The Pediatric Vestibular Symptom Questionnaire: A Validation Study

Marousa Pavlou, PhD, PT[1], Sue Whitney, DPT, PhD, NCS, ATC, FAPTA[2], Abdulaziz A. Alkathiry, PT[2,3], Marian Huett, PhD, PT[4], Linda M. Luxon, CBE, BSc, FRCP[5], Ewa Raglan, MD, LRCP, MRCS, FRCS, FRCP[6], Emma L. Godfrey, PhD[7], and Doris Eva-Bamiou, MD, MSc, PhD, FRCP[5,6,8]

Objective To develop and validate the Pediatric Vestibular Symptom Questionnaire (PVSQ) and quantify subjective vestibular symptom (ie, dizziness, unsteadiness) severity in children.

Study design One hundred sixty-eight healthy children (female, n = 91) and 56 children with postconcussion dizziness or a vestibular disorder (female, n = 32), between ages 6 and 17 years, were included. The PVSQ contains questions regarding vestibular symptom frequency during the previous month. The Strengths and Difficulties Questionnaire (SDQ), a brief behavioral screening instrument, was also completed.

Results The PVSQ showed high internal consistency (10 items; Cronbach $\alpha = 0.88$). A significant between-group difference was noted with higher (ie, worse) PVSQ scores for children with vestibular symptoms ($P < .001$); no significant differences were noted between patient groups. The optimal cut-off score for discriminating between individuals with and without abnormal levels of vestibular symptoms was 0.68 out of 3 (sensitivity 95%, specificity 85%). Emotional and hyperactivity SDQ subscale scores were significantly worse for patients compared with healthy participants ($P \leq .01$). A significant relationship was noted between mean PVSQ and SDQ (parent-rated version) hyperactivity and total scores for patients ($P \leq .01$) and the SDQ (self-rated) emotional, hyperactivity, and total score ($P \leq .01$) in healthy controls. However, mean SDQ subscale and total scores were within normal ranges for both groups.

Conclusions Self-reported vestibular symptoms, measured by the PVSQ, discriminated between children presenting with vestibular symptoms and healthy controls and should be used to identify and quantify vestibular symptoms that require additional assessment and management. *(J Pediatr 2016;168:171-7)*.

Vestibular disorders are the most common cause of dizziness in children with a prevalence of 0.7%-15%.[1-3] Vestibular migraine, benign paroxysmal vertigo of childhood (a migraine precursor), postconcussion dizziness because of head trauma, and viral vestibular neuritis are the most common diagnoses.[4-7] However, these disorders may often remain undiagnosed in children[8] as medical professionals may attribute symptoms to a behavioral disorder or "clumsiness."[9,10] This may partly be because children are often unable to express or describe their symptoms without appropriate questioning, may readily accept the symptom terminology proposed by an adult, and may demonstrate behaviors such as clinging to the parent when experiencing dizziness or vertigo.[5,10,11] Vestibular disorders may lead to secondary psychological symptoms and avoidance behaviors with adverse effects on educational achievement and quality of life.[12,13] A detailed medical history, to ascertain symptoms, triggers, and time course, is the cornerstone of the diagnostic decision-making process.[4,5] It is, therefore, of the utmost importance to help a child explain his/her symptoms by providing different descriptors, in order to determine etiology and establish a diagnosis.[11] Although a number of questionnaires[14,15] exist to assess the presence, severity, and impact of vestibular symptoms in adults, there are currently none available for the pediatric population.

This study aimed to develop and validate a questionnaire, the Pediatric Vestibular Symptom Questionnaire (PVSQ), to identify and quantify subjective vestibular symptoms (ie, dizziness, imbalance) in children between 6 and 17 years of age. A secondary study aim was to investigate the relationship between vestibular symptoms and behaviors indicative of psychological problems in healthy children and those with a vestibular disorder or concussion.

Methods

The PVSQ aimed to identify and measure the severity of common vestibular symptoms in children. The design and validation[16,17] consisted of 3 main phases: (1) expert panel review of initial PVSQ items; (2) pilot study to assess the validity

GOSH	Great Ormond Street Hospital
PAF	Principal axis factoring
PVSQ	Pediatric Vestibular Symptom Questionnaire
ROC	Receiver operating characteristic
SDQ	Strengths and Difficulties Questionnaire

From the [1]Center of Human and Aerospace Physiological Sciences, King's College London, London, United Kingdom; [2]Physical Therapy, School of Health and Rehabilitation Sciences, University of Pittsburgh, Pittsburgh, PA; [3]Physical Therapy, College of Applied Medical Sciences Majmaah University, Majmaah, Saudi Arabia; [4]Department of Physiology, King's College London; [5]Department of Neuro-Otology, National Hospital for Neurology and Neurosurgery; [6]Department of Audiological Medicine, Great Ormond Street Hospital for Children; [7]Division of Health and Social Care, King's College London; and [8]University College London Ear Institute, London, United Kingdom

The authors declare no conflicts of interest.

http://dx.doi.org/10.1016/j.jpeds.2015.09.075

and reliability of the PVSQ questionnaire; and (3) main validation study and collection of normative data.

An expert consensus panel comprising 3 consultant pediatric audio-vestibular physicians, 2 physical therapists, and a psychologist constructed and selected questionnaire items. Items were chosen from the validated, vestibular subscale of the Vestibular Symptom Scale[14] and from symptoms recorded in clinic reports for children diagnosed with a vestibular disorder at the Audiological Medicine Department, Great Ormond Street Hospital (GOSH), London, UK. The 11-item questionnaire was modified (wording alterations, bigger font size) after review for ease of completion and acceptability by 10 healthy children and 5 with a vestibular disorder aged between 6 and 15 years old. Children answered the questionnaire based on a concrete reference period of how frequently symptoms were experienced during the previous month as this "anchors" the question, making it easier for a child to answer.[16] Each item was rated on a 0 (never) to 3 (most of the time) scale; a "don't know" category was also included. The total score ranged from 0-33 and was normalized based on the equation: total score/(total question number − "don't know" replies) to yield a score of 0-3 with higher scores indicating greater symptom severity. Ten questions are used in the normalization equation. Question 11, which asks children if their symptoms prevent activity participation, and if yes, to identify which ones, is not included in the equation. The final questionnaire is provided in **Table I**.

Table I. The PVSQ

The following questions ask about how often you feel dizziness and unsteadiness. Please circle the best answer for you.
How often in the past month have you felt the following?

1. A feeling that things are spinning or moving around				
3	2	3	4	?
Most of the time	Sometimes	Almost never	Never	Don't know
2. Unsteadiness so bad that you actually fall				
3	2	3	4	?
Most of the time	Sometimes	Almost never	Never	Don't know
3. Feeling sick				
3	2	3	4	?
Most of the time	Sometimes	Almost never	Never	Don't know
4. A light-headed or swimmy feeling in the head				
3	2	3	4	?
Most of the time	Sometimes	Almost never	Never	Don't know
5. Feeling of pressure in the ear(s)				
3	2	3	4	?
Most of the time	Sometimes	Almost never	Never	Don't know
6. Blurry vision, difficulty seeing things clearly, and/or spots before the eyes				
3	2	3	4	?
Most of the time	Sometimes	Almost never	Never	Don't know
7. Headache or feeling of pressure in the head				
3	2	3	4	?
Most of the time	Sometimes	Almost never	Never	Don't know
8. Unable to stand or walk without holding on to something or someone				
3	2	3	4	?
Most of the time	Sometimes	Almost never	Never	Don't know
9. Feeling unsteady, about to lose balance				
3	2	3	4	?
Most of the time	Sometimes	Almost never	Never	Don't know
10. A fuzzy or cotton wool feeling in the head				
3	2	3	4	?
Most of the time	Sometimes	Almost never	Never	Don't know
11. Do any of these symptoms stop you doing what you want to do?				
If yes, which ones?				

Questionnaire copy not to scale.

PVSQ Validation

The study comprised the completion of the PVSQ, a question set asking about migraines, frequent dizzy spells, severe stomach pain, vomiting, loss of consciousness, binocular vision or hearing difficulty, medication, and regular doctor visits (**Appendix**; available at www.jpeds.com), and the Strengths and Difficulties Questionnaire (SDQ), a brief behavioral screening questionnaire for 4- to 17-year-olds.[18,19] The SDQ informant (4-10 years old) and self-report versions (11-17 years old) both include 5 subscales: emotional, conduct, hyperactivity/inattention, peer relationship problems, and prosocial behavior. Subscale scores ranged between 0 and 10; the total score is the sum of the first 4 scales (range 0-40). The English UK and US versions (www.sdqinfo.org) were used for participants recruited in the UK and US, respectively.

All primary school aged children in years 1 and 2 completed the PVSQ and general questions together with a parent or guardian at home, and those in year 3 and above or in secondary school completed them independently in the classroom under the standardized direction of a research team member. Children with vestibular symptoms completed the study during their clinic appointment.

Fifty-six children experiencing dizziness and/or unsteadiness symptoms because of a vestibular disorder or concussion were recruited from the Department of Audiological Medicine, GOSH, or a tertiary balance center at the University of Pittsburgh Medical Center, Pittsburgh, Pennsylvania after a complete neurologic and neuro-otologic examination. Inclusion criteria were clinical diagnosis of concussion or other pathology giving rise to vestibular dysfunction based on clinical history and clinical examination/test findings, aged 6-17 years, and attend a mainstream school. Children with central nervous system involvement other than migraine or concussion, significant learning difficulties, or orthopedic deficit affecting balance and gait were excluded. Diagnostic criteria for a peripheral vestibular disorder,[20] bilateral vestibular hypofunction,[21] vestibular neuritis,[22] migraine,[23,24] and migrainous vertigo[25] are included in **Table II** (available at www.jpeds.com). Postconcussion dizziness was diagnosed based on complaints of dizziness and/or balance problems on the Postconcussion Symptom Scale or Immediate Post-Concussion Assessment and Cognitive Testing tests.[26] All children were medical referrals to University of Pittsburgh Medical Center and had a clinical and functional evaluation by physiotherapists with expertise in examining and treating children with concussion.

Three-hundred children aged 6-17 years were recruited from 3 primary and 2 secondary mainstream schools in the Greater London area as a healthy control group. A total of 168 questionnaires were eligible for inclusion. Exclusion criteria for the control group included a "yes" answer to questions (**Appendix**) for experiencing migraines (n = 58), frequent dizzy spells (n = 27), vomiting, stomach pain,