The Role of the Internet for Healthcare Information in Otorhinolaryngology

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ABSTRACT

The wide distribution and availability of the internet during the last decades revolutionized the human information and communication behavior. Via the internet, information can be easily retrieved and participative applications allow new types of interaction. The healthcare system is comprehensively affected because information and communication represent an integral part of it. The present contribution is intended to describe this development and its impact on otorhinolaryngology.

The use of the internet for the research of healthcare information is continuously increasing since several years and has meanwhile achieved significant importance. In the clinical context, however, other information sources still have a higher relevance. Laypeople mostly use the search engine of Google when performing health-related research. Even if the reliability of the presented information is difficult to assess, alternative offers that are specialized on valid healthcare information could not prevail. Anecdotic or incorrect information are regularly observed.

Numerous trials investigated the quality of healthcare information on web pages. The methodical spectrum reaches from formula-depending readability testing via structured assessment tools up to certificates. The results show that healthcare information on internet sites is often difficult to understand for the general population. Nearly all social media contain healthcare information and their relevance is increasing. Nonetheless, there is only few scientific knowledge on the characteristics and the effect of healthcare information in social media.

The availability of online healthcare information requires anew understanding of health literacy. The concept of eHealth literacy contains among others literacy, media competence, IT knowledge, and basic scientific knowledge. The implementation of those skills depends on individual and social factors such as education, socio-economic status, and age. Investigations revealed a low health literacy in a high percentage of the patients.

The distribution of the internet also modifies the relationship between physician and patient. Well-informed patients request being involved in medical decisions. Physicians have a particular responsibility regarding the counseling of medical laypeople by weighting and verifying information. By actively participating, physicians should contribute to digitization in medicine for the benefit of their patients. Medical associations are particularly invited to shape this process.

Inhalt

1. Methods

In the context of this review article, a literature research was performed via PubMed in the MEDLINE database. Hereby, the following key words were entered: “Internet”[Mesh] AND “Patients” [Mesh] OR “Consumer Health Information” [Mesh] AND “Internet” [Mesh] OR “Physician-Patient Relations” [Mesh] AND “Internet” [Mesh] OR digital patient empowerment OR dr. google[ti] OR dr google[ti]. This search query was last updated on July 2, 2018. Only articles published in English or German were included, which resulted in 3 589 hits. All search results were classified into original papers and review articles containing online healthcare information and the impact on health literacy as well as on the physician-patient relationship either in general or specifically in otorhinolaryngology. A multistep selection process according to PRISMA (Preferred Reporting Items for Systematic Review and Meta-Analyses) [1, 2] led to 108 publications that were included in this qualitative review article. Additional publications were identified manually by reverse or context search. A scheme of the selection process of the literature is found in ▶ **Fig. 1**.

2. Introduction

The internet is a connection of computers and computer networks serving for information exchange [3]. Since the internet has changed communication in nearly all aspects of human life within a quarter of a century [4], its development is considered as an important cultural-historical milestone of mankind [5]. One basic functional principle is the transmission of digital data as package (packet switching). This allows a decentral linkage of various networks [3]. The data exchange is controlled by network protocols of which the most important ways are called Transmission Control Protocol/Internet Protocol (TCP/IP). Those were formulated by Cerf and Kahn in 1974 [6].

The World Wide Web (WWW) is one part of the internet that is optimized to retrieve structured digital documents. These are called websites and are displayed by means of suitable software (browsers). Today, the World Wide Web encompasses a very broad spectrum of knowledge that is generally available to everyone. Websites are created in a machine-readable markup language, the most common is Hypertext Markup Language (HTML). Transmission of those documents is performed via protocols from the Hypertext Transfer Protocol family (HTTP) [7]. Thus, the internet works today as a broadcasting facility, as distributing mechanism of information, and as medium for collaboration and interaction over distances [3, 4].

Search engines are used to exploit the contents available on the internet; and they are probably one of the most important internet applications [8]. In an automated way, they explore large parts of the internet by indexing [9]. This index is continuously updated and is thereby available for search queries. As a response to a search query, a search engine outputs results, the ranking of which fol-

▶ **Fig. 1** Scheme of the literature selection process.

lows a specific system. The most widespread search engine is Google. The basis of Google's success is an innovative way of ranking search results based on referring links according to their significance [10].

Since about the turn of the millennium, the initial concept of the internet was again advanced significantly. It is now a medium that is characterized by easy usability, independence of platforms and terminal devices (interoperability) as well as user-generated contents. Examples in this context are new terminal devices such as smartphones as well as social media. These principles are summarized as Web 2.0, social web, or participatory web [11–13]. Relevant examples for social media are Twitter, Wikipedia, and YouTube.

Twitter exists since 2006 and allows the exchange of text messages with a maximum length of 280 signs as well as pictures and video clips. Beside the function as social medium, Twitter also has the properties of a mass media [14]. Twitter has more than 300 000 000 active users who write several hundred million messages (Tweets) per day. Occasionally, tweets receive broad coverage on the internet and classic media. Wikipedia is a platform that allows the collaborative creation of an encyclopedia by the users [15, 16]. Since its beginning in 2001, more than 75 000 000 users have created more than 48 000 000 articles in more than 300 languages. It is considered as most extensive encyclopedia in the world. Even if the majority of creators are laypeople and the platform is organized in a very flat hierarchy, Wikipedia achieves an astonishing accuracy, which could be shown in a comparison with the highly traditional English Encyclopaedia Britannica [17]. Since 2005, YouTube is an active platform for sharing videos. Users can upload video clips, watch them, comment on them, and rate them. The number of views reflects the popularity of a contribution. It is not clarified in detail on which mechanisms and criteria the popularity of a contribution depends and how the phenomenon of viral distribution occurs [18].

Complex interactions between creators, users, and contents are hallmarks of social media. Characteristic interactions in social networks such as "follow" and "like" lead to a new kind of feedback between creators and consumers of content. In this way, a collective opinion or rating develops that might be more exact or balanced than an individual opinion. This phenomenon is called "wisdom of the crowd" and has been investigated in social media for example for product ratings [19]. The motivation of people who contribute knowledge into online communities is not yet fully clarified. Probably it is a mixture of extrinsic motivation by recognition and intrinsic motivation by enhancing self-confidence [20].

In modern societies, media play a complex and relevant role in the development of the individual perception of health and disease and the associated values [21, 22]. Thus it is clear why a revolution of the media landscape, as it has occurred by digital media, also leads to changes regarding health-related behavior. Modern medicine cannot be imagined without information technology any more. Accordingly, modifications in this context have a fundamental impact on the healthcare system [23]. Specific for the medium internet is an integration of communication pathways and contents [24]. The health-related use of the internet is continuously increasing since 2003, based on the Health Information National Trends Survey [25]. Already today, digital techniques have relevantly modified the relationship between physician and patient. Beside healthcare information, digital communication and patient data play a crucial role [26]. Currently, this leads to a technical revolution of organization and delivery of healthcare services [24]. The healthcare system transformed in this way is called eHealth and the information technological aspect is defined as medical informatics. The part dealing with the interaction of medical laypeople with electronic healthcare services is defined as consumer health informatics [27, 28]. Benefit, consequences, and disadvantages of digitization in medicine are controversially discussed [29].

Seven aspects of internet use are supposed to have relevant health-related effects on patients: retrieving information, experiencing support, maintaining relationships, influencing behavior, and utilization of healthcare services are considerably well investigated, while formulating experiences and illustrating diseases have not been evaluated in detail up to now [22]. Generally, the digital media allow patients more self-determination in the context of preserving and restoring the own health. This development occurs in an era when the patients' overall self-responsibility is increasingly emphasized [21].

Search engines increase the availability of health-related information to an unprecedented extent [30]. Still, the interaction between the expectation of the user, the phrasing of a search query, and the result is not fully understood [31]. Probably, the identification of relevant and valid results is the greatest challenge [30].

Since the internet plays such a central role in the healthcare system, the present review article will describe the role of health-related content on the internet for otorhinolaryngology. Beside a discussion of the clearly increased accessibility of information due to the internet, content-related aspects of online healthcare information will be described. The impact of the internet on health literacy and the relationship between physician and patient cannot be predicted yet. However, the major factors will be presented here.

3. The Internet as Gateway to Healthcare Information

3.1 Development of internet use for retrieving healthcare information

Patients increasingly use the internet as a source for healthcare information and it has achieved enormous relevance. For several years now, this development has been continuously increasing and it is assumed that to date the vast majority of patients use the internet. Depending on the group of patients interviewed and the time of assessment, patients report in 42–96.4 % of the cases that they have internet access [32–34]. 52.3–90.0 % of the patients also use the internet for systematically searching for healthcare information [32–36].

However, the significance of the internet compared to other information sources is not fully clarified. In the USA, currently 33–70 % of the people mention the internet as primary information source for health issues [25, 37]. Also other assessments consistently described the internet as preferred medium compared to alternatives such as friends and relatives, print media, radio, and TV [25, 37, 38]. Among these trials, the most relevant is the Health Information National Trends Survey (HINTS) that is continuously performed in the USA since 2004 [39]. Also in Europe, the use of the internet is increas-

ing as well as the significance that is attributed to the internet relative to other media [36]. These surveys, however, are population-based and possibly do not reflect a patient's specific situation who is confronted with a specific medical question and is directly affected. In order to clarify this aspect, investigations on internet use are required in patients who are recruited in a clinical institution.

One first trial of this kind dates back to 2000; it was conducted in a gastroenterological outpatient clinic in the USA. A total of 924 patients were interviewed; 50 % (462/924) had internet access and 25.4 % (235/924) used it for health-related research [40]. Also, the access and the significance of the internet for ENT patients has already been investigated several times. An increasing use of the internet could be observed, which in 2002 was reported with 45.5 % [41], while the most recently published report from 2018 mentioned 91.3 % [42]. One study directly compared two surveys from 2000 and 2006 and revealed a considerable increase in the use of the internet also for health-related issues [43]. In contrast to population-based surveys, up to now no study in patients from clinical institutions found the internet as most important source for healthcare information. When assessing a priority, the internet was subordinate [41, 44–46] or even the least relevant source of information [47, 48]. More important than the internet were the treating ENT specialist [44, 45, 47, 48], the pediatrician [45, 47, 48], the general practitioner [41, 44, 46, 48], other treating physicians [46], non-medic professionals from the healthcare sector (dentists, pharmacists, nurses etc.) [45, 47, 48], information brochures [41, 45 , 47, 48], friends or relatives [41, 44, 45, 47, 48], books [41, 47, 48] as well as second opinions [44]. So it seems that in cases of concrete individual affection the traditional information sources come to the fore.

Previous investigations on healthcare-related internet use in the field of otorhinolaryngology have considerable methodical weaknesses. The studies often use own, non-validated questionnaires [41–44, 46, 49]. Only one investigation [50] applied a previously tested questionnaire [40]; other investigations [45, 47, 48] adapted a formerly used one [41, 47, 50, 51]. Until now, the situation in Germany was only reported in one study [44]. An overview of investigations on the internet use of ENT patients in clinical cohorts is displayed in ▶ **Table 1**.

3.2 Technical aspects of health-related research by laypeople

Several particularities characterize a health-related internet research by laypeople. On one hand, the search strategy is often suboptimal because people do not make use of the numerous features of search engines in order to refine or limit search queries [52, 53].

▶ **Table 1** Internet use of ENT patients.

Year	Patients investigated	Institution	Tool	Country	Number of patients	Patients with internet access	Health-related online research	Reference
2002	Outpatients	Outpatient ENT department	Own questionnaire	Great Britain	330	45.5 % (150/330)	13 % [a]	Rokade et al. [41]
2004	Outpatients	Outpatient academic ENT department	Validated questionnaire [40]	Great Britain	535	64.3 % (344/535)	11.6 % (62/535)	Tassone et al. [50]
2005	Parents of patients	Outpatient OR of an academic ENT department	Adapted questionnaire [41, 50–51]	USA	204	83.3 % (170/204)	40.7 % (83/204)	Boston et al. [47]
2008	Oupatients	Outpatient ENT department	Own questionnaire	Great Britain	209 [b]	70.3 % (147/209) [b]	54.5 % (114/209) [b]	Trotter & Morgan [43]
2009	Inpatients	Academic ENT department	Own questionnaire	Germany	506	58.1 % (294/506)	36.2 % (183/506)	Gurr et al. [44]
2009	Parents of patients	OR of an ENT department	Adapted questionnaire [41, 51]	Brasil	132	94.2 % (130/138)	84.8 % (117/138)	Nogueira et al. [45]
2012	Adult patients	Outpatient ENT department	Own questionnaire	Great Britain	201	85.1 % (171/201)	31.8 % (64/201)	Shaw et al. [46]
2013	Patients after hearing aid provision	Outpatient academic ENT department	Own questionnaire	Sweden	158	58.9 %	Not investigated	Thoren et al. [49]
2013	Parents of patients	Outpatient academic ENT departments	Adapted questionnaire [47, 50]	Ireland	501	69.3 % (347/501)	30.0 % (149/497)	Glynn et al. [48]
2018	First outpatient presentation	Non-university and university ENT outpatient departments	Own questionnaire	USA	1,564	91.3 % [c]	38.8 % [d]	Pagedar et al. [42]

a no single values; b only data from a survey of 2006; the publication also describes a survey from 2000 where 43/204 patients had internet access (21.1 %) and the health-related online research amounted to 15.7 % (32/204); c calculated, no single values; d no single values.

For example, searching by entering key words is more frequently performed than searching for categories [54]. On the other hand, laypeople mostly use only general search engines such as Google and nearly never medical platforms [53]. In most cases, only the first hits from the top of the list of search results are further pursued [53, 54]; in less than 3 % of the cases, hits after the first 10 positions are selected [52]. Often, users cannot remember after a research from which internet page they have retrieved certain information [52].

When looking for healthcare information, study participants spend a relatively high part of the time to evaluate the reliability of search results [54]. In general, websites of public institutions, a professional layout, easily understandable language, and the reference to scientific sources are considered as particularly reliable [52]. Possibly, however, there are national differences [53]. Efforts to prioritize reliable internet pages are seen in the development of a search engine specialized to healthcare-related issues called "Khresmoi for everybody" (K4E) [55]. Beside a probably extremely low name recognition, study participants preferred Google in the direct comparison which leads to the assumption that enhanced healthcare education is necessary [56].

3.3 Disadvantages of health-related information on the internet

Disadvantages of the enormously increased availability of online healthcare information are regularly discussed. For example, cyberchrondria (also called Morbus Google) was defined as excessive fear about the own health status based on online healthcare information [57–59]. It may also cause problems when patients do not make use of preventive examinations because of information they have found on the internet [60]. Anecdotic information from the internet bear the further risk that impressively described cases are associated with wrong or misdirecting information [22]. A systematic evaluation, however, led to few published cases where damage was obviously caused by online health-related information [61]. Therefore, the most relevant consequences are rather seen on the level of the physician-patient relationship.

In the discipline of otorhinolaryngology, the benefit of an online algorithm on diagnostics was investigated. In a group of 61 female and male patients, the correct diagnosis was given in 70.5 % (43/61). This was, however, only one of an average of 13 provided differential diagnoses. Only in 16.4 % (10/61) of the cases, the first diagnosis suggested by the application was correct [62]. This investigation elucidates frequently observed problems with internet applications that come with a broad knowledge base while their benefit is generally limited without human medical expertise and clinical experience.

4. Quality of Online Healthcare Information

The fact that patients increasingly use the internet for health-related queries leads to the questions about the quality of online healthcare information. In particular the quality and accuracy are often questioned [63, 64]. In the context of health-related experiences they cannot relate to their own previous experiences, patients seem to be highly interested primarily in experiences and decisions of others [22]. However, fact-based online health information has been investigated clearly more in detail because its quality is being discussed for quite a long time [63].

The assessment of the quality of online health information depends on the investigated user group. This is because patients and laypeople focus more on readability while experts rather expect scientific evidence [64]. Nearly always, health-related information is difficult to understand by laypeople [65]. In addition, there is no consensus regarding evaluation criteria; and many trials have methodical flaws with overall poor quality [66]. Patient information that is difficult to read leads to the fact that a major share of the patients can only retrieve little or no benefit [67]. Therefore, probably readability and completeness are opposites [68].

4.1 Methods

Efforts are undertaken to systematically assess the quality of online health information and thus to finally improve it. Beside content-related aspects that naturally have to be evaluated specifically, general readability is considered as major aspect. Due to specific reasons, health-related information is more difficult to understand than everyday texts. Even for linguistically competent laypeople, this may be a real obstacle [69, 70]. With regard to readability, the US Department of Health and Human Services recommends that the difficulty level corresponds maximally to the 7th grade of the US education system [71]. The readability of texts can be mathematically described by assessment of the average number of syllables per word, the number of words per sentence as well as the percentage of commonly understood words [72, 73]. Possible results are generic indices or a numeric value that corresponds to a grade of the American education system [74].

A widely distributed formula is the Flesch Reading Ease Score. It is a dimension-less ratio calculated from the number of sentences, words, and syllables in a text and achieves values between 0 and 100. Higher values represent easier readability [75]. The benchmark is adapted to the characteristics of the English language; however, also a modified formula for German texts exists [76]. The Flesch-Kincaid Grade Level is a numeric value corresponding to the competence standard of a certain grade of the US American education system [77]. The baseline values are the average sentence length and the average number of syllables per word. Other regularly used readability formulas are the Gunning Frequency of Gobbledygook (Gunning Fog index) [78] and the Simple Measure of Gobbledygook (SMOG) [79].

Readability research for healthcare information is limited nearly exclusively to the English language so far; only few readability indexes that are adapted to the German language are found [76, 80]. Besides, there is also a primarily German tool such as the Lesbarkeitsindex LIX (readability index) for German evaluations [81].

The Journal of the American Medical Association formulated four criteria based on which the quality of online medical information should be assessed. A clear and complete transparency of authorship and financing, the statement on sources and references as well as the time of creation and revisions is required [63]. Besides, there are more detailed tools in the form of questionnaires allowing to evaluate the quality of healthcare information systematically. In this context, the validated DISCERN questionnaire is relevant which is also available in German [82–86]. It consists of 8

questions about the reliability of a publication (objective, sources, balance), 7 questions on treatment alternatives (effect, benefit, risks), and one question on the overall rating [82].

Finally, efforts are undertaken to make the quality of online healthcare information visible for the readers by means of a certification procedure. Most widely known is the Health on the Net (HON) foundation that has developed a code of practice for internet pages [87]. This code contains general criteria such as the requirement of contact data and dating of the material as well as data protection and qualification of the authors. Certifications based on this code exist meanwhile for more than 20 years. During this time, more than 20 000 websites have been evaluated; about 13 % of them are continuously re-certified for more than 10 years [55, 88]. It is intended to take this certificate automatically into account for search queries [89, 90]. This approach certainly leads to a good comparability and high validity of the certificates, but it excludes an even approximately full coverage of the internet.

MedlinePlus (http://www.medlineplus.gov) is another important service in this field. It is a toll-free information service of the United States National Library of Medicine (NLM) aiming at the general population. Based on user statistics of the NLM, a catalogue of more than 1 000 diseases was created showing short summaries with a link collection. Besides, there is a dictionary with short definitions of diseases, an address list of healthcare institutions and healthcare professionals in the USA as well as a link collection to professional organizations, publications, libraries, and other dictionaries. The content, however, has to be assembled and regularly revised by an editorial team [91]. This is a high-effort procedure leading to the fact that always only a small percentage of the available online healthcare information can be assessed and retrievable via MedlinePlus [55]. From a German point of view, it is certainly a disadvantage that MedlinePlus is exclusively available in English and Spanish except for singular entries and is aiming at and displaying the conditions of the healthcare system in the USA.

4.2 Investigations

Healthcare information in the field of otorhinolaryngology is provided by many hospitals and professional associations. Investigations are available about non-university hospitals in Germany [92] and about university ENT departments in Germany [93] and the USA [94]. Besides, in the USA the websites of the professional associations of otorhinolaryngology and neighboring disciplines were analyzed [95–100]. A separate evaluation discussed the contents retrieved on pediatric ENT webpages of US American hospitals and societies [101].

Unanimously, patient information available online was classified as being too difficult for the general population. The difficulty of online information material of all American ENT-related associations [95–97] and neighboring disciplines [98, 100] exceeds the recommended level. This is also true for Spanish information provided by US American institutions on their websites [99]. The vast majority of institutional websites on pediatric otorhinolaryngology is too difficult to understand for the average American population [101]. However, this does not only concern the field of otorhinolaryngology. By comparison of different surgical disciplines, it was found that all online information of professional associations in the US are too difficult to read. The ENT society in the USA is midrange in this context [102]. Consequences that might be taken from the reported discrepancy between the difficulty of available healthcare information and the average reading skills of the patients are still discussed [67] and even the general question arises if hospitals should provide online healthcare information at all [92].

Healthcare information displayed on the websites of hospitals or professional associations are certainly an important aspect of an institution's public image. However, probably only a small percentage of the patients would specifically select such sites. Clearly more relevant for the access to online information are search engines. Accordingly, the analysis of health information that might be found via search engines is more in the focus of scientific literature.

For the discipline of otorhinolaryngology, 21 investigations on diseases and 18 on procedures simulated the search queries for online health information performed by laypeople and analyzed the quality of the resulting output. The topics of oncology [103–108], audiology/neurootology/otology [109–117], and plastic surgery [118–122] were most frequently represented. So far, available studies are focused predominantly on content in English. Furthermore, single studies analyzed Spanish [105] and Turkish [123] contents.

In all trials performed up to now, Google was used as search engine. Additionally, Bing [103, 109, 113, 114, 118, 124–127], Yahoo [103–105, 109, 113, 114, 118, 124–130], HONsearch [104], MedlinePlus [105], MSN, AOL, and Ask Jeeves [130] as well as omnimedicalsearch.com, pogofrog.com, searchmedica.co.uk, and imedisearch.com [125] were applied. The readability of the retrieved material according to the Flesch Reading Ease Score amounted to 29.7–61.5 [103, 104, 106–109, 112, 114, 115, 118, 122, 126, 130–139]. This corresponds to the classifications of "difficult" or "fairly difficult" (score of 30–50 and 50–60, respectively), which is usually found in academic and complex texts [75]. This level of readability exceeds the reading skills of the average population. The DISCERN tool calculated sum scores of 28.1–57 [103, 109, 111, 113, 114, 118, 122–124, 126, 136, 139]. This corresponds to a significant distance to the optimal score of 80 so that at best an average quality of online available information can be confirmed. A HON certificate was only found in 0–30.6 % of the analyzed internet pages [103, 111, 122, 133, 134, 136, 138]. An overview about the studies on ENT-specific diseases is found in ▶ **Table 2**, an overview about the procedures is given in ▶ **Table 3**.

One systematic review article discussed online healthcare information in the context of hearing. An evaluation of 8 trials confirmed a poor readability of the analyzed material, the difficulty level exceeded largely the recommendations. As a consequence, the systematic consideration of the good readability was requested for the creation of medical information material [140].

4.3 Social media

Social media are the most characteristic applications of the web 2.0 [11]. The creation and distribution of contents are performed by interacting users and opens new pathways of information distribution and new health-related applications [141]. Participation, data management, and collective intelligence are also characteristics of health-related applications [142]. From the patients' perspective, the aspect of sharing experiences is in the focus [22], besides, health-related computer games, mobile applications, and an easy distribution of videos are possible [143]. The significance of social media for the search for healthcare information is continu-

▶ **Table 2** Analysis of trials on ENT-specific diseases.

Disease	Timepoint of search	Language	Search engine	Search terms	Number of websites	FRES (mean value)	DISCERN overall assessment (mean value, sum)	Percentage of HON certificates	Reference
Microtia and aural atresia	Not mentioned	English	Google	microtia aural atresia	16 (microtia) 14 (aural atresia)	54.4 ± 7.2 (microtia) 52.1 ± 8.6 (aural atresia)	54.4 ± 8.3 (mictrotia) 47.6 ± 10.7 (aural atresia)	0 % (0/16) (microtia) 7.1 % (1/14) (aural atresia)	Alamoudi & Hong [122]
Burning mouth syndrome	June 8, 2015	English	Google	burning mouth syndrome treatment	53	55.4 ± 10.7	Sum not mentioned (mean value 2.4 ± 0.7)	16.9 % (9/53)	Alnafea et al. [134]
Zenker's diverticulum	February 2015	English	Google	Zenker's diver- ticulum	21	Not mentioned	Not investigated	Not investigated	Balakrishnan et al. [210]
Acoustic neuroma	Not mentioned	English	Google	acoustic neuromas	67	39.2 ± 9.4	Not investigated	Not investigated	Cherla et al. [116]
Mucotympanon, otitis media, otosclerosis, Menière's disease, cholesteatoma, perforated eardrum	March 3, 2015	English	Google	a	49	Not investigated	45.3-67.9	30.6 % (15/49)	Danino et al. [111]
Vascular anomalies	October 8, 2015	English	Google	hemangioma; vascular malformation; vascular anomalies	30	40.43 ± 12.13	47.5 ± 12.11	6.7 % (2/30)	Davis et al. [136]
Voice disorders	Not mentioned	English	Google	vocal health; vocal hygiene; how to take care of voice	85	61.5 ± 10.2	Sum not mentioned (mean values 2.45-4.96)	1.2 % (1/85)	Dueppen et al. [133]
Cholesteatoma, sinusitis, tonsillitis, acute otitis media, epistaxis, quinsy	February 2012	English	Google	cholesteatoma; sinusitis; tonsillitis; acute otitis media; epistaxis; quinsy	124	42.3	39	Not investigated	Goslin & Elhassan [139]
Oral cancer	Not mentioned	English, Spanish	Google, Yahoo, MedlinePlus	b	24 English, 24 Spanish	Not investigated	Not investigated	Not investigated	Irwin et al. [105]
Hearing loss	May 4, 2011	English	Google	hearing loss; hearing aids	66	48.26 ± 10.42	Sum not mentioned (mean value 2.04)	13.6 % (9/66)	Laplante-Lévesque et al. [138]
Oral lichen planus	December 2008	English	Google, Yahoo	oral lichen planus; oral lesion lichenoid	19 (Google) 20 (Yahoo)	Not investigated	Investigated, but neither sum nor mean value are mentioned	Not investigated	López-Jornet et al. [128]
Traumatology, cheekbone and mandibular fracture	Not mentioned	English	Google, Bing, Yahoo	cheekbone fracture; jaw fracture	22	Not investigated	41.9 (cheekbone) 38.5 (mandibula)	Not investigated	McGoldrick et al. [124]
Skull base tumors	February 2012	English	Google	skull base tumors	18	Interval of 0-47	Not investigated	Not investigated	Misra et al. [117]
Laryngeal cancer	June 2013	English	Google, Yahoo, Bing	laryngeal cancer; cancer of the larynx; cancer of the voice box; throat cancer	54	48.2 ± 12.6	49.8	29.6 % (16/54)	Narwani et al. [103]
Dysphagia	May 28, 2013	English	Google	swallowing treatment	45	39.1 ± 19.0	Sum not mentioned (mean value 1.61 ± 0.61)	Not investigated	O'Connell et al. [135]
Mucotympanon	Not mentioned	English	Google	glue ear	20	Investigated, but no mean value is mentioned	Not investigated	Not investigated	Pothier [110]
Mucotympanon	Not mentioned	English	Google, Yahoo, Bing	glue ear	27	49.7	57	Not investigated	Ritchie et al. [109]

▶ Table 2 Continued.

Disease	Timepoint of search	Language	Search engine	Search terms	Number of websites	FRES (mean value)	DISCERN overall assessment (mean value, sum)	Percentage of HON certificates	Reference
Recurrent respiratory papillomatosis	Not mentioned	English	Google, Yahoo, Bing	c	51	41.3 ± 14.9	28.1 ± 9.7	Not investigated	San Giorgi et al. [126]
Facial fractures	January 21 and 22, 2012	English	Google	d	41	54.1	Not investigated	Not investigated	Sanghvi et al. [137]
Oral cancer	Not mentioned	English	Google, Yahoo, HON-search	oral cancer	119	36.0 ± 14.9	Not investigated	Not investigated	Varela-Centelles et al. [104]
Snoring	March 14, 2013	English	e	snoring treatment	16	Not investigated	Sum not mentioned (mean value 2.37)	Not investigated	Veer et al. [125]
Velopharyngeal insufficiency	Not mentioned	English	Google	velopharyngeal insufficiency; VPI; velophar- yngeal dysfunction; VPD	22	Not investigated	Not investigated	Not investigated	Xie et al. [211]

a glue ear; otitis media; otosclerosis; Menière's disease; cholesteatoma; ear perforation; b oral cancer; mouth cancer; tongue cancer; cancer oral; cancer de la boca; cancer de la lengua; c recurrent respiratory papillomatosis; laryngeal papillomatosis; laryngeal papilloma; larynx papillomatosis; larynx papilloma; wart throat; wart vocal cord d: facial fractures; maxillofacial trauma; broken nose; broken jaw; mandible fracture; broken cheekbone; maxillary fracture; Lefort fracture; zygomatic fracture; e Google, Bing, Yahoo, omnimedicalsearch.com, pogofrog.com, searchmedica.co.uk, imedisearch.com; FRES: Flesch Reading Ease Score.

ously increasing and it may be expected that social media will further prevail in the professional routine of practitioners [144, 145]. Current fields of application of social media in healthcare systems encompass the simplification and acceleration of communication especially between patients and between physicians and patients [16, 146]. As for other technical innovation, young technophilic people are the first to benefit from health-related social media. Potential users are also people with a low socio-economic status and chronically sick people [143].

In many areas, major concerns are expressed regarding the use of social media in healthcare, among others in the context of data protection and professional behavior [16]. The American College of Physicians (ACP), i. e., the US American association for internal medicine, issued a very cautious code of conduct for the professional presentation in social media [147]. The disadvantages might consist of the fact that a superiority of social media to traditional communication pathways is not scientifically proven, that data protection concerns exist, and that new technologies might distract from actual medical problems [148]. While thereby risks of social media use in the healthcare environment are clearly seen, others argue that advantages likely outweigh the disadvantages [145].

For the field of otorhinolaryngology, several options for the implementation of social media were described, in particular with regard to improving a continuous physician-patient contact. Social media might contribute to keeping patients away from untrustworthy websites. By means of Twitter, Facebook, and Blogspot, messages of different lengths can be sent to a group of users that have previously signed up to the author (followers). YouTube provides a platform with an user-friendly availability of video clips. Via social media, physicians may distribute information that are frequently needed by patients. This would then allow a more targeted and efficient personal contact. Furthermore, the contact to the physician via social media provides the patient with access to a trustworthy source of information [146].

Due to the high speed and the possibility of distributing information via re-tweets, Twitter may be an efficient communication medium for institutions and subjects from the healthcare sector [149]. Beside the time efforts that have to be spent on another communication medium, a high percentage of wrong information as well as the typical difficulty to evaluate the trustworthiness of an online source is critically discussed [150]. Up to now, no systematic review on the use and on the benefit of Twitter is available for the discipline of otorhinolaryngology. An overview with an exemplary selection of Twitter accounts in otorhinolaryngology is found in ▶ **Table 4**.

As one of the most frequently visited webpages overall, Wikipedia plays an important role for healthcare information. Wikipedia probably contains more than 164,000 articles on health-related topics that are read more than 10,000,000 times worldwide [151]. Wikipedia articles often rank on prominent positions in the results of search queries [152, 153] and are used by patients as well as by physicians, professionals of other health-related services, and medical students [151, 154]. Whereas only few content-related errors can be found [16], the readability of Wikipedia articles tends to be even poorer than for example information from public institutions [152]. Another weakness of Wikipedia is that possible conflicts of interest of the authors are not yet considered or disclosed

▶ **Table 3** Analysis of trials on ENT-specific procedures.

Procedure	Timepoint of search	Language	Search engine	Search terms	Number of websites	FRES (mean value)	DISCERN overall evaluation (mean value, sum)	Percentage of HON certificates	Reference
Adenotomy, tonsillectomy, ventilation tubes	April 2014	Turkish	Google	Not mentioned	60	Not investigated	35.7-39.1	Not investigated	Acar et al. [123]
Endoscopic sinus surgery	Not mentioned	English	Google	endoscopic sinus surgery	31	47.1	Not investigated	Not investigated	Cherla et al. [132]
Ventilation tubes	August 25, 2016	English	Google	ear tubes tympanostomy tubes PE tubes	10	50.4 ± 11.6	Not investigated	Not investigated	Harris et al. [115]
Rhinoplasty	November 2014	English	Google, Bing, Yahoo	rhinoplasty; nose job; nose reshaping; nose reshaping surgery	66	57.8	40	Not investigated	Haymes [118]
Hearing aids	November and Dezember 2014	English	Google	hearing aid, hearing aids, siemens hearing aid und andere	15	51.8-55.3	Not investigated	Not investigated	Joseph et al. [112]
Tracheostomy care	Not mentioned	English	Google	tracheostomy care	50	57.2 ± 16.7	Not investigated	Not investigated	Kong & Hu [107]
Tonsillectomy, septoplasty, myringoplasty	Januar 2007	English	Google, Yahoo	tonsillectomy; septoplasty; myringoplasty	60	Not investigated	Not investigated	Not investigated	Kulasegarah et al. [129]
Ventilation tubes	March 26, 2012	English	Google, Yahoo, Bing	myringotomy; tympanosto-my; grommet; ear tube	84	49.4 ± 12.9	38.5	Not investigated	McKearney et al. [114]
Thyroidectomy	March 2010	English	Google, Yahoo, MSN, AOL, Ask Jeeves	thyroidectomy	103	43.9	Not investigated	Not investigated	Muthukumarasamy et al. [130]
Otoplasty	Not mentioned	English	Google	otoplasty	44	Not investigated	Sum not mentioned (mean values 1.8-2.3)	Not investigated	Nissan et al. [121]
Neck lift	November 2015 - January 2016	English	Google	neck-lift	45	Investigated, no mean value mentioned	Sum not mentioned (mean value 1.3-2.3)	Not investigated	Rayess et al. [120]
Rhinoplasty	September 2016	English	Google	rhinoplasty	20	Investigated, not mean value mentioned	Sum not mentioned (mean value 2.05-2.42)	Not investigated	Rayess et al. [119]
Cochlea implantation	May 2014	English	Google, Bing, Yahoo	cochlear implant; cochlear implant surgery	40	Not investigated	35.6	Not investigated	Seymour et al. [113]
Thyroplasty	June 25, 2013	English	Google	thyroplasty treatment	50	29.7 ± 16.6	Sum not mentioned (mean value 2.20 ± 0.60)	Not investigated	Ting & Hu [131]

▶ **Table 3** Continued.

Procedure	Timepoint of search	Language	Search engine	Search terms	Number of websites	FRES (mean value)	DISCERN overall evaluation (mean value, sum)	Percentage of HON certificates	Reference
Leukoplakia treatment	July 8, 2015	English	Google	leukoplakia treatment	47	47.5 ± 11.1	Sum not mentioned (mean value 2.3 ± 0.7)	170 % (8/47)	Wiriyakijja et al. [108]
Laryngectomy	November 2016	English	Google	laryngectomy	44	52.3	Not investigated	Not investigated	Wong et al. [106]
Tonsillotomy	Not mentioned	English	Google, Yahoo, Bing	partial tonsillectomy intracapsular tonsillectomy	150	Not investigated	Not investigated	Not investigated	Wong & Levi [127]
Tonsillectomy	June 2016	English	Google	10 different[a]	30	Not investigated, no mean value mentioned	Not investigated	Not investigated	Wozney et al. [212]

FRES: Flesch Reading Ease Score; a: tonsillectomy AND parent; tonsillectomy AND children; tonsillectomy AND care; tonsillectomy AND "caring for your child"; tonsils AND surgery AND care; tonsillectomy AND "what to do"; tonsillectomy AND "parent education"; child AND tonsils AND removed; hospital AND tonsillectomy AND information; tonsil AND information AND surgery AND pediatric.

[16]. The benefit of healthcare information on Wikipedia for patients and the impact on the physician-patient relationship have not been systematically investigated so far [153]. Beside Wikipedia, there are numerous other Wikis specialized on health-related topics that rank far behind the count of articles and users of Wikipedia [152].

YouTube is another one of the most frequently visited webpages. The possibility to distribute videos provides particular chances for patient information [155, 156]. Because of the immanent lack of a central or systematic quality assurance, YouTube videos about medical topics probably contain a very high percentage of incorrect information. The distribution of anecdotic or even wrong information is therefore a high risk of this platform [156]. This was shown in a scientific analysis on videos of movement disorders where 66 % of the cases were wrongly classified [157]. In this context, a solution with the necessary impact on the unmanageable amount of material is not yet available. Besides, it should be scientifically investigated how patient information may be distributed via YouTube in way that is as valid as possible [156].

YouTube also provides content in the field of otorhinolaryngology that has already been evaluated scientifically. However, there is no consensus with regard to evaluation tools. Only one single study [158] uses an instrument that has been validated earlier [159]. The evaluation of another trial is based on earlier publications [160], two other publications refer to each other [121, 161]; and apart from this, ad hoc developed scales are applied [162–164]. The summarizing evaluation of the quality and the benefit of the content, however, is negative in many cases [158, 162, 164]. In particular videos that are uploaded by single users have a lower quality than those shared by healthcare professionals, institutions, or professional organizations [160, 163]. An overview about YouTube in otorhinolaryngology is found in ▶ **Table 5**.

Patient platforms are social networks specifically for the healthcare sector [16]. The interaction mediated between patients via internet has been considered as potentially relevant factor for a long time now. Still, the systematic scientific assessment is difficult because of the diversity of patient platforms on the internet [22, 165]. However, patient platforms such as PatientsLikeMe [166] may also be relevant for scientific research because they allow new ways for the retrospective evaluation of patient data. This was evident for example for the substance of lithium that was suggested for the treatment of amyotrophic lateral sclerosis. The starting point was a trial of 16 patients and 28 control subjects who showed a significantly lower disease progress due to the application in an interval of 15 months [167]. A patient-initiated analysis based on data from the platform of PatientsLikeMe was able to recruit and analyze within very short time 149 patients who were treated with lithium as well as 447 control subjects. Hereby, no effect of lithium was found in a period of up to 12 months [168]. Similarly, the off-label use of amitriptyline and modafinil has been be evaluated in 3 342 cases [169]. Likewise applications in otorhinolaryngology are not yet reported.

▶ **Table 4** Selection and activity of twitter accounts with regard to otorhinolaryngology.

User name	User	Affiliation	Country	Follower	Tweets	Active on Twitter since
@phonak	Phonak (Sonova Holding AG)	Medtech company	Switzerland	16,583	10,650	November 26, 2012
@drluebbers	Dr. Christian Lübbers, Weilheim i. OB	ENT practitioner	Germany	11,704	8,053	February 18, 2015
@AcademyofAuD	American Academy of Audiology	Professional association for audiology	USA	11,301	5,459	January 9, 2009
@AAOHNS	American Academy of Otolaryngology–Head and Neck Surgery (AAO-HNS)	Professional ENT association	USA	7,892	4,810	March 23, 2009
@medel	MED-EL GmbH	Medtech company	Austria	6,070	2,173	February 2, 2010
@JAMAOto	JAMA Otolaryngology—Head & Neck Surgery	Scientific journal	USA	4,449	4,216	July 7, 2009
@MenieresSociety	Meniere's Society	Foundation and self-help organization	United Kingdom	3,385	1,770	February 7, 2012
@ENT_UK	The British Association of Otorhinolaryngology	Professional ENT association	United Kingdom	2,150	2,110	November 11, 2011
@UCLEarInstitute	UCL Ear Institute, University College London (UCL)	Institute for hearing research	United Kingdom	2,039	1,457	May 2, 2012
@CochlearGlobal	Cochlear Ltd.	Medtech company	Australia	1,674	480	November 25, 2014
@OtoRhinoLaryn	Physicians Employment (PhysEmp)	Job market for physicians	USA	1,473	201	January 20, 2010
@OandNonline	Otology & Neurotology	Scientific journal		1,384	5,196	October 28, 2011
@evidENT_UCL	evidENT	Scientific group	United Kingdom	946	346	February 21, 2014
@EandHonline	Ear and Hearing	Scientific journal	USA	763	2,801	October 28, 2011
@HearingResearch	American Hearing Research Foundation (AHRF)	Foundation for hearing research	USA	639	883	April 4, 2012
@HNOPraxisRuhr	HNO Practice in Essen	Private practice	Germany	39	120	September 25, 2014
@hnoprax	HNO Pracitice in Wuppertal	Private practice	Germany	41	7	March 19, 2013
@HNOAssistent	Assistant representation of the DGHNO	Part of a professional ENT association	Germany	6	23	May 22, 2018
@DGHNOKHC	German Society of Oto-Rhino-Laryngology, Head and Neck Surgery	Professional ENT association	Germany	4	26	May 2, 2011
@Dr_Reichel	Dr. Jochen Reichel, München	Private ENT practice	Germany	4	102	May 29, 2008
@Praxis_HNO	ENT practice in Ingolstadt	Private practice	Germany	1	13	June 26, 2017

Status: September 9, 2018.

5. eHealth Literacy

5.1 Literacy and health

With regard to individual patients, healthcare information serves for developing the own abilities and skills for handling health issues. For this purpose, the concept of health literacy has been introduced. Literacy in this context does not only mean competence regarding the ability to read, but in particular also aspects of media competence [170]. Still in 1999, the American Medical Association defined health literacy as the skills that are necessary to read and understand health information and to adequately act as patient [171]. Currently, health literacy is understood as further reaching concept that beside the ability to obtain, understand, evaluate, and observe health information also includes individual and social factors influencing these skills [172, 173].

These abilities and factors are closely related with the medium and are currently in a modification process because the internet is becoming the predominant medium for communication and information in healthcare service [70]. As a consequence, the definition of health literacy was extended in order to include also relevant competences with regard to the use of digital media. Similar to the concept of eHealth, now the term of eHealth literacy (electronic health literacy) is found [173]. According to Norman and Skinner, eHealth literacy encompasses 6 components in two sections of skills: reading/calculating, information literacy, and media literacy as analytic skills as well as (analogue) health literacy, IT knowledge, and basic scientific knowledge as context-specific skills [174]. It is still not fully clear how eHealth literacy should be assessed and which consequences will result for the development and the implementation of digital applications in healthcare services [175].

▶ **Table 5** Overview about analyses of YouTube content referring to otorhinolaryngology.

Disease/procedure	Timepoint of search	Language	Search term	Number of videos	Assessment tools	Reference
Croup[a]	October 6, 2015	English	croup + child OR croup + baby	38	Medical Video Rating System (MVRS) [159]	Knight et al. [158]
Oral cancer	December 4 and 5, 2015	English	mouth cancer oral cancer	188	Developed ad hoc	Hassona et al. [163]
Sjögren's syndrome	May 21, 2015	English	Sjogren's syndrome	36	Adapted from earlier investigations	Delli et al. [160]
Adeno-tonsillectomy, vent tubes	February 4 and 7, 2013	English	b	102	Developed ad hoc	Sorensen et al. [162]
Rhinosinusitis	August 17 and 18, 2012	English	sinusitis	100	Developed ad hoc	Biggs et al. [164]
Otoplasty	Not mentioned	English	otoplasty	50	Analogue to [161]	Nissan et al. [121]
Facelift	Not mentioned	English	facelift	99	Developed ad hoc, also used in [121]	Nissan et al. [161]

[a] Also hypovolemia in pediatric patients was evaluated. Only the assessed values for croup are mentioned here; b This trial used a search query that was constructed for possibly complete query, but probably does not reflect the search habitudes of patients or laypeople. ~"Tonsillectomy" OR ~"adenoidectomy" OR ~"tonsil removal" OR ~"adenoid removal" OR ~"tonsil surgery" OR ~"adenoid surgery" OR ~"tonsillitis surgery"; ~"Ear tubes" OR ~"ear tube surgery" OR ~"ear infection surgery" OR ~"myringotomy" OR ~"tympanostomy tubes".

Health literacy has an impact on the individual health situation, this correlation could be confirmed in several systematic review articles [176, 177]. A strong correlation between health literacy and the mortality of older people could be revealed [177]. People with low health literacy have a 1.5–3 fold higher risk for an unfavorable course of a disease [176]. Furthermore, there are associations with regard to hospital admissions, use of emergency institutions, rarer participation in vaccination and preventive examinations such as breast screening as well as even a poorer general health status of older people [177]. These results are mainly based on studies from the USA where general health insurance was not obligatory for a long time and so bias with regard to the socio-economic status is possible. However, there are similar results in a long-term study with 7 857 patients aged 52 years or older performed for more than 5 years. Because of the comparable healthcare systems, these data are probably more similar to the situation in Germany [178].

eHealth literacy is relevant for the course and the prognosis of diseases. For cancer patients a detailed conceptual framework was suggested how the internet may influence the outcome of a cancer disease by the provision of information as well as the mediation of interaction with physicians and other patients [179]. Also in this context, a low health literacy seems to have a negative impact on the ability to use online health information [180].

5.2 Factors

At first glance, it might be expected that the internet facilitates the access to health information as additional medium for the population [28, 70]. However, since among others technical resources are necessary for the use of the internet, it is finally not clear if the provision with health information is really facilitated or actually made more complicated [38]. Moreover, different socio-economic characteristics determine the level of health literacy [28, 173]. The role of the internet for the empowerment of patients to be more responsible regarding their own health must be seen in the context of social conditions of how the internet is used and how this responsibility can thereby be observed [21].

Different factors have been described that are consistently associated with less health-related online research and low health literacy. Hereby, lifestyle and level of education seem to be more important for health-related online research than technical conditions [181]. A high level of education was described as most important factor that allows prediction of a successful online search for valid health-related information [37, 182], while a low educational level is associated with poor health literacy [183–186]. A similar correlation is found on German and European levels with a low social status [182, 185, 187, 188]. Regarding the influence of the age, contradictory findings exist. People older than 65 years searched least for health-related information [37, 182, 189]. While in many studies a high age is correlated with a low health literacy [184, 185], one investigation showed that subjects with statutory health insurance in Germany even have an increasing health literacy with increasing age [190]. People with migration background in Germany use the internet more rarely for search queries for health information [188]; and a migration background is associated with low health literacy [185]. Chronically sick patients use the internet less frequently and thus cannot take advantage of it [189]. Throughout Europe, an individually reported poor health status seems to be associated with a low health literacy [187]. Conversely, in Germany there is a close correlation between health awareness and health literacy [186]. In the USA, people who belong to ethnic minorities or whose mother language is not English, are more likely to have an inadequate health literacy [183]. Finally, women use the internet more frequently for finding health information than men [36].

The combination of these factors results in particular patient groups that are not adequately or not at all provided with healthcare information either generally or online. In otorhinolaryngology, for example cancer patients might be a group with rare internet access and thus poor online information due to their higher age and lower educational level [191].

5.3 Distribution

The mentioned factors also lead to the fact that health-related internet use and health literacy in the population are unequally distributed. For Germany, population-related data of 2013 exist, according to which 44–54 % of the adults have a problematic or inadequate health literacy [185, 186]. An even higher share of 59.5 % of the interviewed subjects was found in an investigation from 2014 that considered only members of statutory health insurances in Germany [190]. Compared to European standards, the distribution of health literacy in Germany is estimated to be rather high; poorer scores are reached by Austria, Bulgaria, Greece, Poland, and Spain among 8 investigated countries. The highest score was found in the Netherlands, Germany ranked third behind Ireland [187]. Specifically for otorhinolaryngology, a study in the USA with outpatients revealed that 10 % had an inadequate health literacy and more than one quarter had a partial deficit [183].

Based on the significance of health literacy, strategies are evaluated to increase the patients' health literacy or reduce the consequences of poor health literacy. In this context, design and audiovisual media are applied [192]. In Germany, an initiative was founded in 2017 called "Allianz für Gesundheitskompetenz" (Alliance for Health Literacy) in order to improve health literacy in Germany [193].

6. Physician-patient Relationship

6.1 Changes due to the internet

Since many years already, technological innovations of digitization and the associated changes of the patients' health literacy lead to a fundamental change of the relationship between physicians and patients [26, 194]. This is explained by the fact that modern societies are strongly shaped by mass media and thus media-based contents are more frequently introduced by the patients into the relationship to the physician [21]. Most likely, in the future physicians have to get used to an even more partner-like relationship between physicians and patients [194, 195]. The situation that information about medical facts might influence a patient independently from the treating physician, is not new and correlates with regard to technological innovations of media are found in nearly every medical era [196]. Perhaps it is more difficult to cope with the impact of the internet because it is the first innovation in healthcare that is not fully controlled by physicians and but rather by the patients [197].

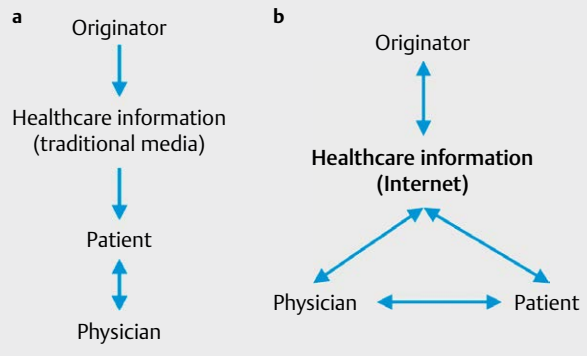
While patients use the internet increasingly for retrieving health information, many physicians are still reluctant [24]. It is problematic for the relationship between physicians and patients that the medical authority is increasingly questioned. Besides, preferences developing from online information may be counterproductive for health. Furthermore, intensive discussions with patients are perceived as very exhausting [179]. A challenge of the physicians' medical competence may lead to very negative reactions and thus impair significantly the relationship with the patients [198]. The phenomenon of premature consent describes the situation that a patient consults a physician with an already preconceived opinion and based hereon does not follow the physician's explicit recommendation. This factor has probably increased due to the availability of online health information and is also called "Dr. Google". Apparently, many physicians tend to go along with the patients' wishes stimulated by internet research [198]. Despite the due respect of the patients' autonomy, from an ethical perspective, however, a physician is not obliged to follow a patients' wish that he or she considers as unreasonable [199]. Hence, it is finally the quality of health information that is crucial for the physician-patient relationship. Wrong or irrelevant information of patients may lead to poor treatment results [198].

6.2 Chances for improvement

Since the internet allows very direct information exchange with high speed, it might reduce a patients' dependence on physicians and lead to a new form of autonomy [24]. Modern, well-informed patients generally wish suitability, control, and selection of different options when claiming healthcare services [195]. However, currently it cannot be predicted how this focus on self-responsibility for health changes the patients' role because there is probably a limit up to which the responsibility for the own health by laypeople can be taken over without professional actors and the socio-cultural context [21].

The improved access to information via the internet leads to the fact that patients request a major part of decisions with regard to their own health [200]. But patients also report about difficulties of handling health-related online information. A too large multitude of information, contradictory findings, and too complex information are mentioned in this context [201, 202] and can make autonomous decisions based on online information alone impossible [202]. There is a relationship between extensive internet use and health-related anxiety resulting from consultations of the internet with regard to health questions [203]. Perhaps this is why many patients prefer the face-to-face contact with the treating physician and use the internet as secondary source [204]. Physicians are requested to discern and to verify online information. Accordingly, investigations reveal that since many years the confidence in physicians remains on a high level despite progressing digitization [205]. This fact has to be considered as positive because a successful result of the interaction between physicians and patients requires confidence in the internal relation [206]. Another relevant aspect for patients is probably the contact to other patients mediated by the internet. This effect, however, is still difficult to quantify due to methodical reasons [165].

Physicians should actively work on the benefit of internet use for the physician-patient relationship [207]. For example, physicians might include questions about health-related online information in history taking. Patients usually mention knowledge they have retrieved online only indirectly in the discussion with a physician [201]. Until now, physicians seem to overestimate the patients' health literacy [184], possibly because the physician-patient relationship has always been characterized also by a gap between read-



▶ **Fig. 2** Simplified scheme regarding the physician-patient relationship. **a** Situation without internet, **b** Situation with internet. The internet use mainly results in increasing possible interactions.

▶ **Table 6** Possible measures referring to eHealth literacy.

- Public relations
  - Coordinated creation of reliable and trustworthy health information
  - Implementation of a continuous presence in the social media towards laypeople, patients, and colleagues
- Scientific work program
  - Accessibility and quality of German health information on diseases and procedures
  - Distribution, barriers, and effect of health literacy related to specific medical disciplines
  - Elaboration and evaluation of interventions to improve health literacy related to specific medical disciplines

ing competence and background knowledge of the well-trained and informed physician and the average patient [67].

In the majority of the currently available investigations, a positive opinion of the physicians towards online health information was stated [179]. It might be positive for physicians that patients who have found online information have a broader prior knowledge about health-related topics [198, 200–202]. Precondition for an improved relationship between physicians and patients by digitization remains a critical discussion of the disadvantages and a realization of the patients' gain in autonomy [29]. Mostly it is considered as the physician's obligation independently from the medium to provide adequate information for the patients [146]. In order to act in the patients' interest, physicians have the ethical obligation to protect them against risks that might arise from missing or wrong information [206]. The current model of decision making in health questions contains a discussion of the advantages and disadvantages of different options and a consideration of personal values of the individual patient (shared decision making) [200]. Finally it is the task of healthcare professionals to make sure that digitization in medicine improves healthcare provision [26].

Also in otorhinolaryngology, initially patients do not automatically report about their prior knowledge from the internet. However, the attitude towards the disease, the physician, or therapy procedures may be influenced [45, 48]. Based on the example of rhinoplasty, it was possible to show that the internet seems to play a particular role as marketing tool for plastic-esthetic interventions [208]. Even if the level of internet use is very high especially in the context of esthetic indications, this example seems to make clear that the direct contact to the physician cannot be replaced because information given by the treating physician is usually more exact and individually adapted [209]. Overall, the availability of the internet leads to increased interactions of physicians, patients, and available health information. A scheme is displayed in ▶ **Fig. 2**.

7. Conclusion, Outlook, and Further Approaches

The internet is a technological innovation penetrating all areas of human life as medium and communication tool. This also affects healthcare services where the availability of information and the speed of communication have an impact on the health literacy of patients as well as the relationship between physicians and patients. Indirectly, there is also an influence of the treatment success of diseases.

Naturally, otorhinolaryngology is also concerned by this process. Detailed scientific knowledge in this discipline is available on internet use by patients as well as on English health information. There is a need for research with regard to the availability and the quality of German online health information, to the significance of the internet as well as to obstacles regarding the access for ENT patients within the conditions of the German healthcare system.

Each medical discipline is challenged to actively contribute to digitization-related change in health literacy of patients. Beside the practical improvement of the specific eHealth literacy by targeted public relations activities, the impact of digitization should be scientifically evaluated. An overview about possible measures is found in ▶ **Table 6**.

Conflict of Interest

The authors state that there is no conflict of interests.

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