as craniofacial anomalies, malnutrition, cerebral palsy, Down's syndrome, hydrocephalus, convulsive syndrome, spina bifida, microcephaly and psychomotor delay. Most are non-ambulatory and dependent for feeding. There are three units in the facility: one unit accommodates up to 25 children from birth to 4-years old with four-to-five auxiliary nurses (ANs) and one trained nurse (TN) during the day and two ANs after 5 p.m.; the second and third units support a total of 78 children aged 5–18 years with seven-to-eight ANs during the day and four ANs after 6 p.m.

Procedures. The principal investigator (PI), an SLP and the first author organized the eight site visits conducted during the PRECEDE stage and developed the evaluation plan (see Table I). SLP graduate students accompanied the PI on site visits in the PRECEDE stage to assist with data collection. Most students volunteered at the centre between 10–16 days. The PI was present on all visits. Thus, the membership of the research team varied per visit, although several members were present on more than one visit.

In this PRECEDE stage, the PI evaluated the existing service model in the orphanage to identify predisposing, reinforcing and enabling factors. This stage lasted for 24 months. It involved the PI (a) collecting medical information (e.g. age, sex, height and weight, prior incidents of pneumonia) on each child as a baseline, (b) having SLP students write down their observations and impressions of feeding and oral care sessions, with 29 of 56 students' reflections across three pre-intervention visits being randomly selected for tabulation of observed predisposing factors, and (c) conducting a total of 20 formal individual interviews with the DON, medical doctor, physical therapist, nutritionist and nurses, who were asked questions about mealtime positioning, implementation of feeding, oral care, and use of equipment. Open-ended interview questions presented in the same order were used for all participants (see the Appendix).

Results

Identifying predisposing, reinforcing and enabling factors

In the 12 months prior to the start of the intervention, 10 cases of pneumonia confirmed by x-ray were recorded, nine children required nebulizer treatments, six needed frequent suctioning and five died of respiratory infections.

Predisposing factors. Predisposing factors concerning various feeding issues were identified in the student reflections and tabulated for the needs assessment. The factors were determined by the frequency of comments. Information on improper positioning for both the feeders and children are described in Table II.

Students reported a number of difficulties related to feeding equipment. Use of large tablespoons was mentioned by 33.8% of the commenters, followed by 29.6% that indicated improper teats on bottles, specifically using teats that had large holes or were in poor condition. Limited use of specialized bottles was mentioned by 28.2% of the commenters and 8.5% observed lack of cup drinking for the older children.

Table II. Identified issues with child feeding positions from 29 student reflections in the PRECEDE stage.

Child feeding position	*n*	%
Wheelchair		
Feeder standing	48	57.1
Feeder not at midline	27	32.1
Ineffective use of feeding space	5	6.0
Improper feeder to child distance	4	4.8
Total	84	100.0
Lap		
Improper child positioning	31	45.6
Improper chair for feeding	19	27.9
Feeder not at midline/facing child	13	19.1
Lack of head support	7	10.3
Total	68	100.0
Crib		
Improper child positioning	43	74.1
Lack of head/trunk support	15	25.9
Total	58	100.0
General comments		
Lack of physical support	30	40.5
Improper positioning of feeder/child	22	29.7
Feeder/child not at midline	22	29.7
Total	74	100.0

n, frequency of comments.

Student comment themes on feeding technique and feeding/swallowing problems are indicated in Table III. Table IV contains the comment themes on oral care and medication delivery. Comments on social communication were categorized into lack of interaction (63.6%) and stimulation (36.4%).

Table V contains the staff priority themes on positioning, feeding, health issues and equipment based on the interviews conducted. Data were tabulated according to the position of the interviewee and the

Table III. Identified issues with feeding technique and feeding/swallowing skills from 29 student reflections in the PRECEDE stage.

	n	%
Feeding technique		
Rapid feeding	39	30.5
Pacing	26	20.3
No oral clearance	19	14.8
Excess amount	16	12.5
No lip closure	15	11.7
Premature termination	9	7.0
Lack of independent feeding	2	1.6
Mandible restriction	2	1.6
Total	128	100.0
Feeding/swallowing problem		
Improper food consistency	36	30.0
Coughing	34	28.3
Chest congestion	17	14.2
Suctioning	8	6.7
Respiratory changes	7	5.8
Choking	7	5.8
Nebulizing	6	5.0
Improper liquids	5	4.2
Vomiting	3	2.5
Total	120	100.0

n, frequency of comments.

Table IV. Identified issues with oral care and medication delivery from 29 student reflections in the PRECEDE stage.

	n	%
Oral care		
Excess oral rinse	11	22.0
Mandible restriction	8	16.0
Coughing	8	16.0
Lack of pacing	8	16.0
Lack of lip closure	7	14.0
Improper positioning	6	12.0
Improper head posture	2	4.0
Total	50	100.0
Medication delivery		
Rate of delivery	13	23.6
Lack of lip closure	12	21.8
Lack of head support	11	20.0
Improper midline positioning	10	18.2
Excess amount	5	9.1
Mandible restriction	4	7.3
Total	55	100.0

n, frequency of comments.

Table V. Staff priority themes on positioning, feeding, health issues and equipment from 20 interviews in the PRECEDE stage.

Position/ priority	Comments
Medical doctor (interviewed 3×)	
1.	Respiratory and health issues related to feeding
2.	Lack of knowledge and skills
3.	Children fed rapidly
4.	Positioning
5.	Feeding time
Head nurse (interviewed 3×)	
1.	Children fed rapidly
2.	Feeding timing issues
3.	Inadequate knowledge and skills
4.	Lack of knowledge of dysphagia signs and symptoms
5.	Positioning
6.	Proper use of equipment
7.	Respiratory and health issues
8.	Appropriate food textures
Nursing staff comments (6 nurses interviewed 3 × each)	
1.	Lack of staff
2.	Meal scheduling problems
3.	Lack of time
4.	Difficulty using special feeding equipment
5.	Confusion over signs and symptoms
6.	Have some knowledge and skills
Nutritionist (interviewed 4×)	
1.	Positioning
2.	Feeding children rapidly
3.	Feeding timing issues
4.	Improper food and liquid textures
5.	Respiratory issues
6.	Correct use of equipment
7.	Lack of knowledge of dysphagia signs and symptoms
8.	Inadequate knowledge and skills
Physical therapist (interviewed 4×)	
1.	Feeding children rapidly
2.	Positioning
3.	Feeding timing issues
4.	Respiratory and health issues
5.	Lack of application of knowledge and skills
6.	Proper use of equipment

number of interviews. Comments were ranked in the order of the priority indicated by the interviewee.

Reinforcing factors. The administration and members of the nursing staff were welcoming and supportive of the efforts of the intervention team. The presence of the team was a positive reinforcing factor. They provided verbal instruction and modelled appropriate positioning, feeding technique and the proper use of feeding equipment. The fundamental negative reinforcing factor was normalization of feeding and oral care technique that focused on rapid delivery. Observations of feeding behaviour on successive visits indicated that on-going involvement of the IAS-L team was necessary in order for consistent changes to be made.

Enabling factors. As mentioned, ANs were challenged by limited supplies and staff, time constraints and scheduling issues. For example, initially, all of the older children were fed supper in their cribs. This practice was maintained because the majority of the staff left after supper, leaving four staffers to care for 78 children. One student wrote:

> The nurses feed the kids supper in their cribs and don't position them upright. One of the major problems is that it is difficult to elevate the cribs and there are not enough pillows to position them correctly.

Staff members often squirted water into the oral cavity without touching the lips for purposes of hygiene because the bottle was used for several children at a time. This resulted in coughing episodes among some of the children. This practice was maintained due to staff and time constraints.

The staff smiled at the children and provided physical stimulation (e.g. stroking their face or heads) during feedings. However, verbal engagement was limited. Some nurses did not talk to the children during the entire meal. One student wrote: "The nurses really care about the children, but don't seem to have time to talk to them when they are feeding them".

In addition, ANs did not communicate among themselves about oral intake information, the mealtime performance of specific children or feeding technique.

Stage 2: PROCEED

Methods

Participants. The participants were the same as described in the PRECEDE stage.

Procedures. The PROCEED stage entails developing the project objectives to address identified needs, implementing the resulting action plan and then evaluating the effectiveness of the plan. The head administrator and nursing staff gave permission to videotape and photograph during feedings and oral care on the paediatric units during multiple visits. Over 90 photographs of correct and incorrect mealtime behaviours were collected during this phase by the PI.

Developing project objectives. Considering observations, reflections, photographs, and interviews, the research team developed objectives and an intervention protocol to encourage changes in desired behaviours and environments. The research team developed five target areas that served as the content for the intervention during the implementation phase. The target areas and specific interventions for each area are listed below. All interventions were based on current research and clinical practice (Arvedson, 2008; Arvedson & Brodsky, 2002; Lefton-Greif & Arvedson, 2008; Rosenthal, Sheppard, & Lotze, 1995; Sheppard, 2008).

Knowledge and skills: Train volunteers and nursing staff in mealtime positioning, proper feeding technique, signs and symptoms and complications of dysphagia and oral care; instruct all staff members on the underlying rationale for feeding and oral care technique; identify those children who should have thickened fluids and who should not have mixed textures; and refer all children who exhibit difficulty swallowing liquids, food and medication to the MD for a work-up and dysphagia referral.

Feeding equipment: Feed the children with smaller spoons; provide children with cleft palate and weak suck with special bottles; identify children who could drink from cups; and use teats that are in good shape and free from large holes.

Feeding, oral care and medication delivery technique: Feed children at midline at a slow rate using small amounts; provide pacing cues to those infants and children who require assistance in co-ordination of sucking, swallowin, and breathing; promote and facilitate lip closure and oral clearance; for teeth brushing, position children upright and brush slowly without holding the child's mandible to prevent mouth closure; irrigate the mouth using small amounts of water; facilitate lip closure; and allow time for the child to swallow.

Positioning: Feed infants in a semi-reclined position with head support and hips and knees flexed; feed young children with good sitting balance in highchairs instead of in the feeders' laps; feed older children in their wheelchairs instead of in their beds as much as possible; elevate children who are fed and receive oral care in bed with positional devices and physical prompts and allow them to remain upright for 30 minutes after meals; feed all children at midline, with hip and knee flexion, and reposition as needed before, during and after medications, meals and oral care; use positional devices and physical prompts to support the child's head and torso; instruct the staff on how to position children with

abnormal muscle tone or abnormal movement patterns to facilitate postural stability for safe and efficient feeding; ensure all feeders are sitting comfortably in a padded chair with arm supports during feedings, medication delivery and oral care.

Communication: Have feeders provide verbal stimulation while feeding the children and encourage them to report children's swallowing, feeding, oral care status and amount consumed to each other.

Implementing the action plan. In this phase, program objectives were converted into action. The first effort was the provision of donated supplies and equipment. From visits nine through eleven (January, May, and August 2012), the team and staff experimented with the best feeding materials and positional and seating devices for feeding the children in a safe and efficient manner. Over repeated trials, therapeutic spoons and cups (e.g. Maroon: nosey cups), specialized feeding bottles (e.g. Haberman, Pigeon and Mead Johnson), teats, special pillows (e.g. husband, Boppy, Posey, wedges) and adaptive seating equipment were explored.

On the 12th visit (November 2012) and two days prior to the intervention, four different mealtimes were videotaped (Sony DSC-WX50) by the PI, which captured 8–10 nursing staff members feeding 10 children for 3-minute segments. Thirty-five videos were obtained over 2 days. On the first day of the intervention, staff was given a written pre-test to assess feeding and oral care knowledge and awareness of signs and symptoms and complications of dysphagia. This was followed by a 90-minute PowerPoint lecture on the five target areas developed in the PRECEDE stage. A post-test was administered after the lecture.

Small group training sessions across seven meals with 10 different children were conducted on days 2–5. Staff members were asked to model proper and improper ways of positioning, feeding and providing oral care to children. Following the intervention (days 6–7), the PI videotaped seven different mealtimes which captured eight staff members feeding up to 8–10 children for 3-minute segments. Thirty-two videos were obtained. Three months after the intervention (February 2012), staff members were post-tested on the knowledge assessment and signs and symptoms and complications of dysphagia. In addition, three mealtimes were videotaped by the PI, which captured 8–-10 staff members feeding 10 children for 3-minute segments. Thirty videos were obtained over 3 days.

Summative evaluation. In order to assess the impact of the program, the knowledge test was administered before and after the intervention and at the 3-month follow-up. The test consisted of 36 pictures of the nurses and students feeding children. The pictures were collected previously by the PI. Participants were asked to indicate whether the feeding or oral care technique or child or feeder positioning in the picture was correct or incorrect. Seventeen of the pictures indicated correct technique and 19 were incorrect; all pictures were randomly sequenced in the test. Scores were the sum of correct answers out of 36. Coefficient alpha, assessing internal consistency reliability for the test, was 0.83. In addition, participants were asked to write down three signs and symptoms of dysphagia and two complications to a total score of five.

The 97 video clips that were obtained were viewed independently by two SLPs trained and experienced in paediatric dysphagia. The SLPs used a binary correct/incorrect rating to evaluate the nurses on 40 variables covering positioning of the feeder and child, lip closure and oral cavity clearance, feeding technique and socialization. The SLPs were unaware of whether the video clips were taken prior to or following training.

The number of observations per variable ranged between 4–190, with a median of 56. Median inter-observer agreement over the 40 variables was 100.0% (range from 83.7–100.0%). Verbal stimulation was the only variable with inter-observer agreement below 90.0%.

Health measures were collected from medical charts and included weight, height, incidents of pneumonia, frequency of nebulizer treatments, and need for suctioning 11 months post-intervention. These were compared to those obtained 12 months prior to the intervention.

Results

Table VI displays the descriptive statistics for the pre-test, post-test and 3-month follow-up scores for the feeding knowledge test and the staff's ability to provide signs and symptoms and complications of dysphagia. Data were analysed using a one-way ANOVA. The differences between the three scores for the feeding and positioning knowledge test were significant ($F_{(2,\ 96)} = 44.58$, $p < 0.01$, $\eta^2 = 0.48$). Post-hoc analyses using the Bonferroni correction indicated significant improvement from pre-test to

Table VI. Results of feeding knowledge assessment and dysphagia signs/symptoms and complications in the PROCEED stage.

Test	*n*	*M*	SD
Feeding knowledge			
Pre-test	40	19.20	4.63
Post-test	40	26.13	5.21
3-month follow-up	19	30.16	1.95
Total	99	24.10	6.21
Signs/symptoms and complications			
Pre-test	40	0.85	1.29
Post-test	40	4.18	1.53
3-month follow-up	19	3.26	1.10
Total	99	2.66	2.04

n, number of staff members who participated in assessments; *M*, mean correct score on the test, with a maximum possible score of 36 for feeding knowledge assessment and a maximum possible score of five for signs/symptoms and complications of dysphagia.

post-test ($t_{(78)} = 6.29, p < 0.01$), post-test to 3-months ($t_{(57)} = 3.26$, $p < 0.01$) and pre-test to 3-months ($t_{(57)} = 9.88$, $p < 0.01$). Significant differences were also noted for knowledge of signs and symptoms and complications of dysphagia ($F_{(2, 96)} = 61.76, p < 0.01$, $\eta^2 = 0.56$). Post-hoc analyses indicated that both post-test ($t_{(78)} = 10.49$, $p < 0.01$) and follow-up scores ($t_{(57)} = 7.02, p < 0.01$) were significantly better than the pre-test scores, but there were no significant differences between the post-test and the follow-up score ($t_{(57)} = -2.32$, $p = 0.10$).

Table VII contains a cross-tabular analysis comparing nurses performance on feeding positioning, lip closure, and oral clearance analysed from video samples of feeding sessions prior to and following training. Cross-tabular analyses of feeding technique and socialization variables by training are presented in Table VIII. Significant changes were noted across all study variables ($p < 0.01$).

Assessment of health measures 11 months post-intervention revealed the following: infants and young children gained an average of 2.2 pounds, the older children had an average weight gain of 0.4 pounds with no increases in height, pneumonia cases dropped from 10 in the previous year to three, children requiring nebulizer treatments due to chest congestion declined from nine to three and suctioning was reduced from six to three, children. Five children died the year prior to the intervention; two deaths occurred during the 11-month follow-up period. In addition, five of the older children are drinking from cups, compared to none in the previous year.

Discussion

The findings of the evaluation indicate that, as a consequence of the PRECEDE-PROCEED intervention, nursing staff members increased their knowledge and skills on feeding, positioning, oral care technique and appropriate use of equipment. Significant changes were shown on the knowledge test and the post-training videotaped feeding sessions. Following training, ANs had a greater tendency to position the children properly, provide

Table VII. Cross-tabulations of positioning, lip closure and oral clearance variables by training from 97 video clips of nurses feeding 8–10 children across 14 meals in the PROCEED stage.

Positioning variables	Not trained	Trained	Total	$\chi^2_{(1df)}$
Sitting				69.19**
Correct *n*	10 (14.3%)	92 (76.7%)	102 (53.7%)	
Incorrect *n*	60 (85.7%)	28 (23.3%)	88 (46.3%)	
Total *n*	70 (36.8%)	120 (63.2%)	190 (100.0%)	
Proper positioning				109.69**
Correct *n*	12 (19.4%)	103 (97.2%)	115 (68.5%)	
Incorrect *n*	50 (80.6%)	3 (2.8%)	53 (31.5%)	
Total *n*	62 (36.9%)	106 (63.1%)	168 (100.0%)	
Neutral head posture				115.1**
Correct *n*	8 (14.3%)	101 (97.1%)	109 (68.1%)	
Incorrect *n*	48 (85.7%)	3 (2.9%)	51 (31.9%)	
Total *n*	56 (35.0%)	104 (65.0%)	160 (100.0%)	
Facilitate head and trunk support				104.6**
Correct *n*	10 (20.8%)	97 (100.0%)	107 (73.8%)	
Incorrect *n*	38 (79.2%)	0 (0.0%)	38 (26.2%)	
Total *n*	48 (33.1%)	97 (66.9%)	145 (100.0%)	
Midline				
Correct *n*	22 (36.7%)	100 (96.2%)	122 (74.4%)	70.67**
Incorrect *n*	38 (63.3%)	4 (3.8%)	42 (25.6%)	
Total *n*	60 (36.6%)	104 (63.4%)	164 (100.0%)	
Promote lip closure				39.82**
Correct *n*	25 (43.9%)	79 (91.9%)	104 (72.7%)	
Incorrect *n*	32 (56.1%)	7 (8.1%)	39 (27.3%)	
Total *n*	57 (39.9%)	86 (60.1%)	143 (100.0%)	
Facilitate lip closure				15.81**
Correct *n*	4 (25.0%)	31 (81.6%)	35 (64.8%)	
Incorrect *n*	12 (75.0%)	7 (18.4%)	19 (35.2%)	
Total *n*	16 (29.6%)	38 (70.4%)	54 (100.0%)	
Allow time for clearance				73.12**
Correct *n*	4 (8.2%)	57 (89.1%)	61 (54.4%)	
Incorrect *n*	45 (91.8%)	7 (10.9%)	52 (46.0%)	
Total *n*	49 (43.4%)	64 (56.6%)	113 (100.0%)	
Stimulating clearance				28.61**
Correct *n*	4 (14.3%)	34 (79.1%)	38 (53.5%)	
Incorrect *n*	24 (85.7%)	9 (20.9%)	33 (46.5%)	
Total *n*	28 (39.4%)	43 (60.6%)	71 (100.0%)	

** $p < 0.01$.

Table VIII. Cross-tabulations of feeding/socialization variables by training from 97 video clips of nurses feeding 8–10 children across 14 meals in the PROCEED stage.

	Feeding/socialization			
Variables	Not trained	Trained	Total	$\chi^2_{(1df)}$
Appropriate amounts of liquids presented				7.18**
Correct *n*	6 (37.5%)	35 (74.5%)	41 (65.1%)	
Incorrect *n*	10 (62.5%)	12 (25.5%)	22 (34.9%)	
Total *n*	16 (25.4%)	47 (74.6%)	63 (100.0%)	
Appropriate amounts of solids presented				50.01**
Correct *n*	2 (4.7%)	16 (100.0%)	18 (30.5%)	
Incorrect *n*	41 (95.3%)	0 (0.0%)	41 (69.5%)	
Total *n*	43 (72.9%)	16 (27.1%)	59 (100.0%)	
Rate of feeding				45.04**
Correct *n*	6 (10.9%)	66 (67.3%)	72 (47.1%)	
Incorrect *n*	49 (89.1%)	32 (32.7%)	81 (52.9%)	
Total *n*	55 (35.9%)	98 (64.1%)	153 (100.0%)	
Eye contact				57.59**
Correct *n*	28 (42.4%)	100 (94.3%)	128 (74.4%)	
Incorrect *n*	38 (57.6%)	6 (5.7%)	44 (35.6%)	
Total *n*	66 (38.4%)	106 (61.6%)	172 (100.0%)	
Verbal stimulation				19.09**
Correct *n*	23 (34.8%)	73 (68.9%)	96 (55.8%)	
Incorrect *n*	43 (65.2%)	33 (31.1%)	76 (44.2%)	
Total *n*	66 (38.4%)	106 (61.6%)	172 (100.0%)	

** $p < 0.01$.

head and trunk support when required and feed them at midline. An increase in promoting and facilitating lip closure and allowing time or stimulating for oral clearances were also evident in trained ANs. A majority of the trained nursing staff now feed children with more appropriate amounts and at a slower rate. Although staff members have shown improvement in socialization, they need to verbalize more with the children as they feed them. Feeding should be a social activity; as such, the feeder could use the opportunity to provide meaningful interaction (Arvedson & Brodsky, 2002).

Prior to the intervention, staff members tended to ignore coughing and signs of choking. They are becoming aware that such patient responses are possible indications of improper feeding or need for further evaluation and management and are reporting them to the research team. In a recent visit, an AN told the researcher that she had suggested to the nutritionist to modify a child's food consistency because he was choking on mixed textures. The AN and the nutritionist changed the child's diet to puréed textures only. This decision was made without the intervention team and shows the development of a learning community. The organization has asked the IAS-L team to develop a swallowing and feeding instructional videotape and manual and to conduct on-going formal instruction.

The consensus among the administrators, MD, nursing staff and volunteers and the research team is that there has been an observable reduction in the number of coughing and gagging episodes and wet and gurgly voice quality. Medical records have also indicated a reduction in respiratory infections, suctioning and nebulizer treatments. The infants and young children gained weight and there was no reported weight loss for the older children 6 months post-intervention.

One consequence of the intervention is that the children's health status is being more closely monitored. The staff has greater awareness of dysphagia-related complications as indicated by assessment results. As a direct result of the student reflections, the DON and nurses have begun developing a feeding surveillance system for the older children in which one AN will be assigned to feed seven-to-eight children and document food and liquid intake. Children with swallowing problems have been identified and recommendations have been made for feeding and swallowing interventions. These interventions included NPO, changes in liquids and food textures, use of positional devices, specific swallowing and feeding recommendations and referrals to specialists. Some older children have been recommended for cup drinking, while other children have been upgraded to various textures.

This IAS-L intervention program has been ongoing for 5 years, during which the IAS-L research team has made 16 visits and brought needed equipment to improve the feeding and oral care of the children. Visits have combined information and instruction with informal gatherings. It is a collaborative model in which the American university and its participating organization engage in mutual exchange of resources and information that benefits both. This model stands in opposition to the "helicopter" model in which IAS-L programs come into a service provider, collect data, train students and then leave (Keith, 2005).

The relationships that bind the research team with the personnel of the participating organization reinforce a workplace learning community in which knowledge and information is exchanged (Butler & Dawkins, 2007; Rowden, 2007; Walden & Bryan, 2011). Feelings of trust have been built between the two groups such that the research team has been allowed increasing access to the organization's facilities and have been allowed to videotape and otherwise document their activities.

Limitations and future research

The observational data including the videotaping of the nursing staff may be considered a limitation of this study. Although the staff members were videotaped frequently, they may have modified their behaviour in the presence of the author and IAS-L team. The interviews were conducted by the PI, which may bias the results. Anthropologic and meal consumption records were not available for all of the children, which limited some of the outcome measures. Further concerns include presenting medications appropriately in the correct position, promoting cup drinking for older children and the use of a single sports bottle to irrigate children's oral cavity after brushing their teeth. These issues and health outcome information will be focused on in subsequent interventions.

Additional research needs to be conducted on this project as it continues and evolves. The ultimate goal is to develop a learning community so that workplace learning will result and a "train the trainer" environment will unfold. To further this effort, a training video and manual are in the process of being developed. All new staff members will be required to view them. The impact of the training video and manual upon feeding, positioning and oral care technique should be assessed in future research.

Knowledge and skills on proper feeding, positioning and oral care technique is crucial for maintaining successful growth and health outcomes in high-risk children worldwide. The World Report on Disability (2011) has modified the individual impairment outcome measures classification system by including individual activities, such as eating and walking, and restrictions in activities such as the ability to use public transportation. OPD falls within the new classification system and may provide a gateway for the future development of more Speech-Language Pathology education and rehabilitation programs in developing countries.

Conclusion

The PRECEDE-PROCEED model provided an excellent framework for the IAS-L intervention program. Observations have shown that feeding, medication delivery and oral care technique have improved dramatically through the intervention. Staff members' knowledge of positioning and feeding technique as well as their knowledge of signs and symptoms and complications of dysphagia drastically improved. This study has shown that a long-term collaborative and supportive I-ASL program has provided important improvements in the dysphagia and health care management of children with disabilities and complex medical problems in a developing country.

Acknowledgements

We would like to thank Patricia Schwartz, Briana Sullivan, Ariana Gluck, Jessica Greco and all of the CSD students and volunteers that participated in this project.

Declaration of interest: The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the paper.

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Appendix: Interview protocols

1. Are there an adequate number of chairs to sit in when feeding?
2. Are you able to position yourself comfortably for feeding?
3. Why do you feed the children in their cribs?
4. Are you able to position the children adequately during feeding in your lap, wheelchair or crib?
5. Do you have adequate positioning and feeding equipment such as spoons, bottles, cups, pillows and bibs?
6. Are there sufficient staff and volunteers to feed the children?
7. Is there enough time to feed the children appropriately?
8. Are the meals given during appropriate times?
9. Can you describe any barriers for appropriate positioning, feeding and oral care?
10. How would you improve the feeding process or oral care procedures?
11. Describe possible problems (signs or symptoms) an infant/child may have swallowing or feeding.
12. Describe some complications associated with swallowing and feeding problems.