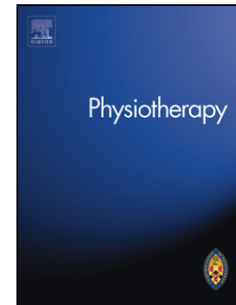


Accepted Manuscript

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Authors: A.J. Male, G.M. Ramdharry, R. Grant, R.A. Davies, I.D. Beith



PII: S0031-9406(18)30219-0
DOI: <https://doi.org/10.1016/j.physio.2018.08.007>
Reference: PHYST 1045

To appear in: *Physiotherapy*

Received date: 22-2-2018

Please cite this article as: Male AJ, Ramdharry GM, Grant R, Davies RA, Beith I.D. A survey of current management of Benign Paroxysmal Positional Vertigo (BPPV) by physiotherapists' interested in vestibular rehabilitation in the UK. *Physiotherapy* (2018), <https://doi.org/10.1016/j.physio.2018.08.007>

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**A survey of current management of Benign Paroxysmal Positional Vertigo (BPPV)
by physiotherapists' interested in vestibular rehabilitation in the UK**

**A.J. Male^{a,b} MResCP MCSP, G.M. Ramdharry^a PhD, R.Grant^a MSc CStat, R.A. Davies^c FRCP
PhD, I.D. Beith^a PhD MSc MCSP DipTP (Cert Ed)**

^a Faculty of Health Social Care and Education, Kingston University and St. George's
University of London, Cranmer Terrace, London SW17 0RE

^b Therapy Services, National Hospital for Neurology and Neurosurgery, Queen Square,
London, WC1N 3BG

^c Department of Neuro-Otology, National Hospital for Neurology and Neurosurgery,
Queen Square, London WC1N 3BG

Correspondence to: A.J. Male

(P): Therapy Services, National Hospital for Neurology and Neurosurgery, Queen
Square, London, WC1N 3BG

(E): a.male@nhs.net or amandajmale@hotmail.com

(T): +44 7990 548924

Ethical approval:

Ethical review was completed by the Faculty of Health Social Care and Education
(FHSCE) at St. George's University of London.

Funding:

This research was funded by a National Institute for Health Research, Masters in Clinical Research degree.

Objectives:

Benign Paroxysmal Positional Vertigo (BPPV) is the most common cause of dizziness. Extensive research has identified the best assessment and treatment manoeuvres for each subtype of BPPV. Education in vestibular rehabilitation (VR) is inconsistent. It is unclear if the evidence has been adopted by UK physiotherapists in clinical practice and no research has investigated this specifically.

Design:

An online survey with closed- and open-text answers.

Participants:

A purposive sample of physiotherapists interested in VR. A response rate of 67% (100/150) was obtained, from which 20 responses were excluded.

Results:

Participants had good evidence-based awareness in assessment (99%) and treatment (90%) of posterior BPPV. Horizontal BPPV assessment awareness was lower than treatment (46% versus 75%). Differential diagnosis was poor in subjective (25%) and objective stages of assessment (43%). 36% were able to list ≥ 3 test precautions with all three nystagmus characteristics described by 29%. 81% encourage activity restrictions

post-treatment. Only 28% were aware of practice guidelines or Cochrane reviews in BPPV.

External courses were rated the top method for learning how to manage BPPV (53%). Lack of peer support (34%) was the main challenge faced whilst learning. Recommendations for improving BPPV education included more external courses (26%) and competency guidelines (15%).

Conclusions:

Good awareness of research evidence was observed in some aspects of BPPV management but many areas require development. Translation and implementation of evidence remains poor and suggests changes in education and knowledge dissemination are warranted.

Keywords: Vertigo, Benign Paroxysmal Positional Vertigo (BPPV), Physical Therapy, Assessment, Treatment, Evidence-based Practice

Introduction:

BPPV is characterised by brief rotational vertigo provoked by changes in position, such as rolling over in bed, bending down or looking overhead ^[1]. It commonly causes imbalance and results in a higher risk of falls, especially in the elderly ^[2]. BPPV causes a significant impact on independence, contributes to low mood and anxiety and can incur a high cost to the health service and economy ^[3, 4].

Extensive research has identified the best assessment manoeuvres and treatment techniques for each subtype of BPPV, incorporating three Cochrane meta-analyses ^[5-7], two practice parameters ^[8, 9] and eight systematic reviews ^[10-17]. These assessment and

treatment manoeuvres are safe and quick to complete, require no specific equipment and can be performed in any clinical setting, including in the community ^[2].

There is high-level evidence that vestibular rehabilitation (VR) is beneficial for unilateral vestibular problems, including BPPV ^[7]. Physiotherapists are trained to address balance and gait impairments, to work in a wide variety of clinical settings and specialities and are therefore well placed to provide VR ^[18]. Despite this, VR is not consistently included in registration education programs ^[19].

An international survey of VR by 133 allied health professionals identified that 80% had received no training at qualifying level in VR ^[19]. There were only 133 replies, of which only three were from the UK and just two were physiotherapists. The findings therefore offer little insight into the current learning methods of physiotherapists in the UK.

To the authors' knowledge, no research has explored the provision of evidence-based care or identified what opportunities and methods are preferred for learning how to manage BPPV, the challenges faced and any recommendations to facilitate knowledge acquisition for physiotherapists in the UK.

Aims and objectives

The two primary aims of this research were:

- 1) To explore to what extent current physiotherapy management of BPPV is meeting evidence-based recommendations in the UK.
- 2) To explore physiotherapists preferences for evidence-based training in BPPV management in the UK.

Method:

Design

An online survey with closed- and open-text answers was developed to capture the practices and opinions of physiotherapists over a wide geographical area^[20]. Thirteen open-text compulsory questions explored real-life practice and investigated to what extent the research evidence was known about and incorporated in practice.

The remaining questions covered participant demographics, learning opportunities and challenges, and asked for details of how the challenges were overcome. Recommendations for how to improve learning by physiotherapists about BPPV were also requested. Finally, participants were asked if they knew of any evidence-based guidelines. This question was positioned at the end of the survey to allow real-practice to be explored, and to reduce any bias to other answers.

Survey development

There were no existing validated tools, to the authors' knowledge, that could be employed for this research. A new survey was developed in collaboration with experienced researchers, clinical experts and physiotherapy colleagues using two stages of pre-piloting and formal piloting. It consisted of a total of 26 questions and took less than 20 minutes to complete (see supplementary information 1).

Recruitment

A purposive sample of physiotherapists who were members of a professional network in the UK with an interest in VR, were enlisted. To ensure a narrow confidence interval of proportional data, a standard formula was used^[21], and a sample of 100 was recommended. Participants were emailed an invitation, participant information sheet and the survey URL by the network's membership secretary. No more than three direct

contacts were made by email. Responses were anonymous with no identifiable data collected.

Ethical review was completed by the Faculty of Health Social Care and Education (FHSCE) at St. George's University of London.

Data Analysis

Data were exported from SurveyMonkey and prepared for analysis with Statistical Package for Social Sciences (SPSS) version 21. Participant characteristics and work demographics were analysed descriptively for central tendency and spread. Open-text answers to aspects of BPPV management were analysed using quantitative manifest content analysis against an evidence-informed content analysis framework prepared in advance in conjunction with an expert Audiovestibular Physician, (see supplementary information 2). Each answer was allocated a binary code, where, '1' implied adequate evidence-based knowledge and '0' implied absent or inadequate evidence-based knowledge. A percentage awareness score and 95% CI for each question were calculated. To define levels of awareness, interpretation frameworks used for correlation, proportions and reliability were applied ^[22].

Categorical data were presented as frequencies. Open-text answers regarding learning experiences were analysed into themes and presented as frequencies.

Results:

Data collection lasted nine weeks (April-June 2015). The 150 physiotherapy members of the professional network were sent the survey and as 100 responses was the target sample, recruitment was closed when this number of participants was reached. This represents 67% of the membership (100/150). Non-responders were not identifiable for

follow up. Of the target sample of 100, 80 were included for final data analysis. Twenty were excluded; one response was not from the UK and the other 19 had not completed the compulsory questions.

Participant characteristics

Participants ranged from Band 4 to 8b with a median grade of Band 7, had worked with vestibular patients an average of 7 years (IQR 3 to 12years) and managed patients with BPPV more than once a month. 46% of participants stated that they worked as part of a team, comprising on average three persons (median 3). Most of the participants described themselves as working in no more than two work settings (cumulative frequency 89%).

65% (52/80) delivered VR as part of their work role but only 35% (28/80) worked in a specialist vestibular service as their main work setting (see table 1).

Question	Answer options	Frequency n (%)	Collapsed categories and frequency n (%)	
Main work setting	Acute care	9 (7)	Collapsed categories: Specialist vestibular service 27 (34) Others 53 (66)	
	Community rehabilitation	8 (7)		
	Falls	10 (8)		
	Inpatient rehabilitation	8 (7)		
	Outpatients	51 (42)		
	Respiratory/Cardiovascular care	0 (0)		
	Specialist vestibular service	27 (22)		
	Other	8 (7)		
Specialities currently working in	Elderly care	16 (11)	Collapsed categories: Vestibular rehabilitation 52 (65) Others 28 (35)	
	General medicine	3 (2)		
	Musculoskeletal	29 (19)		
	Neurology	31 (21)		
	Orthopaedics	12 (8)		
	Respiratory/Cardiovascular	1 (1)		
	Vestibular rehabilitation	52 (35)		
	Others	5 (3)		

Table 1: Number of work settings and specialities for participants (% rounded to nearest whole number)

Evidence-based awareness

The maximum number of responses for the evidence-based awareness questions was 80. The average total awareness score was eight out of 13 (IQR 6 to 9). The overall proportion of responses demonstrating knowledge in line with the evidence was explored per dimension and is presented in figure 1.

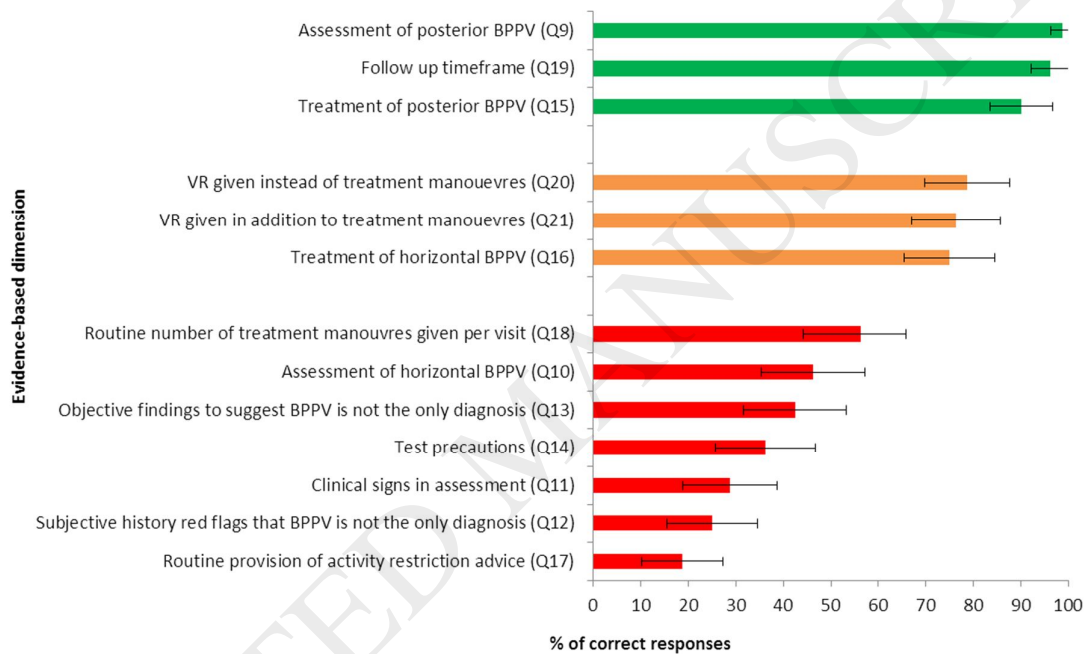


Figure 1: Current physiotherapy management of BPPV compared to evidence-based content analysis per question with 95% CI. Three distinct groups emerge, depicted in different colours for ease of visualisation.

Applying interpretation frameworks used for correlation, proportions and reliability, the groups can be described as having 'Good' (>80%), 'Fair' (70-79%) and 'Poor' (<60%) levels of awareness of the evidence for each dimension (see table 2).

'Good' (>80%)	'Fair' (70-79%)	'Poor' (<60%)
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Assessment of posterior BPPV (Q9)	VR given instead of treatment manoeuvres (Q20)	Routine number of treatment manoeuvres given per visit (Q18)
Follow-up timeframe (Q19)	VR given in addition to treatment manoeuvres (Q21)	Assessment of horizontal BPPV (Q10)
Treatment of posterior BPPV (Q15)	Treatment of horizontal BPPV (Q16)	Objective findings to suggest BPPV is not the only diagnosis (Q13) Test precautions (Q14) Clinical signs in assessment (Q11) Subjective history red flags that BPPV is not the only diagnosis (Q12) Routine provision of activity restriction advice (Q17)

Table 2: Summary of levels of awareness in BPPV management

Ninety nine percent (79/80) of participants demonstrated very 'good' awareness in assessing and 90% (72/80) in treating the most common sub-type posterior BPPV, and 96% (77/80) in knowing the timeframe for follow-up. Seventy nine percent (63/80) of participants had 'fair' awareness in appropriate use of VR instead of, or 76% (61/80) in addition to treatment manoeuvres for BPPV; and 75% (60/80) in treating horizontal BPPV.

They had 'fair' awareness in appropriate use of VR either instead of (63/80, 79%, 95% CI: 70-88%) or in addition to treatment manoeuvres for BPPV (61/80, 76%, 95% CI: 67-86%) and in treating horizontal BPPV (60/80, 75%, 95% CI: 66-85%).

According to interpretation frameworks, participants indicated a 'poor' level of awareness (<60% of respondents) in seven dimensions that related to accurate differential diagnosis and identification of the need for medical review (questions 10, 11, 12 and 13), patient safety (question 14) and effective treatment (questions 17 and 18).

Specialist vestibular services were more likely to demonstrate evidence-based awareness compared to non-specialist services (see table 3).

Question/aspect of BPPV management	Percentage of correct answers (%)	
	Specialist vestibular services (n=27/80)	Non-specialist services (n=53/80)
Assessment of posterior BPPV (Q9)	100	98
Assessment of horizontal BPPV (Q10)	56	43
Clinical signs in assessment (Q11)	37	25
Subjective history red flags that BPPV is not the only diagnosis (Q12)	30	23
Objective findings to suggest BPPV is not the only diagnosis (Q13)	41	43
Test precautions (Q14)	37	36
Treatment of posterior BPPV (Q15)	96	87
Treatment of horizontal BPPV (Q16)	93	66
Routine provision of activity restriction advice (Q17)	26	15
Routine number of treatment manoeuvres given per visit (Q18)	56	57
Follow-up timeframe (Q19)	100	94
VR given instead of treatment manoeuvres (Q20)	89	74
VR given in addition to treatment manoeuvres (Q21)	81	74

Table 3: The percentage of correct answers for each evidence-based question, comparing those that worked in specialist vestibular services to non-specialist services

The final question asked if participants knew of any evidence-based guidelines for BPPV management. Only 28% (22/80) were familiar with existing evidence, stating the two American practice guidelines and Cochrane reviews as the sources.

Preferences for evidence-based training in BPPV

Learning experience questions were non-mandatory and had participant response rates between 72-91% (n=58-73/80). Participants could provide more than one answer to each question and therefore the total number of responses varied.

Participants rated external courses as the most popular method for learning how to manage BPPV (see figure 2).

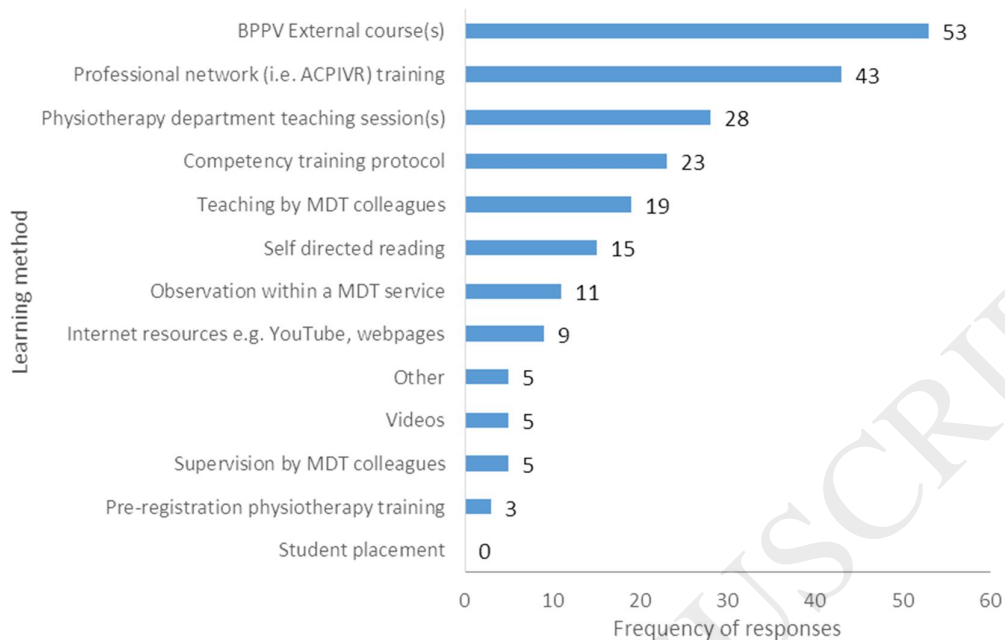


Figure 2: Learning opportunities and methods preferred by physiotherapists to learn how to manage BPPV (total participants $n=73$, total number of responses= 219)

Physiotherapists reported the main three challenges in learning how to manage BPPV as being a lack of peer support ($n=26/77$, 34%), obtaining regular patient exposure ($n=14/77$, 18%) and confidence ($n=10/77$, 13%).

The main way these challenges were overcome was through attendance at external courses ($n=39/129$, 30%). The importance of support from others was highlighted, be it through supervision and mentoring ($n=22/129$, 17%), multidisciplinary team support ($n=30/129$, 23%) or observing specialist clinics ($n=3/129$, 2%).

The main themes that emerged as recommendations for improving how physiotherapists learn to manage BPPV focussed on training and support. Accessing an expert mentor ($n=15/87$, 17%), attending external courses ($n=23/87$, 26%), and the development of competency guidelines ($n=13/87$, 15%) were recommended. Participants also highlighted the need for VR to be routinely included in undergraduate programs ($n=14/87$, 16%) with more advanced training at postgraduate level ($n=4/87$, 5%).

Discussion:***Evidence-based awareness******I. 'Good' levels of awareness***

Participants demonstrated good levels of evidence awareness about assessment and treatment of posterior BPPV, and when to review patients. Posterior BPPV accounts for 85-95% of cases of BPPV [3] and there is more high-level research evidence for this subtype [5, 6, 8, 9] potentially accounting for the better evidence awareness that was observed.

II. 'Fair' levels of awareness

Horizontal BPPV accounts for between 5-15% of cases [23, 24] and can result from attempts to treat posterior subtype [25]. Therefore, it is important that clinicians managing BPPV can treat this sub-type to the same standard and proficiency as posterior BPPV.

Treatment manoeuvres have been reported as more effective than Brandt-Daroff exercises and should now be used as the first treatment approach for BPPV [7], however not all participants were aware of this.

III. 'Poor' levels of awareness

Levels of awareness of evidence relating to differential diagnosis, patient safety and effective treatment were 'poor'.

Activity restrictions or remaining upright at night after a manoeuvre have now been shown to provide no benefit [6, 8, 9]. Yet 81% of participants in this study still advocate two days of restrictions, suggesting a lag for evidence-based principles being translated into

practice in healthcare ^[26-28]. Whilst suggesting two days of activity restrictions does not seem inconvenient, the documented risk to re-enforcing movement avoidances and developing neck stiffness must not be overlooked ^[29].

There are three distinct genres for causing dizziness: neurological, otological and others ^[8]. The participants demonstrated 'poor' breadth of knowledge for differential diagnosis within physical testing more than subjective assessment. Clinicians need to be able to detect red flags reliably to ensure onward appropriate referral is requested and relevant testing is completed. Subjectively, there was a focus on neurological causes and sudden hearing loss that is unrelated to BPPV ^[30] and should be treated as a medical emergency, was not reported. However, the structure of the survey question may have impacted on the content provided and if participants were explicitly asked about hearing loss the levels of awareness may have been different.

To diagnose BPPV requires accurate interpretation of nystagmus features provoked by the testing manoeuvres. Only 29% of participants reported three or more characteristics of the nystagmus as advocated by Dix and Hallpike (1952) ^[31] with only one feature reported by 46%. This suggests neurological causes could be missed.

There are many different conditions and situations when caution is required while undertaking the testing manoeuvres, albeit they may still be possible with some modifications ^[8]. Participants listed very few answers, suggesting low levels of awareness of when to be cautious. Cervical instability was not listed by all the participants, with no precautions listed by 3 participants.

Less than half the participants could name the test for horizontal BPPV. The incidence of horizontal BPPV is lower, with a higher spontaneous resolution rate, as turning over in bed replicates in part the treatment manoeuvre of the BBQ roll ^[32, 33]. Furthermore, the

assessment manoeuvre for horizontal BPPV has not been researched as extensively as the Dix-Hallpike Test. These factors may explain why participants had less awareness for this test.

The number of treatment manoeuvres per session varied. Careful and experienced clinical reasoning could suggest repeating the manoeuvre after a brief rest as a logical recommendation, as the recovery rates go from 80% to 92% after a second treatment for the most common sub-type of BPPV and the manoeuvres are safe to execute^[34]. The indication and benefit of repeated manoeuvres thus remains an area for further investigation, with consideration to the differences in service type, geographical distribution of patients and individualised patient care.

The final question of the survey revealed that less than a third of participants knew of any evidence-based guidelines for BPPV. Whilst the practice guidelines were created by American Academies, they were published in reputable, high impact journals. Few participants were aware of these guidelines or the several Cochrane reviews undertaken relating to BPPV. Courses should be informed by good evidence and therefore it would be expected that these guidelines would be better known. This suggests a gap between dissemination and implementation and suggests more promotion of the research evidence is required.

Preferences for evidence-based training in BPPV

I. Preferred learning opportunities

The over-arching theme of 'training' resonated strongly as the most preferred method or opportunity for learning how to manage BPPV. Passive methods such as external courses, professional networks or in-house methods were the most preferred route of

delivery. Self-directed routes such as reading, accessing online resources and watching videos were less popular. Given the large amount of literature available in BPPV to critically appraise, assimilate and translate into practice plus the time required to do so, this may explain why self-directed routes were less popular.

II. Learning challenges

'Lack of peer support' was the most common challenge reported when learning how to manage BPPV. The complexity of interpreting nystagmus characteristics and confidence in managing these patients independently was also noted. BPPV nystagmus is brief and the direction guides intervention. Videos and online resources are available that show the characteristic nystagmus, but are typically recorded whilst the patient is wearing goggles. This changes the nystagmus to a degree adding a further level of complexity to interpretation and does not relate to real practice.

III. How were the challenges overcome?

Instructional learning methods were preferred for learning how to manage BPPV, through attendance at external courses and formal supervision. The importance of role models was also highlighted in the survey responses, along with access to support from experts and links with specialist services. These formal methods suggest a benefit from specialist services, not merely for patients to access but to ensure evidence-based high-quality training.

IV. Learning recommendations

Participants recommended more access to 'training' and links with 'expert mentors' for physiotherapists learning how to manage BPPV. Interestingly, 'formal academia' was only recommended in a small proportion of responses at both undergraduate and

postgraduate levels. A higher proportion recommended the development of a 'competency training protocol'. Such a document could assimilate the vast array of literature into a standardised training program, suggesting participants prefer learning methods that are embedded in clinical practice and clearly link research to practice.

Strengths and limitations

This is the first research, to the authors' knowledge, to explore UK physiotherapists' learning experiences in managing BPPV in the UK. It provides some evidence of the challenges clinicians face and introduces recommendations to overcome these challenges.

The overall response rate was high. However, the rate reduced over the questions suggesting participants may have been influenced by questionnaire burden.

The method of recruitment required meant non-responders were not identifiable for follow up. The participants were also predominantly based in England and were members of a professional network interested in VR, and therefore the results are not generalisable to all areas of the UK or to all physiotherapy. Furthermore, the use of a survey for data collection may have influenced the depth and specific content of responses provided and thus impacted on the evidence-based judgements made against the content analysis framework, for example relying on free-recall for question 12 about red flags. The study was under-powered secondary to excluding incomplete responses. Therefore, obtaining a larger sample would be advisable to ascertain if statistical significance is achieved.

Conclusions:

This research has demonstrated some aspects of BPPV management are well-aligned to the research evidence, for example managing the common sub-type posterior BPPV.

It also revealed several areas that could benefit from improvement, relating to safe differential diagnosis and effective treatment. Raising awareness of key literature is vital in order to facilitate evidence-based awareness and the further development of the physiotherapy profession in effectively managing BPPV.

No standardised BPPV competency frameworks, readily accessible training or resources are currently available in the UK. The findings of this research suggest that the establishment of such tools could increase evidence-based awareness and management of BPPV, in order to improve patient care. The need for more access to support from experts and peers was also indicated for learning to manage BPPV.

Implementation of knowledge is a complex topic acquiring considerable research attention. This attention is much needed to ensure that translation of evidence into practice is achieved in a more acceptable timeframe. Understanding physiotherapists' experiences and preferred learning methods may enable the optimum approach to be adopted and to facilitate a timely implementation.

Finally, a trend was noted that working in a specialist vestibular service enhanced evidence-based awareness. This suggests establishing more specialist vestibular services could be beneficial. This would reduce the need for lengthy and costly travel by patients to gain access to care that could be promptly provided more locally. Furthermore, increasing the number of specialist providers would make access to experts and peer support easier for colleagues in non-specialist services.

Conflict of interests:

Nil

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