Rate Your Physician: Findings from a Lithuanian Physician Rating Website

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Abstract. Physician review websites are known around the world. Patients review the subjectively experienced quality of medical services supplied to them and publish an overall rating on the Internet, where quantitative grades and qualitative texts come together. On the one hand, these new possibilities reduce the imbalance of power between health care providers and patients, but on the other hand, they can also damage the usually very intimate relationship between health care providers and patients. Review websites must meet these requirements with a high level of responsibility and service quality. In this paper, we look at the situation in Lithuania: Especially, we are interested in the available possibilities of evaluation and interaction, and the quality of a particular review website measured against the available data. We thereby identify quality weaknesses and lay the foundation for future research.

Keywords: Lithuanian physician review websites · Medical service ratings

1 Introduction

Review websites for Health Care Providers (HCP) such as physicians are a well-known nowadays [4–7, 9–12, 25, 26, 29]. So-called Physician Review Websites (PRWs) receive a lot of attention because they are online available to patients in many countries [29]. For example, there is the American website `Ratemds.com`[1], the German `Jameda.de`[2] or the Lithuanian "`Pincetas.lt`"[3]. They all have in common that they are well-frequented and record a high user interaction. PRWs also cover the large number of HCPs and attract a great deal of media attention [24], which is caused by HCPs, who do not want to be reviewed online [1]. This raises legal questions [2]. However, PRWs are not only seen negatively by HCPs because they use them for advertising purposes [20] although this is of questionable legality [8]. The high level of user interaction distinguishes PRWs from other medical information sources on the Web such as health care news (e.g. "`Sveikata.lt`"), health related products (e.g. "`Hiperfarma.lt`") or health communities (e.g. `Pasveik.lt/lt/forumas/`) [27]. Actually, the online-based reviewing of medical services seems to be the next

[1] http://www.ratemds.com, founded in 2004, ∼ 1,700,000 HCPs, ∼ 2,600,000 reviews.
[2] http://www.jameda.de, founded in 2007, ∼ 275,000 HCPs, ∼ 2,000,000 reviews.
[3] http://www.pincetas.lt, founded in 2006, ∼ 60,000 HCPs, ∼ 80,000 reviews.

R. Damaševičius and G. Vasiljevienė (Eds.): ICIST 2018, CCIS 920, pp. 43–58, 2018.
https://doi.org/10.1007/978-3-319-99972-2_4

consequential step in the development of the Web 2.0, which already allows reviewing holiday resorts, films, products, etc. [20, 22, 23]. Additionally, multiple studies have been conducted on PRWs for many countries like Germany and the USA [6, 9, 10, 15]. When PRWs are analyzed, it is important to consider national influences: It must be pointed out that the PRWs can greatly differ in the way and quality of implementation. For example, this specifically applies to language, health system, rating scheme (e.g. star-rating vs. grade-based rating, qualitative vs. quantitative), the rating issues (e.g. friendliness, waiting time, parking, Wi-Fi) and the protection of patients' privacy. Until now, it has not been investigated in any Baltic country or any country in the Eastern part of the European Union. This situation is dissatisfying because local legal and social characteristics are reflected on these portals and are therefore worth investigating, especially, when considering the European Union's attempts for a unified single digital market across Europe [14]. Regarding the current legal cases of how to deal with PRWs' business model and the missing neutrality of PRWs between HCPs and patients, it is also unsatisfying not having investigated a PRW from the Eastern European Union [8]. Comparing different PRWs in detail makes it possible to identify good and bad idiosyncrasies on PRWs and to figure out and promote a better quality understanding. This is the primary purpose of this paper. Firstly, this study investigates one Lithuanian PRW by looking at the website data and by using natural language processing (NLP) techniques. This way, we evaluate the quality of the provided review data. Secondly, we briefly investigate online health information websites in Lithuania in order to underline the role of user-interaction which is unique to PRWs. Finally, we draw our conclusions from the used data, and discover future research topics such as a comparison of PRWs across Europe and the world.

The outline of this paper is as follows: Sect. 2 provides an insight into current research and even an explanation how the data acquisition and preprocessing steps were conducted. Section 3 gives an overview on our data set, and Sect. 4 presents our findings. In Sect. 5, we discuss our findings and compare them to international competitors. In Sect. 6, we conclude and give a brief outlook on future research.

2 Current State of Research

PRWs can significantly influence HCPs' success and they are useful and even decision-making for patients searching an HCP [10]. In 2013, one of six HCPs around the world was rated and the demand of PRWs is continuously growing [12]. As presented later, more than nine of ten reviews are positive. At the same time, any evidence for considerable doctor-bashing is denied, which is often discussed in the media [12].

The research so far only covers certain areas. There are some studies presenting data of PRWs from different countries [12, 15, 18]. Others analyze how German patients use PRWs [7]. Other studies investigate the patient's rating behavior by using German PRW data and investigate second-hand ratings [17], rating inconsistency by means of NLP [19], and cognitive bias in online reviews [28]. Other aspects like latent connectivity of HCPs (i.e. hidden connections among HCPs) are explored as well [4–6, 11]. Here, an important issue is privacy. Medical information is sensitive because, for example, users of PRWs can be identified because of their review contents [6].

Furthermore, others search for reasons how the ratings of physicians are achieved [21]. They therefore analyze reviewer statistics [29] and combine physicians' and patients' information to get better insights into the rating behavior [16]. But so far, there is no study collecting and using a data set from a North-Eastern European PRW like Lithuania. Furthermore, there is little research about Lithuanian websites in the medical sector. There is only one overview of Lithuanian medical information sources on the Internet [27]. In the following, we adopt the original table from 2014 with current websites but keep the general classification scheme (see Table 1).

Table 1. Lithuanian web sources for health care and lifestyle. Based on [27]

Section	Subsection	Online project
Informational	Overview & Library	Emedicina.lt
		Lmb.tl
	Health care news	Smlpc.lt
		Pasveik.lt
		Visivaistai.lt
		366.lt
		Farmapedia.lt
		Sam.lt
		Vlk.lt
	Health care news and products	Camelia.lt
		Eurovaistine.lt
		Zoopharma.lt
	Health related products	Hiperfarma.lt
		Hipereko.lt
		Hiperzoo.lt
		Ecohit.lt
		Ekomed.lt
		Nvaistine.lt
Participatory	Weak participation	Sveikaszmogus.lt
		Sveikata.lt
		Odontologija.com
		Mednews.lt
		Imunitetas.lt
	Consultations	Manosveikata.lt
		Konsultuokis.lt
		E-pacientas.lt
	Strong participation	Sveikasvaikas.lt
		Pincetas.lt

A low coverage of health-related websites in a comparatively small country like Lithuania seems quite normal. However, there is, as it can be seen in Table 1 a high number of different services. Since we deal with PRWs, we stick to the participatory section. For this purpose, our work is focused on a PRW categorized in Table 1 as "strong participation" in reviewing health care providers.

While [27] name "Pincetas.lt" as well-known PRW in Lithuania, we have serious doubts concerning the data quality and relevance of the website. One question is whether all HCPs really exist or whether there are errors and anomalies in the data. Furthermore, we are interested in the providers' specialties, their geographical distribution and average ratings. It will be interesting to view the reviews in combination with the corresponding provider. Until now, the distribution of reviews per HCP, the geographical distribution of reviews, etc. are unknown. For this reason, acquiring and analyzing data from "Pincetas.lt" will lead to new findings and provide a starting point for scholars dealing with similar research topics.

3 Descriptive Statistics

In order to present an example for and introduce to the data from PRWs, we provide a translated review from the Lithuanian website "Pincetas.lt" in Fig. 1. In general, reviews are divided into a quantitative and a qualitative part. The quantitative part includes the grades that can be awarded for categories such as friendliness and competence. They are shown as overall grades for all given ratings (summary). The qualitative part consists of an individual review text and a recommendation (green text color for recommendation).

Figure 1 shows an example for a Lithuanian physician review text translated into English. In addition to a timestamp (e.g. 2017-07-17, 11:55), the reviewer's IP address is also given (here shortened to keep anonymity), which is absolutely questioning concerning privacy issues. Moreover, HCPs can reply to a review. First, we have to acquire, build and preprocess a data set for our research purposes because no structured Lithuanian PRW data set is available right now.

3.1 Data Acquisition and Preprocessing

We use HCP profiles, medical institution profiles and free text reviews from the Lithuanian PRW "Pincetas.lt" as data source. The PRW was founded in 2006 and it is growing steadily, measured by the number of reviews submitted. The first review we acquired is dated on 14/07/2006. Overall, only 45 reviews were written in 2006, compared to 3,503 in 2007 and a total of 5,599 in 2008. This is a remarkable growth, which was repeated in 2015: While until 2015, between 6,000 and 8,000

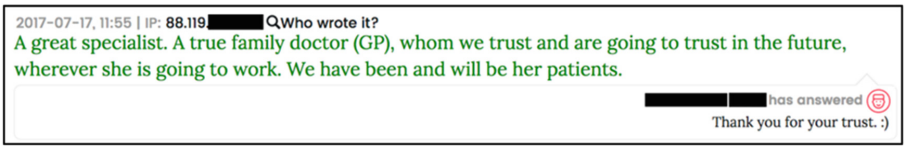

Fig. 1. Sample HCP review on Pincetas.lt (translated from Lithuanian)

reviews have been written per year, in 2016 it climbed up to 10,810 and in 2017 to 12,914 reviews. We acquired our data set between July and December 2017 by using a fully automated approach (similar to the procedure described in [4]). Therefore, a crawler was developed, which searched the PRW and gathered all listed HCPs in the website's index. Subsequently, the information was stored in a database and further processed, e.g. by tokenizing sentences, lemmatization, etc. Our data set contains 57,311 profiles of health care providers (e.g. names, licenses, workplaces), 2,983 medical institutions (e.g., area of expertise, address data), and 81,765 reviews for HCPs and medical institutions (e.g., review text, sentiment). Furthermore, the data set contains IP addresses, which can be assigned to the respective reviews. IP addresses of the reviewers who were not logged-in are published with the corresponding review text. These IP addresses were also used to identify the country, city, internet provider and geographic coordinates (longitudes, latitudes), which represent valuable additional information. Moreover, reviews without texts also exist, but are not separately listed. Nevertheless, preprocessing is still essential: Examples are the names of the HCPs, which do not exist as individual data fields (first names, surnames) but as a single string. Since separate first and last names are more suitable for further data processing, we split them during the preprocessing step. The same isolation technique is applied to medical licenses such as "*Vidaus ligų gydytojas Išduota: 2009-05-27, Nr. MPL-XXXXX, Galiojanti*" (Internal illnesses doctor Issued: May 27, 2009, No. MPL-XXXXX, Valid). Another example is the gender of a HCP. This information is not available on this PRW. Therefore, we have analyzed HCPs' first and last names, which provide information about gender in most cases. For this purpose, we used the internal word evidence such as typical Lithuanian first names (e.g. "*Birutė*") and last name suffixes (e.g. "*-ienė*"). On the one hand, each review is represented by its ID, HCP ID, timestamp, IP address, sentiment, review text (i.e. comment) and a reply by the doctor (if provided). On the other hand, each HCP is characterized by its ID, name, area of specialization, recommendation value, total number of ratings, licenses, workplaces, average ratings like how patients rate the diagnosis, question answering, etc. (grades from 1 to 5, where 5 is the best), and whether the HCPs offer an online appointment booking on their website.

3.2 Overview Over Health Care Providers, Medical Institutions and Reviews

In the following, we describe our data subsets (HCPs, medical institutions and reviews) individually, knowing well that they are strongly interlinked.

Health Care Providers. We acquired 57,311 HCP profiles, which cover 78 specialist areas. The three most represented areas of specialization are "*Bendrosios praktikos slauga*" (general nursing), "*Medicinos gydytojas*" (physician), "*Odontologija*" (odontology). About 5% of the acquired profiles did not specify any specialist area. It is surprising that the most frequent area is nursing. Since the specializations are accompanied by the corresponding licenses, it is also worth to review this information: In total, 87% of the provider's profiles contain information about licenses, whereof 85% have at least one valid license. Conversely, this means that 15% have no valid license and 13% of the providers have not provided any information about this.

Medical Institutions. Next to the provider's data, we also acquired 2,983 profiles of medical institutions including medical practices and hospitals. From the data set, it can be noted that HCPs are often assigned to more than one institution. Most of the providers with information about their workplace are assigned to only one medical institution (75.4%), followed by two (18.2%) and three institutions (5.8%). Only 1.6% of the HCPs are assigned to more than three institutions. This information is missing in 83.7% of acquired HCPs.

Reviews and Ratings. With 81,765 review texts, we have acquired quite a small amount of data compared to PRWs considered in the literature so far [6, 18]. This may be related to the different population sizes in Lithuania vs. the USA. The reviews are distributed in such a way that 6,750 HCPs (12%) are covered. However, this does not mean that these providers were not evaluated at all – in total 167,050 (quantitative) recommendations were provided. 9,124 HCPs (16%) have at least one rating. The average number of ratings for all HCPs with at least one rating is nine, with 48,187 HCPs (84%) having received no rating at all.

3.3 Identified Spam

Unlike the PRWs we have examined so far, "`Pincetas.lt`" uses only a few anti-spam techniques (e.g. captchas) and no anti-fake measures were identified. This is risky because spammers and fakers are interested in the data for several reasons: On the one hand, there are competing HCPs who maybe want to negatively review other HCPs or give positive ones to themselves. On the other hand, patients, who react emotionally to a perceived treatment, can review one or more HCPs several times. A third possible case could be that a PRW itself generates (fake) reviews. Due to this fact, we may have to exclude certain reviews from our investigation as they do not meet our quality standards. When the number of HCP's published reviews is compared to the given total amount of reviews on top of the page, we noticed mismatches. For example, one doctor is said to have 23 reviews while only 20 are visible. We assume the hiding of offensive and dubious reviews, especially as this sample HCP received very negative grades.

4 What Data Tells Us: Insights into Our Findings

In the following, we focus on the ratings, reviews, overall quality and evaluate the information about the reviewers. After that, we conduct a qualitative evaluation of the PRW and point out possible improvements.

4.1 HCPs in Detail

The highest number of qualitative reviews received by one HCP is 249 and 1,256 recommendations. These values are comparable to other European PRWs. HCPs' activity on PRWs is also comparable, there are HCPs who participate very actively on PRWs, comment on reviews, and maintain their profiles and there are some who seem to completely refuse this medium. It is mainly explained by the fact that the HCPs do

not register themselves on these websites. Participation and approval of a HCP is not mandatory. This is of course a disadvantage because the overall data quality would increase through higher HCP participation. While HCPs' addresses are not provided on this PRW, the ones of workplaces like hospitals are made public (see Fig. 2). Since most HCPs are associated with workplaces such as hospitals and medical practices, we consider the workplaces as representative for a distribution of HCPs. As Fig. 2 shows, most HCPs are in Vilnius (capital city) and Kaunas (second largest city). Therefore, this is unsurprising because these are Lithuania's biggest cities [30]. However, rural areas seem to be underrepresented in comparison to bigger cities.

4.2 Ratings and Reviews

As already mentioned, a distinction must be made between ratings and reviews. It is possible to evaluate an HCP quantitatively and qualitatively, while the qualitative evaluation (review) is optional. For this reason, there are more quantitative ratings (167,050) than qualitative reviews (81,765). In other words, more than half of the submitted ratings are without review text. As stated before, we expect even some hidden reviews because 81,765 reviews are online, but arithmetically, there should be 83,926 reviews in total (i.e. sum of all review counters on the HCPs' profiles).

Eight dimensions can be quantitatively evaluated (see Table 2). Currently, all dimensions have to be rated. However, there are also HCP profiles in which not all dimensions are specified. This may be a mistake, or the rating system has been changed over the years. The peculiarity of the investigated PRW is that the reviewers do not assign a specific quantitative rating per dimension (such as 1 to 5 out of 5 stars) but select one of the predefined values, which are mapped to a floating-point grade scale from 1 to 5 by the PRW (5 is best). In addition to these dimensions, an indication has to be given, whether the HCP can be recommended or not. As already mentioned, the grades are interrogated by phrases. For example, for a very effective perceived treatment, a matching answer is "*Pilnai išgydė*" (cured completely) for the best rating (5). Furthermore, when it comes to the waiting period in a HCP's office, patients were asked to provide the waiting time. The conversion to a grade then provides e.g. zero minutes as grade 5 and 15 to 20 min as grade 3. For other users, there are only numerical grades visible on the HCP's profile. The profile coverage shown in Table 2 refers to how many of the 11,436 HCPs with at least one rating received a rating in this dimension. It turns out that all dimensions are rated well on average. This raises the question of whether the ratings may be different for the individual areas of specialization. And it is proven that within this data set, the ratings vary depending on the area of specialization: Table 3 shows the best and worst grades per rating dimension, excluding the area of specialization with less than ten ratings. In addition, only the primary specialization has been taken into account, as indicated by HCPs on their pages.

Further findings can be found in the written reviews. The 81,765 reviews consist of 74% positive and 26% negative reviews (based on recommendation). This fits existing research [24], according to which, despite all perceptions, PRWs are predominantly evaluated positively [12, 23]. In general, reviews tend to be either very positive or

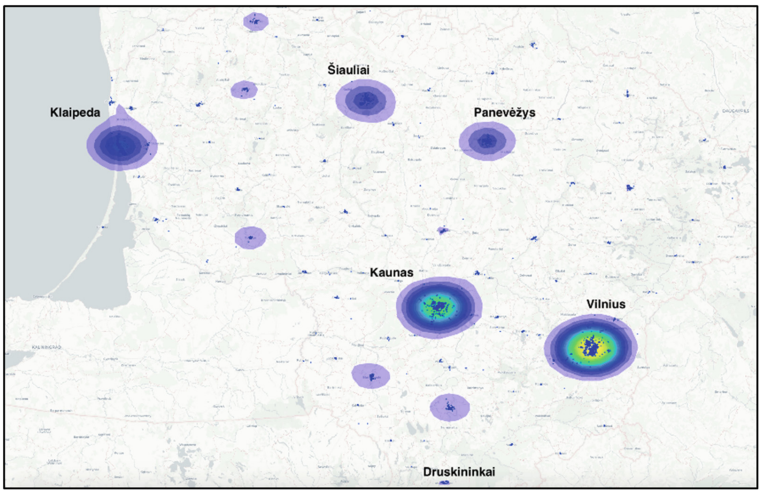

Fig. 2. Distribution of HCPs based on medical institutions

Table 2. Rating dimensions, grades and profile coverage

Rating dimension	Ø Grade	Coverage
Ar atsakė į visus Jums rūpimus klausimus? Were all your questions answered?	4.07 of 5	11,321 (**98.9%**)
Ar skyrė pakankamai laiko? Did you receive sufficient time for treatment?	4.02 of 5	11,308 (98.8%)
Kaip vertinate paslaugų kainas? How do you rate the service prices?	**4.42** of 5	11,242 (98.3%)
Kaip tiksliai diagnozavo Jūsų problemą? How accurately was your illness diagnosed?	4.13 of 5	11,236 (98.3%)
Kiek laiko laukėte, kol Jus priims? How long did you wait for the appointment?	**3.76** of 5	11,164 (97.6%)
Ar paskirtas gydymas buvo veiksmingas? Was the prescribed treatment effective?	4.03 of 5	11,106 (97.1%)
Ar po apsilankymo pasidomėjo kaip jaučiatės? Was there a follow-up contact?	3.96 of 5	8,879 (**77.6%**)
Ar atsilyginote gydytojui asmeniškai? Did you pay the doctor directly, i.e. extra?	No data acquired	

negative [22]. However negative reviews have a stronger impact than positive ones [31].

So far, we have not seen any PRW with a high response rate from the HCPs. There are, indeed, good reasons not to react [24]. It is the same in this analyzed PRW: Just 0.17% of the reviews received replies from the HCP. It is noticeable that these are not only reactions to negative reviews, but also words of gratitude. In this context, we have looked at the communication regarding the used sentiment words. Thus, the most

Table 3. Average ratings per area of specialization

Dimension	Ø Grades	Area of specialization
Answered questions	4.6 3.4	*Odontologija* (odontology) Vaikų pulmonologija (pediatric pulmonology)
Treatment time	4.6 3.4	*Odontologija* (odontology) *Neurologija* (neurology)
Service prices	4.9 3.3	*Vaikų hematologija* (children's Hematology) *Patologija* (pathology)
Diagnose accuracy	4.9 3.4	*Burnos higiena* (oral hygiene) *Vaikų neurologija* (child Neurology)
Waiting period	4.9 2.7	*Dantų technika* (dental technology) *Vaikų pulmonologija* (pediatric pulmonology)
Treatment efficiency	4.9 3.4	*Burnos higiena* (oral hygiene) *Neurologija* (neurology)
Follow-up contact	4.6 3.4	*Širdies chirurgija* (heart surgery) *Dermatovenerologija* (dermatovenerology)

common sentiment words (1- to 2-grams) in positive reviews are "*ačiū*" (thanks), "*puiki*" (great) and "*maloni*" (nice), while negative reviews are dominated by "(*labai*) *nemaloni*" (very unpleasant), "*nieko gero*" (nothing good), "*nerekomenduoju*" (not recommend). Here, it should be noted that a review can also just consist of one word, e.g. "*ačiū"* (thanks). The shortest reviews found on the PRW have a length of one character (e.g. ".", "+"), while the average in the whole data set is 188 characters. The longest review has 7,247 characters and is negative. However, on average, negative reviews (290 characters) are longer than positive ones (152 characters).

Because of the frequency analysis, we identified many duplicates in the database – even if looking for 6-gram phrases. The reasons for that can be different (e.g. spam). An example therefore is "*Sveiki, norėčiau pasidalinti savo nuomone*" ("Hello, I'd like to share my opinion"). A phrase that is found twice in the data set and written for the same HCP within four minutes. It can be assumed that it was an unintentional duplicate review. Other examples indeed suggest systematic spam activity. Since we have repeatedly recognized the use of phrases from other reviews in supposed spam reviews, we have developed a graph-based procedure for further analysis. We have divided all reviews into sentences and then identified those which are often used in reviews (Fig. 3). On one hand, this leads to sentences like "*buvo nemalonų*" (was unpleasant) being marked as frequent, which is not critical. On the other hand, reviews that are partially copied or even whole copies are detected. We split our 81,765 reviews into 167,123 sentences, of which 96.5% are unique and 3.5% are used in more than one review (full copies). We can only speculate about the motivation to mix different existing texts to create new reviews. In the case of review duplicates, we cannot exclude that patients copy existing reviews for the same HCP, when they share the same opinion. This would also explain why years have sometimes passed between such duplicates. Unfortunately, we have limited space in this study to describe this situation in more detail. However, one example for plagiarism is given in Fig. 4, which shows a case where all sentences are identical in both reviews. If we look at further details in

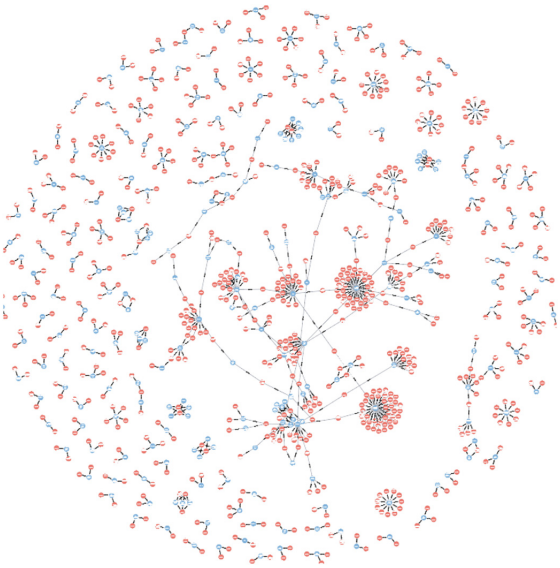

Fig. 3. Sentences and their appearance among different reviews

our data set, an anomaly can be assumed, since the reviews were written within five minutes for the same HCP from the same IP address.

It is more difficult to detect duplicates, in which marginal changes (in many cases numbers) are present (see Fig. 5). In this example, the HCP with ID 2497 has four ratings of this kind (three of them are visible in Fig. 5). While the first one was written in 2011, the other three reviews were written within three months in 2017. Since three of the four reviews can be assigned to the same IP address, this could be a patient who often visits the HCP and simply expresses the same opinion over and over again. However, this does not explain why so many other HCPs have identical review texts.

4.3 Insights into User's Review Behavior

In the following, we will take a look at the reviewers. What can we learn about those who give ratings and write reviews?

Reviewer Location. The acquired data set has a special feature that we have not had in similar data sets examined so far: Reviews are not anonymous but have a unique IP address. This is surprising, since previous work assumed that reviews in this domain deserve special privacy protection and PRWs are also interested in this protection [6]. At the same time, this protection of the reviewers ensured that it was not possible to analyze the reviewer's behavior. Now, this is possible with the clearly marked data. However, there are two aspects to consider: On the one hand, patients and reviewers do not have to appear in person [17]. This means that a review does not necessarily represent the opinion of the patient (third party representation). It also means that a reviewer does not even necessarily have to be the patient (fake reviews). On the other

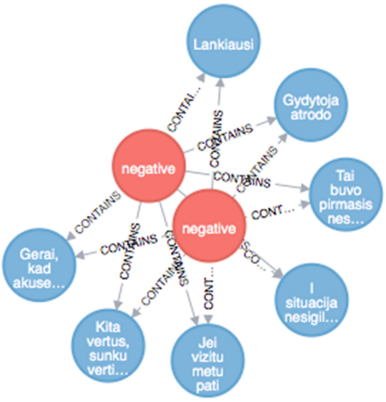

Fig. 4. Detected plagiarism

2497	Manau reikėtų pervertinti gydytojos kvalifikaciją. Pirmą kartą konsultacijos laukiau apie 30 min, registratūroje tuo metu slaugytojos
10199	Manau reikėtų pervertinti gydytojos kvalifikaciją. Pirmą kartą konsultacijos laukiau apie 30 min, registratūroje tuo metu slaugytojos
20135	Manau reikėtų pervertinti gydytojos kvalifikaciją. Pirmą kartą konsultacijos laukiau apie 30 min, registratūroje tuo metu slaugytojos
2751	Manau reikėtų pervertinti gydytojos kvalifikaciją. Pirmą kartą konsultacijos laukiau apie 45 min, registratūroje tuo metu slaugytojos
2497	Manau reikėtų pervertinti gydytojos kvalifikaciją. Pirmą kartą konsultacijos laukiau apie 45 min, registratūroje tuo metu slaugytojos
2497	Manau reikėtų pervertinti šitos gydytojos kvalifikaciją. Pirmą kartą konsultacijos laukiau apie 45 min, registratūroje tuo metu slaugy
8274	Manau reikėtų pervertinti šitos gydytojos kvalifikaciją. Pirmą kartą konsultacijos laukiau apie 45 min, registratūroje tuo metu slaugy

Fig. 5. Examples of duplicates with marginal changes

hand, reviewer can hide IP addresses (by using e.g. VPN, proxy servers) or IP addresses are used by several people (e.g. public Wi-Fi). This is possible in public areas such as medical institutions, stations of public transportation or catering establishments.

By taking into account the mentioned limitations, a few interesting findings can be derived: In total, ratings from 80 countries were submitted. The locations from all over Europe can be found in Fig. 6. Unsurprisingly, since "`Pincetas.lt`" is only available in Lithuanian, 94% of the reviews come from Lithuania (55.2% from Vilnius, 21.6% from Kaunas and 8.9% from Klaipėda). Another 1.3% come from the United Kingdom, 0.8% from the USA and 0.6% from Germany. This distribution of countries is in line with emigration movements[4] and therefore appears coherent. Furthermore, there is no significant difference in the distribution of positive and negative reviews with reference to the country of origin. While there were no significant numbers of reviews from Russia (0.2%, mostly from Moscow), still a few Russian reviews can be found. This is also remarkable because the registration process is in Lithuanian, too. More noticeable is the number of ratings given per IP address. Are there IP addresses that rate very often or that always rate only one provider? This could be useful for spam and fake review detection. On average, 1.6 reviews are assigned per IP address, while 74% of IP addresses are assigned to only one review, 16% are assigned to two, and 5% to three reviews. This number of reviews is considering that several doctors, nurses and

[4] See for more information: http://123.emn.lt/en/, accessed 16/01/2018.

pharmacists can be involved in a treatment as HCPs. Especially without any temporal information, this number can be judged as inconspicuous IP addresses with five or more reviews (3.4%) are more interesting when they are written within a defined period (e.g. month). There are several examples in the data set: An eye-catching example is an IP address (185.127.*.*) which wrote 198 reviews within June to December 2017 and thus evaluated 148 HCPs. On one single day, 21 reviews were written for different HCPs, but all of them, with one exception, were negative. It is also very noteworthy that the texts are very similar: Some of them are 1:1 plagiarism, some of them are copied texts with marginal changes. What is surprising here is the fact that the phrases are also used in reviews of others.

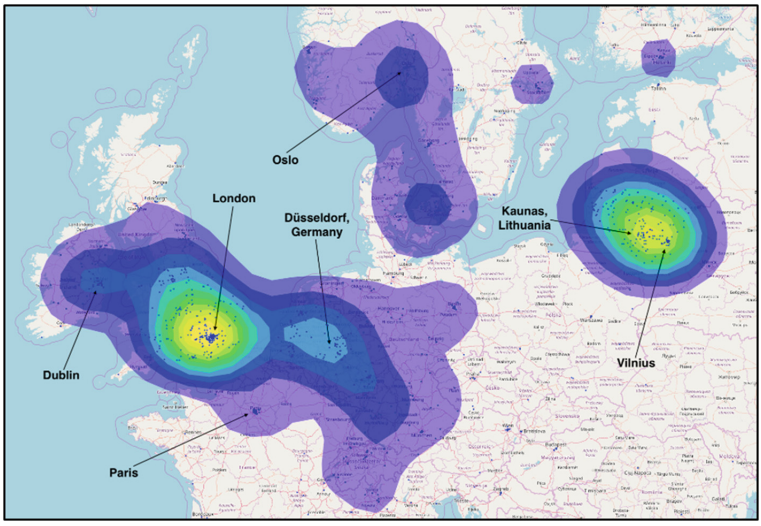

Fig. 6. European reviewer locations based on the provided IP addresses

5 Looking Beyond Own Data: A Discussion

The investigated PRW shows several differences compared to international competitors. This concerns the on-page functions on the one hand and the quality of provided information (in particular the review texts) on the other hand, e.g. protection mechanisms against spam.

On the positive side, it should be noted that the PRW reflects well the national characteristics. We have rarely seen PRWs listing licenses of HCPs, which is a favorable feature. It is particularly interesting to see which licenses have expired. This ensures high transparency (assuming that this data is also maintained). Showing IP addresses of reviewers is difficult to evaluate. On the one hand, this can prevent abuse;

on the other hand, this may harm the privacy of users. As the debate about cyberbullying[5] is strong in Lithuania [3, 13], the PRW meets national standards here. Whether it would be a better solution, for example, to use hash values or unique IDs, is at least to be considered. IP addresses allow user tracking across pages, which should be avoided due to privacy concerns. Assuming that reviews are usually written honestly, users face a serious lack of privacy. Nevertheless, showing an identifier of non-registered users demonstrates a fair-use policy to everyone. An interesting finding derived from the IP addresses is the geographical distribution of the reviews. While most reviews come from Lithuania, the others are mostly sent from common emigration destinations of Lithuanians. This is a plus for the data quality and a finding that cannot be drawn from other PRWs. In addition, the IP addresses gave us a clue to detect spam and fake reviews. Unfortunately, we found that the quality of this PRW is significantly lower than comparable PRWs. While "`Jameda.de`" has between 0 and 223 reviews per HCP, the Lithuanian PRW has between 0 and 249 reviews though being a considerably less-used service. It is interesting that at "`Jameda.de`", there are only 2% of reviews exclusively quantitative [18], while on this PRW there are roughly 50% quantitative. Moreover, the regarded PRW could be improved by making use of the true rating dimensions. That is, users rate HCPs according to textual expressions which are converted into grades. Giving the information that, for example, grade 3 is a waiting period of 15–30 min would be beneficial for all involved parties and more informative than numerical grades, especially due to various ways of understanding grades.

Furthermore, the function to link research and news articles related to a HCP is an interesting next step providing more information about the professionality of the HCPs. In comparison, "`Jameda.de`" provides an article feature while recommending topic-related articles, when viewing a HCP's profile. Furthermore, they provide detailed reviews including single grades given per review. Additionally, they provide business hours, addresses and so forth. A non-distinguishing function is the self-presentation on the German PRWs. HCPs can upload pictures of their practice, specify their treatment focus, education, etc. Here, the investigated Lithuanian PRW seems rather simple. If necessary, payed HCP pages and features could also be a business concept for "`Pincetas.lt`." However, "`Jameda.de`", is criticized for precisely this service because it is assumed that paying HCPs receive better grades. Moreover, on-page advertising doesn't make PRWs appear particularly trustworthy.

6 Conclusion and Future Work

This study investigates Lithuanian medical information websites and the largest Lithuanian PRW in particular. We chose Lithuania because it has a PRW that experiences a high usage as well as growth during the last years, as stated before. It became clear that Lithuania has a large number of information portals covering a wide range of information (Sect. 2). We have also shown that PRWs are a well-researched area and

[5] See https://cyberbullying.org, accessed: 22/01/2018.

that they play an important role for independent patient information. On the one hand, PRWs are navigators in the medical profession and on the other hand, they serve as an interaction platform for patients, which can reduce the imbalance of power between HCPs and patients. Unfortunately, this is precisely where we found out that this Lithuanian PRW still has some shortcomings.

The overall quality of the review texts is not satisfactory, because there are a lot of fake and spam reviews. Furthermore, it is not certain whether the reviewers are really patients, since no verification of the information takes place. Moreover, it is not possible for patients to understand how the overall grades of the HCPs are calculated, as the grades are not broken down. More transparency is needed on the analyzed PRW.

In sum, it can be said that the studied PRW is a valuable tool for patients to obtain and share information about HCPs. Here, HCPs get the chance to receive and comment on the concerns and feedback of patients. The offered features are comparable with other PRWs from Germany and the USA. However, since patients rely on the quality of information, there are still some improvements to be done. As we have opened the topic of international PRWs, we are keen on further studying these websites. As demonstrated by earlier research, PRWs are already influencing HCP's performance and as PRWs are a central mean for choosing a HCP, further research in this area will be productive. This study has investigated quality information on a Lithuanian PRW and made a brief comparison to prior experiences with German and American PRWs.

In the future, we want to extensively investigate PRWs from several countries in order to provide a broad-based comparison. We are interested in Eastern European, Central European, North American and Asian PRWs. We expect not only qualitative results from a comparison, but data-based findings gathered by NLP approaches.

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