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The Economic Burden of Vertigo and Dizziness

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List of acronyms

BOD, burden of disease

BPPV, benign paroxysmal positional vertigo

BVD, bilateral vestibular deficiency

CCEMG – EPPI-Centre, The Campbell and Cochrane Economics Methods Group and the Evidence for Policy and Practice Information and Coordinating Centre

CHEC, Consensus on Health Economic Criteria

COI, cost of illness

CT, computed tomography

Central Nervous System(CNS)

DALY, disability adjusted life years

ED, Emergency department

ENT, ear-nose-throat

GBD, Global Burden of Diseases, Injuries, and Risk Factors Study

GBP, Great Britain pound

HIT, head impulse test

ICD, International classification of diseases

ICU, intensive care unit

KORA, Cooperative Health Research in the Augsburg Region

MD, Meniere's disease

MeSH, Medical Subject Headings

MRI magnetic resonance imaging

PRISMA, the Preferred Reporting Items for Systematic Reviews and Meta-Analyses

QALY, quality adjusted life years

QoL, quality of life

UK, United Kingdom

USA, United States of America

USD United States dollar

UVD, unilateral vestibular deficiency

WHO, World Health Organisation

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1. Background information

1.1 Introduction to vertigo and dizziness

Vertigo and dizziness are among the most common complaints dealt with by primary care practices (Mueller, Strobl et al. 2013, Grill, Strupp et al. 2014), referral practices (Neuhauser, Radtke et al. 2008, Benecke, Agus et al. 2013) and emergency departments (Kerber, Meurer et al. 2008, Post and Dickerson 2010). The terms vertigo and dizziness are used to describe a variety of sensations, such as unsteadiness and light-headedness and may be the symptoms many pathological or physiological processes (Brandt 2013).

Generally three main forms of vertigo, namely, peripheral vestibular, central vestibular, and non-vestibular forms can be differentiated (Mathieson, Darlington et al. 1999). The most common peripheral diagnosis is benign paroxysmal positioning vertigo (BPPV), found to be prevalent in 9% of the general population (Kerrigan, Costigan et al. 2013) and 17.1% of the patients of a specialized tertiary vertigo clinic (Strupp, Dieterich et al. 2013). Central vestibular vertigo is caused by the dysfunction or injury of the central nervous system (CNS), such as multiple sclerosis, migraines, and acoustic neuromas (Foris and Dulebohn 2018). Other possible causes such as mental disorders and side effects from medications can lead to non-vestibular vertigo. Figure 1 (data from the German Centre for Vertigo and Balance Disorders (Strupp, Dieterich et al. 2013)) shows the frequency of diagnostic classifications amongst 17,718 vertigo patients of a dedicated tertiary care facility .

Finding the potential risk factors could be beneficial for preventing and controlling the disease. Being female significantly increases the risk of having dizziness (Bisdorff, Bosser et al. 2013, Grill, Müller et al. 2013) for both older (Kerrigan, Costigan et al. 2013) and young populations (Humphriss and Hall 2011). Some forms of vertigo such as BPPV (Ferrari, Monzani et al. 2014, Yetiser and Ince 2015) and Meniere's (Havia, Kentala et al. 2005, Harris and Alexander 2010) are more frequent in women. Another widely documented risk factor is age. Many studies (Maarsingh, Dros et al. 2010, Fernández, Breinbauer et al. 2015, Neuhauser 2016) have shown that older adults are particularly likely to suffer from dizziness. Apart from these, consumption of anticonvulsant, anti-hypertensive drugs (Chimirri, Aiello et al. 2013), as well as sedatives and cholesterol-reducing drugs, (Tamber and Bruusgaard 2009) can also

increase the risk of experiencing dizziness. Dizziness is also associated with particular psychiatric disorders, especially depression and anxiety (Wiltink, Tschan et al. 2009, Kozak, Dündar et al. 2018, Wei, Sayyid et al. 2018).

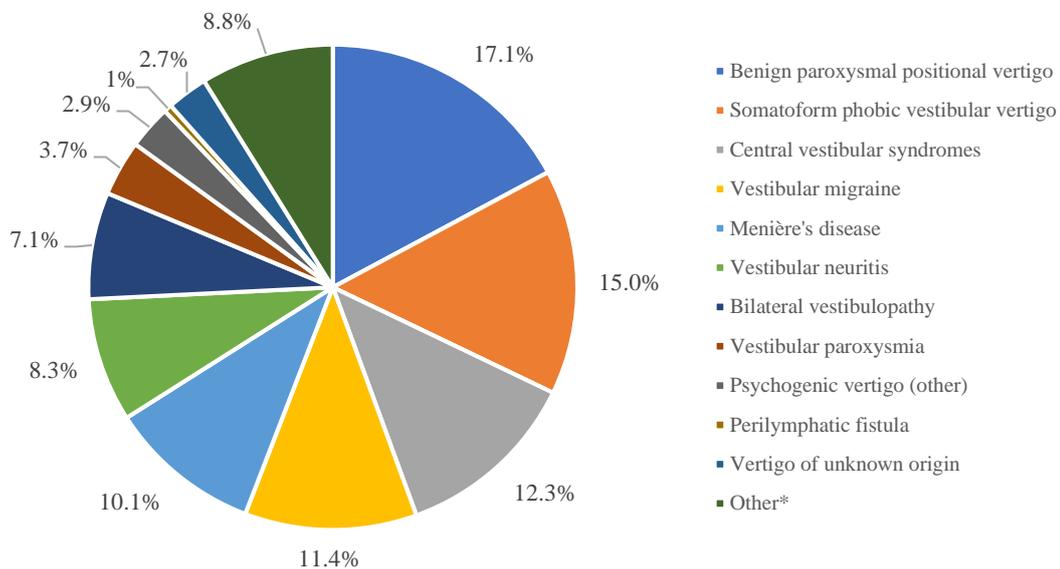


Figure 1: The frequencies of different diagnoses of 17718 dizziness patients, data from the German Center for Vertigo and Balance Disorders.

* Includes, among others, nonvestibular vertigo in neurodegenerative diseases, nonvestibular oculomotor disorders in myasthenia gravis, and peripheral ocular muscle paresis

1.2 The burden of vertigo and dizziness

Burden of disease (BOD) is a concept that was developed in the 1990s (Mathers, Lopez et al. 2006). It is a comprehensive approach to assess the overall impact of disease, injury, and risk factors on society and the state across all regions globally (Murray, Ezzati et al. 2012), by using indicators such as prevalence, mortality, morbidity, disability adjusted life years (DALY), and quality adjusted life years (QALY) to quantify the population health losses. The most important and comprehensive disease burden research program is the Global Burden of Diseases, Injuries, and Risk Factors (GBD) study sponsored by the World Bank and World Health Organisation (WHO).

Much research has been conducted to assess the burden of vertigo and dizziness from different epidemiological perspectives (Neuhauser, Radtke et al. 2008, Lempert

and Neuhauser 2009, Holmes and Padgham 2011, Lai, Wang et al. 2011, Bittar, Oiticica et al. 2013, Wojtczak, Narożny et al. 2017). Due to the high heterogeneity of studied populations, report duration, and disease definition, the one-year prevalence of vertigo and dizziness in the general adult population has been found to range from 3.1% in Taiwan (Lai, Wang et al. 2011), 7% in Germany (Lempert and Neuhauser 2009), 16.4% in Poland (Wojtczak, Narożny et al. 2017) to 42% in Brazil (Bittar, Oiticica et al. 2013). By contrast, studies examining one-year incidence have found similar figures across different studies, ranging from 1.4% (Neuhauser, Von Brevern et al. 2005, Neuhauser, Radtke et al. 2008, Lempert and Neuhauser 2009) to 3.1% (Neuhauser 2016).

Other than prevalence and incidence, quality of life (QoL) is also an important indicator of the burden of disease. There is considerable evidence which demonstrates that dizziness is associated with falling (Alyono 2018), disability (Lasisi and Gureje 2010, Mueller, Strobl et al. 2013), daily life restriction (Tinetti, Williams et al. 2000, Karatas 2008), emotional problems (Karatas 2008, Chang, Hwang et al. 2017), and thus leads to a poor quality of life (Lopez-Escamez, Gamiz et al. 2005, Neuhauser, Radtke et al. 2006, Aratani, Perracini et al. 2011).

Furthermore, dizziness has a notable negative impact on work productivity (Yardley, Owen et al. 1998, Bronstein, Golding et al. 2010). Studies have shown that in 12% of cases orthostatic dizziness was associated with sick leave days (Radtke, Lempert et al. 2011), and 50% of cases reported reduced efficiency (Bronstein, Golding et al. 2010). Thus, dizziness resulted in an economic loss for both individual workers and wider society loss which cannot be ignored.

1.3 The economic burden of vertigo and dizziness

The findings of BOD studies can provide benefits to governments and health care systems for guiding the allocation of resources according to disease and risk priorities (Hoy, March et al. 2010). However, it should be noted that the design of BOD studies focuses only on the fact of losses in health and quality of life, and therefore do not present a comprehensive economic description of the impact on individual income, or the productivity losses for society as a whole (Murray, Ezzati et al. 2012).

To assess the economic burden of disease, cost of illness (COI) studies are widely used to identify and measure the direct and indirect cost of disease (Rice 2000, Larg and Moss 2011). Direct cost, indirect cost and the intangible costs of disease are usually

considered in such calculations in order to make an accurate estimate. Direct costs include all the health care expenditures associated with diagnosis, treatment, and the rehabilitation process. Indirect costs of disease reflect the productivity loss. Intangible costs refer to the pain and sufferings associated with illness, which are hard to measure or transfer into monetary results, and therefore are only conducted by a few COI studies (Tarricone 2006, Xie, Thumboo et al. 2008).

By applying a COI study, we cannot only describe the total costs concisely, but also identify the individual characteristics that could influence health care utilization and expenditure. A widely used model is taken from Andersen's study (Andersen and Newman 1973), which divides factors that might affect health care utilization into three domains: predisposing, enabling, and need factors. Within the research of a particular disease, a comprehensive examination of these influence factors would allow policy makers and health care payers to optimize resource allocation and control the escalation of health care cost. Therefore, COI studies are regarded as useful and important supplementary evidence to BOD studies (Byford, Torgerson et al. 2000).

However, when searching the literature, it can be easily found that even though numerous studies have pointed out that the presence of vertigo and dizziness directly consumed extensive amount of health care utilization due to its diagnostic and treatment process (Wiltink, Tschan et al. 2009, Lai, Wang et al. 2011, Radtke, Lempert et al. 2011, Li, Hoffman et al. 2016), as well as the social economic burden caused by related disability, retirement and sick leave (Neuhauser, Radtke et al. 2008, Mueller, Schuster et al. 2012, Mueller, Strobl et al. 2013, Lüscher, Theilgaard et al. 2014), there is only limited evidence on the economic burden of vertigo.

Up to now, the direct and indirect cost of vertigo and dizziness have not been systematically assessed and thus the economic burden related to vertigo and dizziness is still unclear. Also, determinants of health expenditure due to vertigo are poorly understood.

2. Research objectives

The overall aim of this doctoral thesis is to evaluate the economic burden of vertigo and dizziness among adults. To address this problem, the following research questions will be studied:

- 1) What kind of existing economic evidence can be found from previous studies?

What is already known about the cost of vertigo and dizziness?

- 2) For the general population, what is the total cost of vertigo? Are there health care costs or utilization differences between people with and without vertigo? What individual factors could affect the health care cost of vertigo?

Therefore, this doctoral thesis was divided into two parts.

- a) To answer question 1, a systematic review was conducted, and the existing evidence was summarized and described.
- b) To answer question 2, a cost of illness analysis was performed using cross sectional data from the German Cooperative Health Research in the Augsburg Region (KORA) cohort to quantify the utilization and cost of health care associated with vertigo. Direct and indirect health care utilization data was collected, total cost was calculated and compared between vertigo patients and a control group.

3. Method

To address the two research questions described in the previous chapter, two studies were conducted and published. They build the core of this doctoral thesis. The methods selected in these two publications are summaries and listed as below.

3.1 Publication 1: Economic burden of vertigo. A systematic review

We conducted an extensive systematic literature search on 01 October 2018. The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA statement)(Moher, Liberati et al. 2009) were followed for the organization of the review. Three different electronic databases were searched, namely: Medline (<https://www.ncbi.nlm.nih.gov/pubmed>), EMBASE (<https://www.sciencedirect.com/science/search>) and Cochrane (<http://onlinelibrary.wiley.com/cochranelibrary/search/>). All original studies published in English between 2008-2018 about the economic evaluation of vertigo in developed countries were considered as eligible. Based on the diagnosis classifications of disease (Brandt, Dieterich et al. 2005, Strupp and Brandt 2008), a search strategy was developed using terms including “BPPV”, “Meniere”, “vestib*”, “labyrinthitis”, “dizz*”, “vertigo” and “dizziness”. Terms like “cost”, “financ*”, “econom*”, “burden”, “utilization or utilisation” and “pay*” were used to target

disease cost information.

For data extraction, a Microsoft Excel form was built to obtain variables, referring to general study characteristics and outcome items. Two independent reviewers checked the papers after the literature collection; in lack of consensus, a third made the decision.

The doctoral candidate was the second author of this article. She was primarily responsible for paper collection, data extraction and study selection with the guidance of the first author, Dr. Eva Kovacs. Together with the first author, the doctoral candidate finished the systematic analysis and preparation of the manuscript. The article was submitted to Health Economics Review on 06 March 2019 and accepted for publication after revision on 25 October 2019. The impact factor of the journal was 1.374 in the year of 2019.

3.2 Publication 2: Vertigo and dizziness cause considerable more health care resource use and costs - results from the KORA FF4 study

In this cross-sectional study, data from the German Cooperative Health Research in the Augsburg Region (KORA) FF4 study was used. The KORA FF4 study is the 14-year follow-up of the KORA S4 study, and it is a population-based health survey conducted in the city of Augsburg and two surrounding counties with 2279 participants. The study was approved by the ethics committee of the Bavarian Chamber of Physicians, Munich (FF4: EC No. 06068).

Eight health care cost components were measured to reflect the direct economic burden of vertigo, namely doctor consultations, outpatient hospital visits, inpatient hospital days, days in the intensive care unit (ICU), days in rehabilitation, alternative practitioner consultations, physiotherapy sessions, and drug utilization. Standardized unit prices were assigned to each cost component (see Appendix Table 1 of publication 2) (Bock, Brettschneider et al. 2015). To assess the indirect economic burden of disease by asking gainfully employed participants the question: “How many days have you been unable to work for the last 12 months because of illness?” An average calendar day labour cost was used to calculate the monetary burden due to sick leave (Krauth, Buser et al. 2002, Bundesamt 2013). A social perspective was taken to report all the costs. No discount was considered since the cost data was collected within a single year.

Two questions were used to assess the presence of disease exposure, namely “Have

you ever had vertigo or dizziness?” and “During the last 12 months, have you had vertigo or dizziness?”

Considering the Andersen health care utilization model (Andersen and Newman 1973) and the risk factors previously described which could affect the disease, sixteen covariates were included. They were six predisposing factors (namely age, gender, family status, education level, present job status, physical activity), two enabling factors (namely personal monthly income and health insurance type) and eight comorbidities, respectively.

Since the cost data were skewed, with considerable zero values and outliers, a hurdle model (also known as two-part model) was applied to examine the relationship between exposure and cost outcome. IBM SPSS Statistics for Windows Version 20.0 (Armonk, NY: IBM Corp.) was used for the descriptive tables, and R version 3.3.2 was used to calculate the hurdle model (RCORE 2016).

The doctoral candidate was the first author of this publication and primarily responsible for the conception and the analysis, as well as for the preparation of the manuscript with the guidance of Dr. Ralf Strobl and Prof. Eva Grill. This article was submitted on 01 March 2019 and accepted on 15 May 2019 by The Journal of Neurology after a single revision. The impact factor of the journal at this time was 4.204 in the year of 2019.

4. Results

In the following section each research question is answered based on the results of the two studies:

Within the three databases, 154 original papers were identified and 16 were included in our final systematic analysis. All 16 studies from seven countries presented partial economic evaluation referring to different diagnostic classification of vertigo, among which nine studies presented monetised cost results and seven studies reported health care utilisation. The median quality score of selected studies was six out of 19 total from the Consensus on Health Economic Criteria (CHEC). Repeated and poorly targeted consultations at all levels of health care practitioners, excessive use of diagnostic imaging, and/or of emergency care accounted for the main reasons of high direct cost of vertigo. Disease related sick leave and low workload as well as comorbidity were reported to produce considerable social economic burden. Different

disease severity levels (Benecke, Agus et al. 2013), diagnosis types and setting (Neuhauser, Radtke et al. 2008, Benecke, Agus et al. 2013, Saber Tehrani, Coughlan et al. 2013, Grill, Strupp et al. 2014, Sun, Ward et al. 2014) may influence the cost and health care utilization.

From the analysis of KORA FF4 data, 570 (25.0%) participants reported to have had moderate or severe dizziness or vertigo at least one time within the last 12 months. Evidences could be found that people with vertigo had a bigger economic burden than people without vertigo. Their total health care cost in the last 12 months per person was 2641.9 Euro to 1902.9 Euro, SD=4786.2 and 5944.1, respectively. Among the cost difference of 739 Euro between two groups, the direct cost of consultation fee (especially at primary care physicians) accounted for the largest percentage with 177.2 Euro (461.8 to 284.6, $p<0.01$). Indirect cost due to sick leave among all the gainfully employed participants with vertigo was 920.9 Euro (SD=2111.2) per person, and the average duration of sick leave was 7.5 days (SD = 17.2). After adjusting for covariates, presence of vertigo still increased both the probability of having any health care costs (OR=1.7, 95%CI= [1.2;2.4]) and the amount of health care costs ($\exp(\beta)=1.2$, 95%CI= [1.1;1.4]). The analysis of cost determinants among two groups showed that private insurance and a medium level of education decreased the probability of having any health care costs. Determents analysis among participants with vertigo showed that two individual factors could affect the cost. The probability of having any cost was significantly decreased by having private insurance and increased by higher income.

5. Discussion and conclusions

According to the results of both the cross sectional study and the systematic review, vertigo and dizziness were common complaints with a high prevalence and incidence (Neuhauser, Radtke et al. 2008) in both primary care and hospital care system, which was also in line with other relevant literatures (Davis and Moorjani 2003, Neuhauser 2007, Wiltink, Tschan et al. 2009)

To the best of our knowledge, this is the first systematic review of the existing evidence of the economic burden of vertigo. Referring to our findings in the review, the current evidences for economic burden of vertigo and dizziness were limited. They did not cover the comprehensive assessment of the economic burden and the quality of studies was mostly mediocre. However, the exiting evidences still proved that the

presence of vertigo/dizziness consumed considerable health care resources and could bring quite a large amount of either direct (Neuhauser, Radtke et al. 2008, Wiltink, Tschan et al. 2009, Ahsan, Syamal et al. 2013, Benecke, Agus et al. 2013, Saber Tehrani, Coughlan et al. 2013, Grill, Strupp et al. 2014, Sun, Ward et al. 2014, Gandolfi, Reilly et al. 2015, McDowell and Moore 2016, Ammar, Govindu et al. 2017) or indirect economic burden (Neuhauser, Radtke et al. 2008, Wiltink, Tschan et al. 2009, Benecke, Agus et al. 2013, Sun, Ward et al. 2014) to patient, health care system and the whole society. Furthermore, the lack of conclusive evidence revealed apparent targets for future research. Future economic evaluation shall address the main cost drivers detected above, where evidence-based vertigo management may curb the increasing direct costs by improving the quality of care. These results are further confirmed by the COI study.

With the findings from the KORA FF4 study, it could be shown that in the general population persons who reported at least one relevant episode of vertigo or dizziness during the last 12 months had significantly higher health care costs across almost all cost components. Another notable point is that the cross-sectional study found excess costs caused by medical consultation (especially in the primary care system) and emergency care services, which is just in line with current knowledge (Kerber, Meurer et al. 2008, Ahsan, Syamal et al. 2013) and our systematic review. Benecke et al. found in their study (Benecke, Agus et al. 2013) that, from 13 countries, 63.3% of persons with vertigo had lost working days during the three months preceding the baseline visit which confirms our indirect cost results.

Based on the above findings and current literatures, there are many methods worth trying to control the rising cost of vertigo. Since inappropriate or unnecessary diagnostic tests and examinations lead to waste of medical resources (Neuhauser, Radtke et al. 2008, Grill, Strupp et al. 2014), it is highly recommended that health care givers pay attention to the effectiveness of imaging and avoid overuse. As the cost and health care utilization may varied from different diagnose types (Neuhauser, Radtke et al. 2008, Benecke, Agus et al. 2013, Saber Tehrani, Coughlan et al. 2013, Grill, Strupp et al. 2014, Sun, Ward et al. 2014), so health care givers should notice that these differences and diagnostic pathways should be assessed; more strict and practical guidelines should be developed for physicians (Ahsan, Syamal et al. 2013, Grill, Strupp et al. 2014, Ammar, Govindu et al. 2017). Since it was mentioned that the frequency of specialist consultation was high and only half of the vertigo patients were seen by primary care doctors (Neuhauser, Radtke et al. 2008), training and education of primary

care givers might also be a suggestion to reduce unnecessary treatment and medication(Grill, Strupp et al. 2014, Ammar, Govindu et al. 2017).

To sum up, vertigo and dizziness are common in both the primary care and hospital care system and consume considerable health care resources and costs. Directed cost, such as diagnosis cost, medical consultation cost and emergency visit cost, largely contribute to the economic burden of vertigo. Indirect cost should also receive more attention since dizziness and vertigo could lead to a severe decrease in productivity of the working-age group. Evidence-based vertigo management may help to curb the increasing costs by improving the quality of care, thus reducing the long-term impact of vertigo. Further researches should be carried out to control the rising cost of vertigo.

6. Summary of both articles

Vertigo is a common reason for medical consultations, and its diagnosis and treatment consume considerable medical resources. However, there is limited information on the specific cost of vertigo currently available. Therefore, the objective of both studies is to analyse the economic cost of vertigo.

In the first publication, we aimed to target and summarise the existing evidence from available quantitative researches through a systematic review. All original studies about different kinds of vestibular diseases including unspecified vertigo published in the past ten years about economic evaluation of vertigo in developed countries were considered eligible. By searching three databases (PubMed, Embase, and Cochrane), 154 studies were identified and 16 were finally qualified for inclusion after screening the abstracts and reading the full texts. Nine studies reported monetised results while seven offered health care utilization information. These studies showed that considerable costs were spent on diagnostic imaging, emergency care, and repeated medical consultations. The increased indirect costs (mainly from sick leave) demonstrated that vertigo and dizziness had incurred non-negligible societal burden.

In the second publication, a cross-sectional data from the KORA FF4 study in 2013 was used to analyse the economic burden of vertigo and dizziness and examine which individual characteristics would affect the utilization of health care. The extent of vertigo and dizziness was assessed by a standardized question “During the last 12 months, have you had vertigo or dizziness?”. Eight different cost components of health care utilization were recorded to show the outcome of direct costs, and sick leave information was collected to reflect the indirect cost. Considering the dispersion tendency of the cost data, a hurdle model was applied as a statistic approach. The results showed that, among 2,277 participants (mean age 60.8, 48.4% male), 570 (25%) people were reported to have had dizziness or vertigo in the last year, and it costed 818 Euros more on average than people without vertigo (2720.9 Euro to 1902.9 Euro, respectively). Moreover, vertigo was an independent predictor of health care resource utilization and related costs after adjusting for covariates. These findings confirmed that vertigo requires considerable health care resources and could create significantly more health care related costs in both primary and pertinent secondary health care. Establishing care pathways and streamlined management with primary care physicians as gatekeepers and decision makers would be a promising way to decrease the costs of disease.

7. Zusammenfassung beider Publikationen

Schwindel und Benommenheit gehören zu den häufigsten Beschwerden mit denen sich Patienten beim Arzt vorstellen und dessen Diagnose und Behandlung verbraucht erhebliche medizinische Ressourcen. Derzeit sind nur begrenzt Informationen zu den spezifischen Kosten -von Schwindel verfügbar. Ziel dieser Arbeit ist es daher, die direkten und indirekten Kosten von Schwindel zu analysieren.

Das Ziel der ersten Veröffentlichung war, den derzeitigen Wissensstand aus verfügbaren, quantitativen Untersuchungen durch eine systematische Literaturrecherche zusammenzufassen. Eingeschlossen wurden alle in den letzten zehn Jahren veröffentlichten Originalstudien zu den ökonomischen und sozialen Auswirkungen von Schwindelerkrankungen. In drei Datenbanken (PubMed, Embase und Cochrane) wurden 154 Studien identifiziert. Nachdem die Zusammenfassungen und Volltexte gelesen wurden 16 schließlich in der Studie eingeschlossen. Neun Studien enthielten monetär-relevante Ergebnisse, und sieben Informationen zur Inanspruchnahme des Gesundheitswesens. Diese Studien zeigten, dass erhebliche Kosten für diagnostische Bildgebung, Notfallversorgung und wiederholte ärztliche Konsultationen aufgewendet wurden. Die hohen indirekten Kosten (hauptsächlich durch Krankheitstage) zeigten, dass Schwindel und Benommenheit eine nicht zu vernachlässigende gesellschaftliche Belastung darstellten.

In der zweiten Publikation wurden anhand von Querschnittsdaten aus der deutschen KORA-FF4-Studie 2013 die direkten und indirekten Kosten durch Schwindel analysiert und untersucht. –Das Vorliegen von Schwindel wurde anhand einer standardisierten Frage beurteilt: „Hatten Sie in den letzten 12 Monaten Schwindelgefühle oder -Anfälle? “. Die Inanspruchnahme des Gesundheitswesens wurde in acht Kostenkomponente aufgeteilt, Unter Berücksichtigung der Verteilung von Kostendaten wurde ein Hurdle Modell als statistischer Ansatz angewendet. Die Ergebnisse zeigten, dass unter 2.277 Teilnehmern (mittleres Alter 60.8, 48.4% Männer) 570 (25%) im letzten Jahr Schwindel hatten und durchschnittlich 818 Euro mehr Kosten verursachten als Menschen ohne (2720.9 Euro zu 1902.9 Euro). Darüber hinaus war Schwindel ein unabhängiger Prädiktor für die Inanspruchnahme der Gesundheitsversorgung und der damit verbundenen Kosten. Diese Ergebnisse bestätigten, dass Schwindel und Benommenheit erhebliche Ressourcen für die Gesundheitsversorgung verursachen; sowohl in der primären als auch in der sekundären

Gesundheitsversorgung. Um diese Kosten zu kontrollieren, könnten weitere Untersuchungen durchgeführt werden, um das optimierte Management von Schwindelpatienten im ambulanten Bereich zu untersuchen.

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