Analysis of Instagram® Posts Referring to Cleft Lip

Magdalena Sycinska-Dziarnowska 1, Piotr Stepien 2, Joanna Janiszewska-Olszowska 3,*, Katarzyna Grocholewicz 1, Maciej Jedlinski 1, Roberta Grassi 4 and Marta Mazur 5

1 Department of Interdisciplinary Dentistry, Pomeranian Medical University in Szczecin, 70111 Szczecin, Poland; magdadziarnowska@gmail.com (M.S.-D.); katgro@pum.edu.pl (K.G.);
maciej.jedlinski@hotmail.com (M.J.)
2 Department of Technology and Education, Koszalin University of Technology, 75453 Koszalin, Poland;
piotr.stepien@tu.koszalin.pl
3 Department of General Dentistry, Pomeranian Medical University in Szczecin, 70111 Szczecin, Poland
4 Department of Surgical, Medical and Experimental Sciences, University of Sassari, 07100 Sassari, Italy;
grassi.roberta93@gmail.com
5 Department of Oral and Maxillofacial Sciences, Sapienza University of Rome, 00161 Rome, Italy; marta.mazur@uniroma1.it
* Correspondence: jjo@pum.edu.pl

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Abstract: Background: Social media has become a source of medical information. Cleft lip and palate is a visible congenital anomaly. The aim of the study was to analyze Instagram® posts on the topic of cleft lip. Methods: Instagram® posts with “#cleftlip” from March 2014–March 2017 were accessed. Separate lists of expressions (hashtags, meaningful words, words with emojis or emojis alone) were prepared for primary posts and for replies. Thirty expressions statistically most frequent in primary versus secondary posts and 30 in secondary versus primary posts were identified (Group 1) as well as 30 English words or hashtags (Group 2), non-English words or hashtags (Group 3) and emojis (Group 4). The frequencies of expressions were compared (Z-test for the difference of two population proportions). Results: There were 34,129 posts, (5427 primary posts and 28,702 replies), containing 62,163 expressions, (35,004 in primary posts). The occurrence of all expressions was 454,162, (225,418 in primary posts and 228,744 in replies). Posts with positive expressions such as “beautiful”, “love”, “cute”, “great”, “awesome” occurred more often than these with negative ones. In replies all emojis were positive. Conclusions: Numerous Instagram® posts referring to cleft lip are published and do provoke discussion. People express their solidarity and sympathize with persons affected by cleft.

Keywords: cleft palate; internet; social media

1. Introduction

Instagram® (Facebook, Inc., Menlo Park, CA, USA) is an online photo-sharing application and service, where users may share pictures or videos. It was launched in October 2010 as a free mobile application. On 21 December 2016 it was announced that its community has grown to more than 600 million users and the last 100 million of Instagrammers joined in the past six months [1]. On 26 April 2017 it was announced on Instagram® website that its popularity has grown to 700 million Instagrammers [1].

Since 2012, when 13% people used this service, a significant increase of usage is observed. According to a national survey carried out between 7 March and 4 April 2016 on 1520 adults, about 32% of online adults (e.g., American people who currently use the Internet, according to the same survey it was 86% of the population) or 28% of all adult Americans report using Instagram®—roughly the same share as in 2015, when 27% of online adults used the application. Instagram® use was especially...
high among younger adults; 59% Instagrammers were people between 18–29 year, whereas 8% only were older than 65. According to Pew Research Center women were more likely to use this service (38%) than men (26%). Half of Instagram® users access the platform daily, 35% of them several times a day [2].

Instagram® reflects major social trends, especially among young population. People use Instagram® for communication and entertainment or to express thoughts, moods and feelings. Nowadays, social media play an important role in searching for information by medical caregivers or patients who might look for answers to their questions online [3–6]. Several papers pertaining to the use of social media in the context of a medical problem (diabetes, Zika virus, arthroplasty) could be found. By interacting with other users, people with medical problems may provide or gain support and share information.

Numerous social media network analyzers are available online. One of them is Netlytic [7]. It allows to automatically summarize and gather data from online conversations found on social media sites [7]. A few questionnaire studies on the use of social media in the context of cleft lip has been published in the recent years [8,9]. No studies based on social media surveillance for cleft lip could be found.

The aim of the study was to analyze the frequency of individual meaningful words, emojis, emoticons or hashtags and to compare their frequency in Instagram® posts and their replies.

2. Materials and Methods

2.1. Instagram® Surveillance

The analysis of the content of Instagram® posts was initiated by querying the hashtag #cleftlip using the Netlytic service (netlytic.org, Toronto, ON, Canada), an open-sourced software. All tagged messages with the #cleftlip hashtag on Instagram® were downloaded and exported to a spreadsheet. The download was started on 17 February 2017; it enabled data collection from Instagram® search every hour until 4 March 2017. The data gathered covered all posts from public profiles published by Instagram®. The first captured post was published on 11 March 2014 and the last one on 4 March 2017. Thus, the data contained posts published for almost three years.

The posts collected were divided into primary posts and secondary posts (replies). Primary posts consisted of pictures and their descriptions posted by Instagram® users. Secondary posts were responses to primary posts written by other users or by the author of primary post. Two separate lists of all expressions (hashtags, meaningful words, words combined with emojis or emojis alone) present in the posts were prepared for primary posts and for secondary ones. For the purpose of this article both emojis and emoticons were later stated as emojis. A spreadsheet macro was written to assign each expression the number of occurrences in all primary and secondary posts. Capitalization of letters was ignored as well as dots, commas, exclamation marks and question marks. Then, both lists were grouped into one, containing expressions sorted in descending order by the number of occurrences in primary posts ($x_1$), and each expression was also assigned the number of occurrences in secondary posts ($x_2$). The total list consisted of 62,163 expressions.

The proportion $\hat{p}_1$ of the number of occurrences of each expression in the total number of occurrences of all expressions in primary posts ($n_1$) was calculated. A similar procedure was applied to secondary posts in order to calculate proportion $\hat{p}_2$ from $x_2$ and the total number of occurrences of all expressions in secondary posts ($n_2$):

$$\hat{p}_1 = \frac{x_1}{n_1}$$  
$$\hat{p}_2 = \frac{x_2}{n_2}$$

On the basis of the calculated absolute value of the test statistic z (see the section “Statistical analysis”), 30 expressions statistically most frequent in the primary versus secondary posts were
identified and tabularized. Similarly, 30 expressions statistically most frequent in the secondary versus primary posts were identified. All together the 60 expressions have been placed in Table 1 and designated as Group 1 of expressions. The same procedure has been applied to English words or hashtags (Group 2, Table 2), non-English words or hashtags (Group 3, Table 3) and emojis (Group 4, Table 4). There were no emojis statistically more frequent found in primary versus secondary posts, thus Table 4 consists of 30 emojis from secondary posts only.

| N  | Expressions Dominating in Primary Posts | Expressions Dominating in Secondary Posts |
|----|---------------------------------------|------------------------------------------|
| 1  | #cleftlip 14111 681 53.136 beautiful 173 1647 32.753 |
| 2  | #cleftpalate 1662 359 31.150 love 442 1791 26.535 |
| 3  | #cleftstrong 1459 425 25.889 thank 158 1172 26.239 |
| 4  | #cleftlipandpalate 572 55 21.823 cute 65 848 24.609 |
| 5  | #left 756 209 19.062 😘 104 835 22.528 |
| 6  | #11n700 383 29 18.389 😍 84 630 19.268 |
| 7  | cleft 1254 575 17.881 great 124 701 18.835 |
| 8  | #cleftcutie 768 247 17.841 nice 18 439 18.760 |
| 9  | lip 907 344 17.570 awesome 34 478 18.634 |
| 10 | #cleftproud 563 168 15.867 thanks 70 524 17.561 |
| 11 | #cleftie 284 25 15.552 lindo 14 373 17.389 |
| 12 | #smile 303 39 15.135 gorgeous 14 370 17.310 |
| 13 | #dogs 167 6 12.852 bless 11 360 17.277 |
| 14 | #puppy 184 13 12.835 :) 36 411 16.811 |
| 15 | #love 281 60 12.823 adorable 38 416 16.807 |
| 16 | #cleftbabies 155 5 12.446 sweet 105 568 16.710 |
| 17 | today 304 80 12.337 wow 5 319 16.657 |
| 18 | #beautiful 150 5 12.225 😘 6 301 16.069 |
| 19 | #labioleporino 218 39 11.907 😱 16 323 15.867 |
| 20 | mission 155 12 11.665 precious 14 292 15.125 |
| 21 | #plasticsurgery 208 38 11.564 😊 34 326 14.556 |
| 22 | #dog 134 7 11.246 god 87 435 14.226 |
| 23 | #selfie 127 5 11.152 😍 9 238 13.880 |
| 24 | children 235 63 10.760 amazing 171 584 13.820 |
| 25 | #surgery 159 23 10.705 good 155 552 13.759 |
| 26 | #squishyfacecrew 148 21 10.370 handsome 34 292 13.494 |
| 27 | surgery 507 264 10.029 cutie 31 283 13.441 |
| 28 | new 299 115 9.980 📸 9 222 13.346 |
| 29 | #charity 157 30 9.918 cool 18 224 12.557 |
| 30 | #babiesofinstagram 115 10 9.909 looks 59 306 12.085 |

\(x_1\)—number of occurrences in primary posts, \(x_2\)—number of occurrences in secondary posts, abs\(z\)—absolute value of test statistic.
Table 2. Group two—English words or hashtags with the most statistically significant difference in the frequency of occurrence.

| Nº | English Words or Hashtags Dominating in Primary Posts | English Words or Hashtags Dominating in Secondary Posts |
|----|------------------------------------------------------|--------------------------------------------------------|
|    | Word or Hashtag                                      | Word or Hashtag                                        |
|    | $x_1$  | $x_2$  | $\text{abs}(z)$ | $x_1$  | $x_2$  | $\text{abs}(z)$ |
| 1  | #cleftlip | 4110  | 681  | 53.136 | beautiful | 173  | 1647  | 32.753 |
| 2  | #cleftpalate | 1662  | 359  | 31.150 | love | 442  | 1791  | 26.535 |
| 3  | #cleftstrong | 1459  | 425  | 25.889 | thank | 158  | 1172  | 26.239 |
| 4  | #cleftlipandpalate | 572  | 55  | 21.823 | cute | 65  | 848  | 24.609 |
| 5  | #cleft | 756  | 209  | 19.062 | great | 124  | 701  | 18.835 |
| 6  | #1in700 | 383  | 29  | 18.381 | nice | 18  | 439  | 18.760 |
| 7  | cleft | 1254  | 575  | 17.881 | awesome | 34  | 478  | 18.634 |
| 8  | #cleftcutie | 768  | 247  | 17.841 | thanks | 70  | 524  | 17.561 |
| 9  | lip | 907  | 344  | 17.570 | gorgeous | 14  | 370  | 17.310 |
| 10 | #cleftproud | 563  | 168  | 15.867 | bless | 11  | 360  | 17.277 |
| 11 | #cleftie | 284  | 25  | 15.552 | adorable | 38  | 416  | 16.807 |
| 12 | #smile | 303  | 39  | 15.135 | sweet | 105  | 568  | 16.710 |
| 13 | #dogs | 167  | 6  | 12.852 | wow | 5  | 319  | 16.657 |
| 14 | #puppy | 184  | 13  | 12.835 | precious | 14  | 292  | 15.125 |
| 15 | #love | 281  | 60  | 12.823 | god | 87  | 435  | 14.226 |
| 16 | #cleftbabies | 155  | 5  | 12.446 | amazing | 171  | 584  | 13.820 |
| 17 | today | 304  | 80  | 12.337 | good | 155  | 552  | 13.759 |
| 18 | #beautiful | 150  | 5  | 12.225 | handsome | 34  | 292  | 13.494 |
| 19 | mission | 155  | 12  | 11.665 | cutie | 31  | 283  | 13.441 |
| 20 | #plasticsurgery | 208  | 38  | 11.564 | cool | 18  | 224  | 12.557 |
| 21 | #dog | 134  | 7  | 11.146 | looks | 59  | 306  | 12.085 |
| 22 | #selfie | 127  | 5  | 11.152 | luck | 6  | 150  | 10.979 |
| 23 | children | 235  | 63  | 10.760 | lovely | 16  | 168  | 10.607 |
| 24 | #surgery | 159  | 23  | 10.705 | like | 296  | 652  | 10.197 |
| 25 | #squishyfacecrew | 148  | 21  | 10.370 | job | 29  | 189  | 10.183 |
| 26 | surgery | 507  | 264  | 10.029 | prayers | 20  | 164  | 10.016 |
| 27 | new | 299  | 115  | 9.980 | happy | 277  | 611  | 9.886 |
| 28 | #charity | 157  | 30  | 9.918 | super | 36  | 197  | 9.871 |
| 29 | #babiesofinstagram | 115  | 10  | 9.909 | hi | 10  | 125  | 9.384 |
| 30 | #happy | 114  | 10  | 9.855 | lol | 26  | 162  | 9.311 |

$x_1$—number of occurrences in primary posts, $x_2$—number of occurrences in secondary posts, $\text{abs}(z)$—absolute value of test statistic.
Table 3. Group three—non-English words or hashtags with the most statistically significant difference in the frequency of occurrence.

| Nº | Non-English Words or Hashtags Dominating in Primary Posts | Translation | Language | $x_1$ | $x_2$ | abs(z) |
|----|----------------------------------------------------------|-------------|---------|-------|-------|-------|
| 1  | #labioleporino                                          | cleftlip    | Spanish | 218   | 39    | 11.907|
| 2  | #fissuralabiopalatina                                    | cleftpalate | Spanish | 74    | 9     | 7.555 |
| 3  | #maternidade                                            | maternity   | Portuguese | 65 | 6    | 7.391 |
| 4  | #maedepriemiraviagem                                    | firsttimemom | Portuguese | 52 | 7    | 6.213 |
| 5  | idag                                                    | today       | Swedish | 54    | 9     | 6.035 |
| 6  | #fissuradapelacecilia                                    | ceciliasfissure | Portuguese | 50 | 9    | 5.691 |
| 7  | #pormaiassorrisoemvergonha                             | formoreshamelessmile | Portuguese | 39 | 9    | 4.648 |
| 8  | hoje                                                   | today       | Portuguese | 49 | 17   | 4.311 |
| 9  | blev                                                    | became      | Danish   | 31    | 7     | 4.176 |
| 10 | #abogoiás                                              | imfromgoias | Portuguese/Spanish | 37 | 12   | 3.892 |
| 11 | bibir                                                   | lip         | Indonesian | 34 | 11   | 3.736 |
| 12 | #maedemenina                                            | motherofgirl | Portuguese | 30 | 9    | 3.649 |
| 13 | labial                                                  | lip         | Spanish   | 24    | 6     | 3.538 |
| 14 | pappa                                                   | dad         | Swedish   | 22    | 5     | 3.510 |
| 15 | dudak                                                   | lip         | Turkish   | 38    | 15    | 3.492 |
| 16 | mamãe                                                   | mom         | Portuguese | 52 | 25   | 3.478 |
| 17 | operasi                                                 | operation   | Indonesian | 45 | 21   | 3.325 |
| 18 | bayi                                                    | baby        | Indonesian | 28 | 10   | 3.202 |
| 19 | vamos                                                   | come on     | Spanish   | 25    | 9     | 3.011 |
| 20 | paladar                                                 | palate      | Spanish   | 25    | 9     | 3.011 |
| 21 | pacientes                                               | patients    | Spanish   | 20    | 6     | 2.979 |
| 22 | fick                                                    | got         | Swedish   | 30    | 13    | 2.892 |
| 23 | hendido                                                 | cleft       | Spanish   | 21    | 7     | 2.888 |
| 24 | akan                                                    | will        | Indonesian | 30 | 14   | 2.715 |
| 25 | dias                                                    | days        | Portuguese | 27 | 12   | 2.687 |
| 26 | semanas                                                 | week        | Portuguese | 17 | 6    | 2.513 |
| 27 | hari                                                    | day         | Indonesian | 27 | 13   | 2.502 |
| 28 | labio                                                   | lip         | Spanish   | 36    | 20    | 2.479 |
| 29 | fissura                                                 | fissure     | Portuguese | 28 | 14   | 2.456 |
| 30 | #associacaoreface                                      | #faceassociation | Portuguese/Spanish | 60 | 41   | 2.348 |
| 1  | lindo                                                   | pretty      | Portuguese/Spanish | 14 | 373  | 17.389|
| 2  | linda                                                   | pretty      | Portuguese/Spanish | 11 | 160  | 10.817|
| 3  | gracias                                                 | thank you   | Spanish   | 15    | 141   | 9.536 |
| 4  | deus                                                    | God         | Portuguese | 41    | 193   | 9.258 |
| 5  | sehat                                                   | healthy     | Indonesian | 6    | 67    | 6.761 |
| 6  | muito                                                   | much        | Portuguese | 78    | 197   | 6.436 |
| 7  | coisa                                                   | thing       | Portuguese | 9    | 57    | 5.547 |
| 8  | mais                                                    | more        | Portuguese | 117   | 222   | 4.878 |
| 9  | amor                                                    | love        | Portuguese/Spanish | 26 | 80   | 4.785 |
Table 3. Cont.

| N° | Non-English Words or Hashtags Dominating in Primary Posts | Word or Hashtag | Translation | Language | abs(z) | x₁ | x₂ |
|----|-------------------------------------------------------|----------------|-------------|----------|-------|----|----|
| 10 | terus                                                 | continue       | Indonesian  | 6        | 37    | 4.436 |
| 11 | anak                                                  | child          | Indonesian  | 34       | 88    | 4.395 |
| 12 | buat                                                  | create         | Indonesian  | 7        | 33    | 3.829 |
| 13 | selalu                                                | always         | Indonesian  | 9        | 37    | 3.826 |
| 14 | certo                                                 | of course      | Italian     | 8        | 31    | 3.404 |
| 15 | mesmo                                                 | same           | Portuguese  | 17       | 47    | 3.392 |
| 16 | est                                                   | east           | French/Italian | 9    | 32    | 3.306 |
| 17 | bara                                                  | only           | Swedish     | 5        | 24    | 3.288 |
| 18 | sempre                                                | all time       | Italian     | 33       | 71    | 3.269 |
| 19 | obrigada                                              | thanks         | Portuguese  | 18       | 44    | 2.949 |
| 20 | kasih                                                 | love           | Indonesian  | 8        | 26    | 2.826 |
| 21 | gran                                                  | great          | Spanish     | 5        | 20    | 2.777 |
| 22 | mejor                                                 | best           | Spanish     | 8        | 25    | 2.703 |
| 23 | mau                                                   | want           | Indonesian  | 11       | 30    | 2.681 |
| 24 | skrg                                                  | now            | Indonesian  | 6        | 21    | 2.655 |
| 25 | cara                                                  | dear           | Italian     | 5        | 19    | 2.639 |
| 26 | quero                                                 | want           | Portuguese  | 5        | 19    | 2.639 |
| 27 | nasceu                                                | was born       | Portuguese  | 12       | 31    | 2.604 |
| 28 | tenho                                                 | I have         | Portuguese  | 10       | 27    | 2.523 |
| 29 | nya                                                    | new            | Swedish     | 39       | 70    | 2.500 |
| 30 | sama                                                  | same           | Indonesian  | 19       | 41    | 2.493 |

x₁—number of occurrences in primary posts, x₂—number of occurrences in secondary posts, abs(z)—absolute value of test statistic.

Table 4. Group four—emojis with the most statistically significant difference in the frequency of occurrence.

| N° | Emojis Dominating in Secondary Posts | Emoji | x₁ | x₂ | abs(z) |
|----|--------------------------------------|-------|----|----|-------|
| 1  |                                      | 😁    | 16 | 323| 15.867|
| 2  |                                      | 😊    | 34 | 326| 14.556|
| 3  |                                      | 😊😊  | 9  | 238| 13.880|
| 4  |                                      | 😊😊😊| 6  | 301| 16.069|
| 5  |                                      | 😊😊😊| 16 | 323| 15.867|
| 6  |                                      | 😊😊😊| 6  | 97 | 8.518 |
| 7  |                                      | 😊😊😊| 9  | 222| 13.346|
| 8  |                                      | 😊😊😊| 9  | 198| 8.531 |
| 9  |                                      | 😊😊😊| 52 | 198| 8.531 |
| 10 |                                      | 😊😊😊| 6  | 97 | 8.518 |
2.2. Statistical Analysis

The frequencies of selected expressions in the posts and their replies were compared using a z-test for the difference of two population proportions. The test statistic were applied for expressions meeting the following conditions: \( \min(n_1 \hat{p}_1, n_1 (1 - \hat{p}_1)) \geq 5 \) and \( \min(n_2 \hat{p}_2, n_2 (1 - \hat{p}_2)) \geq 5 \).

| N° | Emojis Dominating in Secondary Posts | \( x_1 \) | \( x_2 \) | abs(\( z \)) |
|----|------------------------------------|-----|-----|---------|
| 11 | 😊                                 | 5   | 93  | 8.452   |
| 12 | 😍😍😍                              | 10  | 102 | 8.225   |
| 13 | 🙌                                 | 10  | 94  | 7.785   |
| 14 | 😊                                 | 5   | 70  | 7.122   |
| 15 | 💖                                 | 5   | 67  | 6.931   |
| 16 | 😎                                 | 13  | 78  | 6.390   |
| 17 | 😊                                 | 10  | 70  | 6.311   |
| 18 | 😊                                 | 15  | 81  | 6.301   |
| 19 | 💖                                 | 9   | 67  | 6.266   |
| 20 | 😊                                 | 11  | 71  | 6.224   |
| 21 | 💖                                 | 65  | 171 | 6.214   |
| 22 | 😊                                 | 13  | 72  | 5.990   |
| 23 | 😊                                 | 6   | 51  | 5.625   |
| 24 | 😍😍😍                              | 5   | 47  | 5.505   |
| 25 | 😊                                 | 16  | 71  | 5.481   |
| 26 | 😍😍😍                              | 17  | 70  | 5.267   |
| 27 | 💖                                 | 6   | 44  | 5.060   |
| 28 | 💖                                 | 13  | 57  | 4.886   |
| 29 | 😊                                 | 7   | 41  | 4.599   |
| 30 | 😊                                 | 5   | 33  | 4.268   |

\( x_1 \)—number of occurrences in primary posts, \( x_2 \)—number of occurrences in secondary posts, abs(\( z \))—absolute value of test statistic.

Names, surnames, question marks, conjunctions, colons, pronouns and dashes were ignored as well as non-meaningful expressions. Emojis occurring one by one were considered as an independent type of emoji. For example, three hearts that occurred one by one were treated independently, as a more expressive form. Non-English expressions were recognized using available online dictionaries and translators (in most cases by Google Translator). If a non-English expression consisted of several words (e.g., #por mais sorrisos sem vergonha), they were separated (#por mais sorrisos sem vergonha) and translated with Google Translator (#for more shameless smile) and then concatenated (#formoreshamelesslysmile).
The null hypothesis $H_0: p_1 = p_2$ (the proportions in both statistical populations are equal) and the following alternative hypotheses were checked:

- two-tailed $H_1: p_1 \neq p_2$ (the proportions in both populations differ);
- one-tailed $H_1: p_1 > p_2$ or $H_1: p_1 < p_2$ (proportion among the expressions occurring in primary posts was higher than the proportion of expressions occurring in secondary posts and the proportion of expressions occurring in primary posts was lower than the proportion of expressions occurring in secondary posts respectively).

Three tests were made for the following hypotheses:

**Hypothesis 1.** $H_0: p_1 = p_2$, $H_1: p_1, p_2$

**Hypothesis 2.** $H_0: p_1 = p_2$, $H_1: p_1 > p_2$

**Hypothesis 3.** $H_0: p_1 = p_2$, $H_1: p_1 \in p_2$

Test 1 was performed for each expression, test 2 for expressions for which $\hat{p}_1 > \hat{p}_2$, and test 3 for expressions for which $\hat{p}_1 < \hat{p}_2$.

For each expression the pooled proportion $\bar{p}$ was calculated:

$$\bar{p} = \frac{x_1 + x_2}{n_1 + n_2}$$  \hspace{1cm} (3)

Value of test statistic was calculated as:

$$z = \frac{\hat{p}_1 - \hat{p}_2}{\sqrt{\bar{p}(1-\bar{p})\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}}$$  \hspace{1cm} (4)

The level of statistical significance was set at $\alpha = 0.05$ and for each test $p$-value was calculated. By comparing the $p$-value with the statistical significance level, it was stated whether there was enough evidence for rejecting $H_0$ for $H_1$ ($p$-value < $\alpha$) or not ($p$-value $\geq \alpha$). The datasets used and analyzed during the current study are available from the corresponding author on reasonable request.

3. Results

The total number of posts downloaded was 34,129 including 5427 primary posts and 28,702 secondary posts. There were 62,163 expressions found in all posts, including 35,004 in primary posts. The total occurrence of all expressions was 454,162, including 225,418 in primary posts and 228,744 in secondary posts. The test statistic conditions have been met for $n_1 = 147,323$ occurrences of expressions in primary posts and $n_2 = 161,270$ in secondary posts. As a result, 59,812 expressions (96.22% of total) had to be removed due to statistically unitary character, so 2351 expressions were tested. Finally, there were 4702 tests performed: 2351 for two-tailed alternative hypothesis and 2351 for one-tailed alternative hypotheses. The summary of the number of test cases decisions for the entire population is presented in Table 5. 1337 expressions were more frequent in primary posts and 1014 expressions were more frequent in secondary posts. As many as 1148 expressions were statistically significantly more frequent in primary or in secondary posts. However, 57.64% of the expressions were as often found in primary as in secondary posts, and 42.36% of expressions showed statistically significantly different frequencies. Out of the expressions that were more frequent in primary than in secondary posts in 51.53% there was no statistically significant dominance over the frequency of occurrences in replies, and 48.47% showed a statistically significantly higher rate of occurrence. Out of the expressions that occurred more frequently in secondary posts than in primary posts, in 50.69% cases there was no statistically significant dominance over the incidence of primary posts, and 49.31% had a statistically significant higher incidence.
Table 5. Summary of test results.

|      | NE  | IE  | Total |      | NE  | IE  | Total |      | NE  | IE  | Total |
|------|-----|-----|-------|------|-----|-----|-------|------|-----|-----|-------|
| H₀:  |     |     |       | H₀:  |     |     |       | H₀:  |     |     |       |
| p₁ = p₂ |     |     |       | p₁ = p₂ |     |     |       | p₁ > p₂ |     |     |       |
|      |     |     |       |      |     |     |       |      |     |     |       |
| NE   | 1355| 996 | 2351  | 689 | 648 | 1337 | 514  | 500 | 1014 |       |
| IE   | 57.64% | 42.36% | 100.00% | 51.53% | 48.47% | 100.00% | 50.69% | 49.31% | 100.00% |       |

IE—there is enough evidence to reject H₀, NE—there is not enough evidence to reject H₀.

It is seen that posts with expressions associated with positive emotions such as beautiful, love, cute, great, awesome occurred more often than with negative ones. In primary posts hashtags were much more frequent than in secondary posts. Among 30 expressions with the most significant difference in frequency of occurrences from the primary posts there were seven words that were not hashtags, for example: lip, cleft and surgery—so words related to the subject of our study. Hashtags used in the posts, help linking the photos and messages up to other subject on Instagram® featuring the same topic.

In the first group of expressions in primary posts dominated hashtags and words associated with cleft lip problem. What was surprising there were hashtags related to animals for example #dog or #puppy. In the same group in secondary posts, expressions with positive meaning were overwhelming. Among non-English words or hashtags a domination of Portuguese and Spanish languages was evident. Also Indonesian language was frequent especially among non-English words from secondary posts.

In group four, what was very surprising, no emojis were found that appeared more frequently in primary posts. The emojis appearing more frequently in secondary posts versus primary posts were the very popular ones, expressing emotions (heart, smile). In replies all emojis were highly positive.

4. Discussion

This is the first study of Instagram® posts dealing with the subject of cleft lip. The present study is based on the largest number of Instagram® posts on a medical problem of all papers found. In the study by Fung et al. [10] 616 Instagram® posts with hashtag #zikavirus were manually coded. Karimkhani et al. [11] analyzed 50 newest posts referring to dermatology. According to thematic content Pila et al. [12] analyzed a sample of 600 Instagram® posts with hashtag #cheatmeal. Another study of 649 Instagram® posts on total knee arthroplasty and 638 posts on total hip arthroplasty was conducted at the Department of Orthopedic Surgery in Cleveland and Houston [6]. Tiggemann and Zaccardo [13] were looking for fitspiration hashtag on Instagram® regarding to body type and activity. A group of the first 600 posts with #fitspiration hashtag were coded for textual and photo content. Yi-Frazier et al. [14] asked twenty teenagers 14 to 18 years old with diabetes type 1 to use Instagram® and post photos on diabetes-related themes. Twelve participants were highly engaged; the whole study lasted for three consecutive weeks. In the study by Chung et al. [15] 16 women were interviewed who consistently shared and recorded on Instagram® what they had eaten. Another study gathered 476 social media posts tagged with #fitspo among the four platforms. Relevant 415 of 476 posts (87.2%) were analyzed. The majority of posts were accessed from Instagram® (360/415, 86.8%) [16].

Medical problems analyzed by previous studies were Zika virus, skin problems, problems with diabetes and in more detail concerning care of diabetes foot [3,5,10,11,17]. Very popular subjects concerning social media were associated with diet, fitness or nutrition [12,13].

Referring to orthodontics, three studies could be found, one—pertaining to patient experience to orthodontic brackets versus Invisalign® [18], another one was a qualitative analysis of orthodontic-related posts on Twitter [19] the last one showed how social media improve knowledge among patients with fixed orthodontic appliance [4].
In the present study, hashtags dominated in primary versus secondary posts. It may be explained by the fact that use of hashtags helps the author of a message to link post with the group of desired subjects.

Pew Research stated that Instagram® is very popular among non-white users. According to this demographic statistics in 2014 Hispanic origin people represent 34% of Instagram® online adult users in the United States of America [20]. This is visible in our study among non-English words or hashtags group (Table 4) represented most often by Spanish and Portuguese languages.

The statistically significant difference in the occurrence of emoji in secondary versus primary posts indicates that replies gave positive responses or comments. This means that many individuals expressed their solidarity and sympathized with persons affected by cleft. The authors find this aspect as very optimistic.

What was remarkable during the review was the fact that there were posts pertained to animals (dogs, cats and a post on a squirrel). This shows that owners of animals with cleft problem also post on Instagram®.

It is worth noticing that the number of replies (28,702) was much higher than of the primary posts (5427). This indicates a great interest in the posts concerning cleft lip. No comparison of primary versus secondary posts that might be used for comparison could be found in other studies analyzing social media.

From the fact that for primary posts, the total occurrence of all expressions was 225,418 (in 5427 posts) and for secondary posts 228,744 (in 28,702 posts), we may assume that the replies were shorter. The possible explanation could be that the primary posts contained detailed descriptions and the replies were spontaneous (often short and emotional) reactions to them.

Personalized medicine may create optimal treatment for the group of patients with cleft lip. Each cleft is unique in terms of its morphology. Every individual affected may suffer from different medical and psychological problems.

It is evident that people affected by a cleft interact with one another via Instagram®. As social media become frequently used as a source of medical information, professionals should be aware of content available through Instagram® and consider using it as a means to provide health education. In the future, a more detailed surveillance of Instagram® posts with #cleftlip hashtag may help us better understand motivation, experiences and expectations of patients with clefts. In this way we may provide more accurate interdisciplinary and holistic treatment for affected persons.

5. Conclusions

(1) Numerous Instagram® posts referring to cleft lip are published and provoke discussion.

(2) In Instagram® posts two groups of meaningful expressions can be identified: one that appear more frequently in primary posts than in secondary posts and the other appearing more often in replies than in primary posts.

(3) Expressions that occur more frequently in secondary posts than in primary ones do not contain offensive words, they are positive. People express their solidarity and sympathize with persons affected by cleft.

(4) Hashtags occur more frequently in primary posts than in replies.

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