Published in final edited form as:

Am J Clin Oncol. 2012 December ; 35(6): 520–526. doi:10.1097/COC.0b013e31821d4906.

The Utilization of Oncology Web-based Resources in Spanish-speaking Internet Users

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Abstract

Objectives: There currently are few web-based resources written in Spanish providing oncology-specific information. This study examines utilization of Spanish-language oncology web-based resources and evaluates oncology-related Internet browsing practices of Spanish-speaking patients.

Methods: OncoLink (<http://www.oncolink.org>) is the oldest and among the largest Internet-based cancer information resources. In 9/2005, OncoLink pioneered *OncoLink en español* (OEE) (<http://es.oncolink.org>), a Spanish translation of OncoLink. Internet utilization data on these sites for 2006–2007 were compared.

Results: Visits to OncoLink rose from 4,440,843 in 2006 to 5,125,952 in 2007. OEE had 204,578 unique visitors and 240,442 visits in 2006, and 351,228 visitors and 412,153 visits in 2007. While there was no time predilection for viewing OncoLink, less relative browsing on OEE was conducted during weekends and early morning hours. While OncoLink readers searched for information on the most common cancers in the United States, OEE readers most often search for gastric, vaginal, osteosarcoma, leukemia, penile, cervical, and testicular malignancies. Average visit duration on OEE was shorter, and fewer readers surveyed OEE >15 minutes (4.5% vs. 14.9%, $p < 0.001$).

Conclusions: Spanish-speaking users of web-based oncology resources are increasingly using the Internet to supplement their cancer knowledge. Limited available resources written in Spanish contribute to disparities in information access and disease outcomes. Spanish-speaking oncology readers differ from English-speaking readers in day and time of Internet browsing, visit duration, Internet search patterns, and types of cancers searched. By acknowledging these differences, content of web-based oncology resources can be developed to best target the needs of Spanish-speaking viewers.

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Conflict of Interest Notification: none

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Keywords

Disparities; Oncology; Spanish; Internet; Cancer Resources

INTRODUCTION

The Internet is an increasingly important resource to obtain medical information for patients with cancer, their families, and their caregivers. Oncology patients and their families search the Internet to supplement the information they receive from their healthcare providers to learn more about their disease, treatment options, and prognosis. This information allows these readers to feel empowered and have a greater degree of participation in their oncology care (1-9).

The increasing use of the Internet as an additional source of medical information has been most evident during the past decade. In 2000, an estimated 52 million adults, or 55% of American Internet users, searched online to obtain medical information. That percentage rose to 80% in 2006, representing 113 million adults. The number of Internet users and web pages devoted to medicine and oncology care are expected to continue to increase rapidly (1,10-13), with cancer currently the second most common disease Internet users seek information online (7,14-22).

In the United States, Hispanic Americans (HA) comprise the second largest ethnic group after non-Hispanic whites. Over 15% of the total US population, approximately 45 million Americans, identifies themselves as Hispanic or Latino (23). HA also represent one of the fastest growing minority groups. While 60% of HA are born within the US, 40% are foreign born (23-25). Nearly half (47%) of HA report Spanish as their dominant language proficiency, 30% are bilingual, and only 23% are English language dominant (25). Therefore, the plethora of English language websites providing oncology information is of limited utility to a large fraction of this minority group.

Although Spanish-speaking oncology patients and their families are increasingly using the Internet to obtain cancer-related information, there currently are very few available web-based resources written in Spanish that provide oncology-specific information. This study examines the utilization of Spanish-language oncology web-based resources and evaluates the oncology-related Internet browsing practices of Spanish-speaking Internet users.

MATERIALS AND METHODS

OncoLink (<http://www.oncolink.org>) is the oldest and one of the largest cancer information resources on the Internet. Founded at the University of Pennsylvania in 1994, OncoLink was instituted to help patients, families, healthcare professionals, and the general public obtain accurate cancer-related information, free of cost, through the Internet. In 9/2005, OncoLink pioneered OEE (<http://es.oncolink.org>), a Spanish translation of the OncoLink website, to provide up-to-date and accurate cancer-related information written in Spanish. The initial translation of the OncoLink website text is performed using WorldLingo (Las Vegas, NV). The accuracy of this translation is ensured by careful review by native Spanish-speaking Oncology Nurse Practitioners and Advanced Practice Nurses who actively practice clinically in the HA community.

Through an AWStats program, an open source log file analyzer, OncoLink collects statistical data regarding Internet traffic on its website. Data are stratified by the number of unique visitors, visits, web pages, and hits. Data are stored and filtered according to when

the visit occurred. Individual visitor domains and hosts are reported. Evaluable Internet navigation and reference data collected include information pertaining to OncoLink and OEE visit duration, URL pages accessed, operating system used, method used to connect to OncoLink and OEE, Internet browser, Internet search engine, and search keywords.

Data regarding Internet utilization and practices on OncoLink and OEE for the calendar years of 2006 and 2007 were generated by the secure OncoLink server and compared. Generalized comparisons between OncoLink and OEE were determined by comparing the respective average values for variables in question between the two sites between 1/1/2006 and 12/31/2007, with the values weighted to reflect changes in Internet traffic to the sites during that time interval. Comparisons over time between OncoLink and OEE were determined by comparing the average monthly values of variables in question over the first six months of 2006 (1/1/2006-6/30/2006, referred to as “early 2006”) with the monthly averages during the final six months of 2007 (7/1/2007-12/31/2007, referred to as “late 2007”).

Statistical analysis was performed with Microsoft Excel for Windows. Chi-squared or Fisher’s exact test for independence were used to compare proportions, and Student’s t-Test was used for continuous measures. Statistical significance was defined as $p < 0.05$.

RESULTS

The total number of visits to OncoLink was 4,440,843 in 2006 and 5,125,952 in 2007. The number of visits to OEE in 2006 and 2007 was 240,442 and 412,153, respectively. The number of unique visitors on OEE was 204,578 and 351,228, respectively. Viewers of OncoLink were more likely to revisit the website, with 2.38 and 3.19 visits per unique visitor in 2006 and 2007, respectively, compared with 1.17 visits per visitor in both 2006 and 2007 to OEE. The total number of web pages viewed on OEE was 818,005 in 2006 and 1,042,274 in 2007, with 3.40 and 2.52 pages viewed per visit in 2006 and 2007, respectively (Table 1).

While the number of visitors and web pages viewed per month on OncoLink was more constant over the two years of analysis, Internet traffic on OEE significantly increased during this time interval. The number of visits per month on OncoLink increased from 378,389 in early 2006 to 405,898 in late 2007, a 7.3% increase. During this interval, visits per month to OEE rose 153.3%, from 13,475 to 34,138, while unique visitors increased 230.9%, from 8,805 to 29,140. Web pages viewed on OEE increased 73.2%, from 39,800 to 68,953 (Table 2). While there was no significant predilection for viewing OncoLink according to day of the week, there was more fluctuation in daily Internet traffic within the week on OEE and a lower percentage of total web pages were viewed by readers of OEE during weekends (22.2% vs. 26.6%) (Figure 1).

Internet traffic also varied according to hour of the day (US Eastern Standard Time) that viewing occurred. There was little variation for viewing OncoLink by the hour of the day, with a high of 2,770,126 cumulative web pages viewed during the hour interval between 11:00pm-12:00am, and a low of 2,300,070 web pages viewed between 6:00-7:00am. Compared with an average of 2,683,475 web pages viewed per hour, the hours with the highest and lowest traffic were only +3.2% and -14.3% from the mean, respectively. Readers of OEE were less likely than readers of OncoLink to browse the website during early morning hours, with a low of 43,408 web pages viewed from 6:00-7:00am. The highest Internet traffic occurred between 7:00-8:00pm, with 106,601 web pages viewed. With an average of 77,512 web pages viewed per hour on OEE, the hours with the highest and lowest traffic were +37.5% and -44.0% from the mean, respectively.

Viewers of OncoLink and OEE differed in operating systems, Internet browsers, and methods to connect to the respective websites. OEE visitors were more likely to use Windows-based personal computers (94.8% vs. 79.1%, $p<0.001$). OEE visitors were also more likely to use Internet Explorer (90.8% vs. 76.1%, $p<0.001$) and less likely to use Mozilla Firefox (7.5% vs. 20.1%, $p<0.001$) as their Internet browser. Additionally, OEE readers were more likely to navigate to the website from search engines (45.5% vs. 5.8%, $p<0.001$) and less likely to connect from a direct address or bookmark (51.9% vs. 92.6%, $p<0.001$).

While the most frequently searched cancer types among OncoLink readers largely mirrored the most common cancers in the US, including skin, breast, colon and lung cancers, along with metastatic sites such as the liver and brain, OEE readers generally searched for information on malignancies less commonly encountered in the general population. In order of descending search frequency, Spanish viewers solicited information on gastric, vaginal, osteosarcoma, leukemia, penile, cervical, and testicular malignancies (Table 3). When assessing the most common malignancies diagnosed in the US, only colon (eighth most commonly search) and prostate (ninth) cancers are among the top ten most search cancers by OEE readers. None of the other most prevalent cancers in the US, including lung, breast, urinary bladder, cutaneous melanoma, non-Hodgkin's lymphoma, renal, thyroid and endometrial, were among the top ten most search cancers by OEE readers.

When compared with OncoLink viewers, the average visit duration on OEE was shorter (157 seconds vs. 436 seconds, $p<0.001$), and fewer readers surveyed the Spanish site for >15 minutes (4.5% vs. 14.9%, $p<0.001$). While the proportion of visitors on OEE remaining on the website for >15 minutes remained relatively stable between early 2006 (4.7%) and late 2007 (4.5%), this percentage increased on OncoLink from 13.3% to 16.9% (Table 4).

DISCUSSION

This study demonstrates that Spanish-speaking users of web-based oncology resources are increasingly using the Internet to supplement their knowledge of the disease. This study also reveals that Spanish-speaking oncology users differ from English-speaking patients with regards to day and time of Internet browsing, visit duration, Internet search patterns, and types of cancers searched. Spanish-speaking Internet users were less likely to search for oncology information on the Internet during weekends and morning hours and had shorter visit durations, and they were more likely to use Windows-based operating systems, Internet explorer as their Internet browser, and navigate to OEE from search engines. Spanish-speaking viewers were more likely to search for information on cancers that are more common in Hispanic populations, preferentially affect younger patients, or related to infectious agents.

Many factors may explain the dramatic rise in Internet utilization among Americans, and particularly Hispanics, to obtain oncology and medical information. First, the Internet is convenient to use and has a vast amount of available information (1). Additionally, patients with cancer believe their needs to obtain information about their disease from their healthcare providers are often unmet (9,17,26-29). This perception may be due, in part, to time constraints placed upon physicians in busy clinical practices and lack of adequate training in communication skills to healthcare team members (9). Health information obtained on the Internet may increase the consistency, quality, and quantity of information that patients and their families receive (13,30).

Spanish-speaking readers were found to be less likely to search the Internet for oncology information during weekends and morning hours, suggesting HA may have limited access to

the Internet during these times. They may be accessing the Internet with more frequency during daytime hours and weekdays based on Internet access through work or other specialized services. This may also explain the shorter visit duration demonstrated among Spanish-speaking visitors.

Our findings of differences in timing of browsing are consistent with previously published reports demonstrating fewer minorities have access to the Internet (18-19). While 43% of non-Hispanic white adults have broadband Internet connections in their place of residence, only 29% of Hispanic adults have this connection. Among regular Internet users, Hispanics are less likely than non-Hispanic whites (79% vs. 92%) to have any type of Internet connection at home (25). Additionally, non-Hispanic white oncology patients are more likely to use the Internet to search for information about their disease than Hispanic and other non-Caucasian patients (18-19,31). This is in concordance with Internet usage of the US as a whole, where 71% of non-Hispanic whites and 56% of Hispanics use the Internet on an average day (10,25). These differences could be related to the cost of obtaining Internet access, or difficulty or frustration when using the Internet, particularly among Spanish-speaking viewers who may encounter few resources written in Spanish. As Spanish-speaking patients gain more access to the Internet and the frequency of free Internet services increases, Spanish-speaking patients will have greater ability to search the Internet for oncology information.

Racial differences in education, primary language, and socioeconomic status may largely explain the existing gap in Internet usage between Hispanics and non-Hispanics in the US. Eighty-nine percent of Hispanics with a college degree use the Internet on an average day, compared with 70% who completed high school as their highest level of education and 31% who did not complete high school. Furthermore, 78% of Hispanics who are English-dominant and 76% of bilingual Hispanics use the Internet at least occasionally, while only 32% of Spanish-dominant HA use the Internet (25). Additionally, 88% of HA with an annual household income of \$50,000 use the Internet, compared with 72% with incomes between \$30,000-\$49,999 and only 39% with incomes below \$30,000 (25).

Internet usage also varies among Hispanics based on country of origin, nativity, and generation. As the native-born segment of the Hispanic population is projected to increase at a faster rate than that from the immigrant group, it is noteworthy that 76% of native-born HA use the Internet, compared with 43% of Hispanic immigrants (23,25). Additionally, while Mexican Americans represent the largest single national origin group among HA, they are among the least likely group to go online (52%). Hispanics of Puerto Rican descent, who more often are born in the US and speak English, are among the most likely to use the Internet (66%) (25,32).

Compared with non-Hispanic whites, HA have lower incidence and mortality rates from the most common cancers, including prostate, breast, colorectal, and lung. However, HA diagnosed with most types of cancers have lower survival rates than non-Hispanic whites, even after accounting for differences such as age and stage at diagnosis (33-34). HA are also more likely to be diagnosed at a more advanced stage or with a larger primary tumor for several common cancers, including prostate, breast, lung, and colorectal, in part, due to their lower utilization rates of cancer screening tests for these malignancies (33-35). HA are less likely to undergo such screening tests due to economic factors or lack of health insurance, social or cultural beliefs, language barriers, lower awareness levels of benefits to cancer screening, or more limited screening education (36-55). By making Internet-based cancer screening educational materials more accessible to Hispanics through the use of oncology web-based resources written in Spanish, disparities in cancer screening rates and overall survival rates between HA and other ethnic and racial groups may diminish.

While the most frequently searched cancer types among OncoLink readers largely mirror the most common cancers in the US, OEE readers most often search for information on gastric, vaginal, osteosarcoma, leukemia, penile, cervical, and testicular malignancies. Cancers of the stomach, liver, cervix, gallbladder, and penis, as well as acute lymphocytic leukemia, collectively affect Hispanics nearly twice as often as non-Hispanic whites. Additionally, Hispanics also have higher mortality rates from these cancers (24,33-34,56-63). Therefore, it is not surprising that three of these malignancies, including gastric, cervical and leukemia, are among the five most frequently search cancer types among OEE readers. Of the 10 most commonly searched cancers among OEE readers, only prostate (second), colorectal (third), leukemia (eighth), and gastric (ninth) malignancies are among the ten most prevalent cancers among HA (24).

In addition to differences in prevalence and mortality rates, the discrepancies in cancers search for between OncoLink and OEE readers may be explained by the higher incidence rates among HA of several cancers that are associated with infectious etiologies. When examining the most frequently search cancer types by Spanish-speaking viewers, links to infectious etiologies disproportionately affecting HA have been demonstrated for *gastric cancer* (the most frequently searched cancer type) with *Helicobacter pylori* (64-65) and *cervical cancer* (tied for fifth most searched) with human papilloma virus [HPV] (66). HPV has also been linked to *vaginal cancer* (second most searched) and *penile cancer* (tied for fifth most searched) (63,67-70). Hepatitis B and C viruses are more prevalent in Hispanic American populations and are associated with *liver cancer*, another malignancy that affects Hispanics with a greater incidence than non-Hispanic whites (65,71). These infectious agents are more commonly seen in first-generation Hispanic immigrants to the US, particularly among immigrants from Central and South America. In contrast, a smaller proportion of cancers among non-Hispanic whites in the US are believed to be related to infectious etiologies. Based on the search patterns of HA demonstrated in this study, the development of additional Internet-based resources pertaining to malignancies associated with infectious etiologies can assist public health interventions that attempt to reduce infection-related cancers among HA.

As data is anonymously tracked through the OncoLink site, there may be other confounding explanations for differences in utilization between the English and Spanish websites. Varying ages or other demographic characteristics of viewers of OncoLink and OEE may contribute to differences in cancer types searched. The Hispanic American population is significantly younger than the general American population, with median ages of 25.9 years and 35.3 years, respectively. In fact, 63% of adult HA are between the ages of 18 to 41 years, compared with only 36% for non-Hispanic whites (23,25,33-34). It is possible that readers of OEE are younger than OncoLink readers, and they are more likely to search for types of cancers that disproportionately affect younger patients, including osteosarcoma (72-73), testicular malignancies (74), cervical cancer (75), and certain types of leukemias (76).

It is also possible that differences in types of cancer searched are attributable to bias from self-selection of Internet readers (77-78). While content pertaining to the most common malignancies, including prostate, breast, and colorectal, has become increasingly available in Spanish through patient pamphlets or online content, Spanish translations of patient educational materials on less common malignancies are more scarce. It is possible that Spanish readers soliciting information on less common malignancies are disproportionate searching the Internet for information not available in other print media. Additionally, many Hispanic cancer patients are also fluent in English, and it is unknown how many choose to read the information in English versus Spanish or toggle between the two sites.

Over the past three decades, various governmental agencies have attempted to improve and protect the health of racial and ethnic minority populations by developing health policies and programs aimed to eliminate health disparities. Following the discovery of large and persistent gaps in the health status among Americans of different racial and ethnic groups demonstrated in the Report of the Secretary's Task Force on Black and Minority Health, the US Department of Health and Human Services created the Office of Minority Health in 1985. In 1988, the Centers for Disease Control and Prevention (CDC) created an independent Office of Minority Health. The US Congress passed the Disadvantaged Minority Health Act of 1990 to improve the health status of underserved racial and ethnic minorities. More recently, the National Cancer Institute (NCI) created the Center to Reduce Cancer Health Disparities in 2001.

Despite the institution of these offices and legislative acts, disparities for HA with cancer persist. Hispanics remain less likely than non-Hispanic whites to enroll in therapeutic cooperative group trials sponsored by the NCI or register for oncologic clinical trials (79-80). In 2006, collaboration between the American Cancer Society (ACS), CDC, NCI, and North American Association of Central Cancer Registries provided a comprehensive compilation of cancer information for Hispanic Americans. This commendable work highlighted continued oncology disparities between Hispanics and other racial and ethnic groups (34).

Even with increasing utilization of the Internet among Hispanic oncology patients and their families to search for information about their disease, there continues to be few available web-based oncology resources written in Spanish. As a result of persistent health disparities and a slow recognition that language barriers may contribute to such disparities, a slowly increasing body of medical information has recently been made available on the Internet to Spanish-speaking patients. The central website for the NCI (<http://www.cancer.gov/espanol>) has been translated to provide Spanish-speaking readers with credible and current information about cancer prevention, statistics, diagnosis, treatment, clinical trials, and research. The CDC offers "Cáncer en español" (<http://www.cdc.gov/spanish/cancer>), a website offering fact sheets, brochures, and other materials in Spanish. The World Health Organization also provides comprehensive cancer information online in Spanish. Through a joint effort between the National Comprehensive Cancer Network (NCCN) and the ACS, Spanish translations recently have become available for such resources as the NCCN Prostate Cancer Treatment Guidelines and the ACS Cancer Resource Information for common malignancies such as breast and colorectal cancer. The ACS also has Spanish-speaking Cancer Information Specialists available to assist callers and provide general cancer information in Spanish.

This study shows that Spanish-speaking individuals are searching for cancer information in their native language in different ways than English-speaking patients. The content of Spanish-language Internet-based oncology resources should be developed to best meet the needs of their Hispanic readers. Websites should feature targeted information and resources based on the unique patterns of utilization of Spanish-speaking populations to better serve this population. More information should be made available to Spanish readers pertaining to malignancies that disproportionately affect HA, including infection-related cancers and cancers that affect younger populations. Emphasis should be placed on the promotion of healthy lifestyles, use of screening services, and benefit of presenting to health care providers for prompt care. Additionally, Internet-based educational and recruitment services for clinical trials should be available in Spanish and designed to foster enrollment of Hispanics in future clinical trials.

CONCLUSION

The current limited accessibility of Internet-based information available to Spanish-speaking oncology patients contributes to disparities in healthcare resources and disease outcomes. More information needs to be available to Spanish-speaking oncology patients and their families, and Internet access needs to be more widely available. By acknowledging the differences in Internet browsing patterns demonstrated in this study between English- and Spanish-speaking patients, the content of web-based oncology resources can be developed to best meet the needs of their Spanish-speaking viewers. As additional web-based resources written in Spanish become available, and as the Internet becomes more widely accessible, the increased knowledge that will be gained among Spanish-speaking oncology patients will help to eliminate health care disparities and lead to improved medical outcomes.

Acknowledgments

Financial Support: none

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Figure 1.
Percentage of Web Pages Viewed on OncoLink and OncoLink en *español* by Day of the Week.

Table 1

Number of Unique and Total Visitors and Web Pages Viewed on *OncoLink en español*.

	<i>OncoLink en español</i>	
	2006	2007
Number of Visits	240,442	412,153
Number of Unique Visits	204,578	351,228
Visits per Visitor	1.17	1.17
Web Pages Viewed	818,005	1,042,274

Table 2Changes in Internet Traffic Over Time on *OncoLink en español*.

	<i>OncoLink en español</i> Internet Traffic
Visitors per Month, Early 2006	13,475
Visitors per Month, Late 2007	34,138
Increase in Visits (%)	+153.3%
Unique Visitors per Month, Early 2006	8,805
Unique Visitors per Month, Late 2007	29,140
Increase in Unique Visitors (%)	+230.9%
Web Pages per Month, Early 2006	39,800
Web Pages per Month, Late 2007	68,953
Increase in Web Pages Viewed (%)	+73.2%

Table 3

Top Ten Most Frequently Searched Cancer Types on OncoLink and *OncoLink en español* and Top Fifteen Cancer Types With the Highest Incidence Among the General United States and Hispanic Populations^γ Listed in Descending Frequency.

Overall U.S. Population [#]	OncoLink	<i>OncoLink en español</i>	U.S. Hispanic/Latino(a) Population [*]
1. Lung & Bronchus (M 2, W 2)	1. Breast Cancer	1. Gastric Cancer	1. Breast (W 1)
2. Prostate (M 1)	2. Liver Cancer	2. Vaginal Cancer	2. Prostate (M 1)
3. Breast (W 1)	3. Skin Cancer	3. Osteosarcoma	3. Colon & Rectum (M 2, W 2)
4. Colon & Rectum (M 3, W 3)	4. Brain Cancer	4. Leukemia	4. Lung & Bronchus (M 3, W 3)
5. Urinary Bladder (M 4)	5. Colon Cancer	5t. Penile Cancer	5. Non-Hodgkins Lymphoma (M 4, W 7)
6. Melanoma of the Skin (M 5, W 7)	6. Lung Cancer	5t. Cervical Cancer	6. Kidney & Renal Pelvis (M 5, W 9)
7. Non-Hodgkin's Lymph [†] (M 6, W 6)	7. Melanoma	5t. Testicular Cancer	7. Urinary Bladder (M 6)
8. Kidney & Renal Pelvis (M 7, W 8)	8. Lymphoma	8. Colon Cancer	8. Leukemia (M 8)
9. Thyroid (W 5)	9. Head and Neck Cancer	9. Prostate Cancer	9. Gastric (M 9, W 10)
10. Uterine Corpus (W 4)	10. Prostate Cancer	10. Sarcoma	10. Thyroid (W 5)
11. Pancreas (M 10, W 10)			11. Uterine Corpus (W 4)
12. Leukemia (M 9)			12. Liver & Intrahepatic Bile Duct (M 7)
13. Oral Cavity & Pharynx (M 8)			13. Pancreas
14. Liver & Intrahepatic Bile Duct			14. Uterine Cervix (W 6)
15. Brain & Other Nervous System			15. Ovary (W 8)

^γRanking for cancers in the top 10 in incidence among men (M) and among women (W) listed in parenthesis. Excludes basal cell and squamous cell carcinomas of the skin.

[#]Adapted from Jemal A, et al (reference 57).

^{*}Adapted from American Cancer Society (reference 24) and Howe HL, et al (reference 34).

[†]Lymph = lymphoma

Table 4Visit Duration of Readers on OncoLink and *OncoLink en español*[#].

Visit Duration	OncoLink	<i>OncoLink en español</i>
Average Duration	436 sec	157 sec
Total More than 15 min	14.9%	4.5%
Total More than 60 min	3.8%	0.4%

[#] Abbreviations: seconds (sec), minutes (min).