

Teleconsultation Between Patients and Healthcare Professionals in the Catalan Primary Care Service: Descriptive Analysis through Message Annotation in a Retrospective Cross-Sectional Study

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Abstract

Background: Over the last decade telemedicine services have been introduced in the public healthcare systems of industrialized countries. In Catalonia, the use of eConsulta, an asynchronous teleconsultation between primary care professionals and citizens in the public healthcare system has already reached 400,000 cases and is growing at a monthly rate of 7%. Despite its widespread usage, there is little qualitative evidence describing how this tool is used.

Objective: To annotate a random sample of these teleconsultations and to evaluate the level of agreement between healthcare professionals with respect to the annotation.

Methods: 20 GPs retrospectively annotated a random sample of 5,382 cases managed with eConsulta according to 3 variables: the type of interaction according to 6 author-proposed categories, whether the practitioners believed a face-to-face visit was avoided, and whether they believed the patient would have requested a face-to-face visit had eConsulta not been available. 1,217 cases were classified three times, by three different professionals, to assess the degree of consensus among them.

Results: In response to the question “Has the online consultation avoided a face-to-face visit?”, GPs answered Yes for 79,6% (4,284/5,382) of the teleconsultations, while to the question “In the absence of a service like eConsulta, would the patient have made a face-to-face visit?” GPs answered Yes 65% (3,496/5,382) of the time. The most frequent uses were for management of test results (26.8%, 1,433/5,354), the management of repeat prescriptions (24.3%, 1,301/5,354) and medical enquiries (14.2%, 762/5,354). The degree of agreement among professionals as to the annotations is mixed, with the highest consensus being for the variable “Has the online consultation avoided a face-to-face visit?” (3/3 professionals agreed 68% of the time (827/1,217), and the lowest for the type of use of the teleconsultation (3/3 professionals agreed 57.6% of the time, 701/1,217).

Conclusions: This study shows eConsulta’s ability to reduce the number of face-to-face visit stands at between 55% (79% x 65%) and 79% of cases. In comparison to previous research, these results are a bit more pessimistic while figures are still high and in line with administrative data’ proxies, which show 84% of teleconsultations do not register an in-person appointment in the following 3 months. With respect to the type of consultation performed, results are similar to previous literature, thus giving robust support to the eConsulta’s usage. The mixed degree of consensus among professionals implies that results derived from AI applications such as message classification algorithms should be understood in light of these shortcomings.

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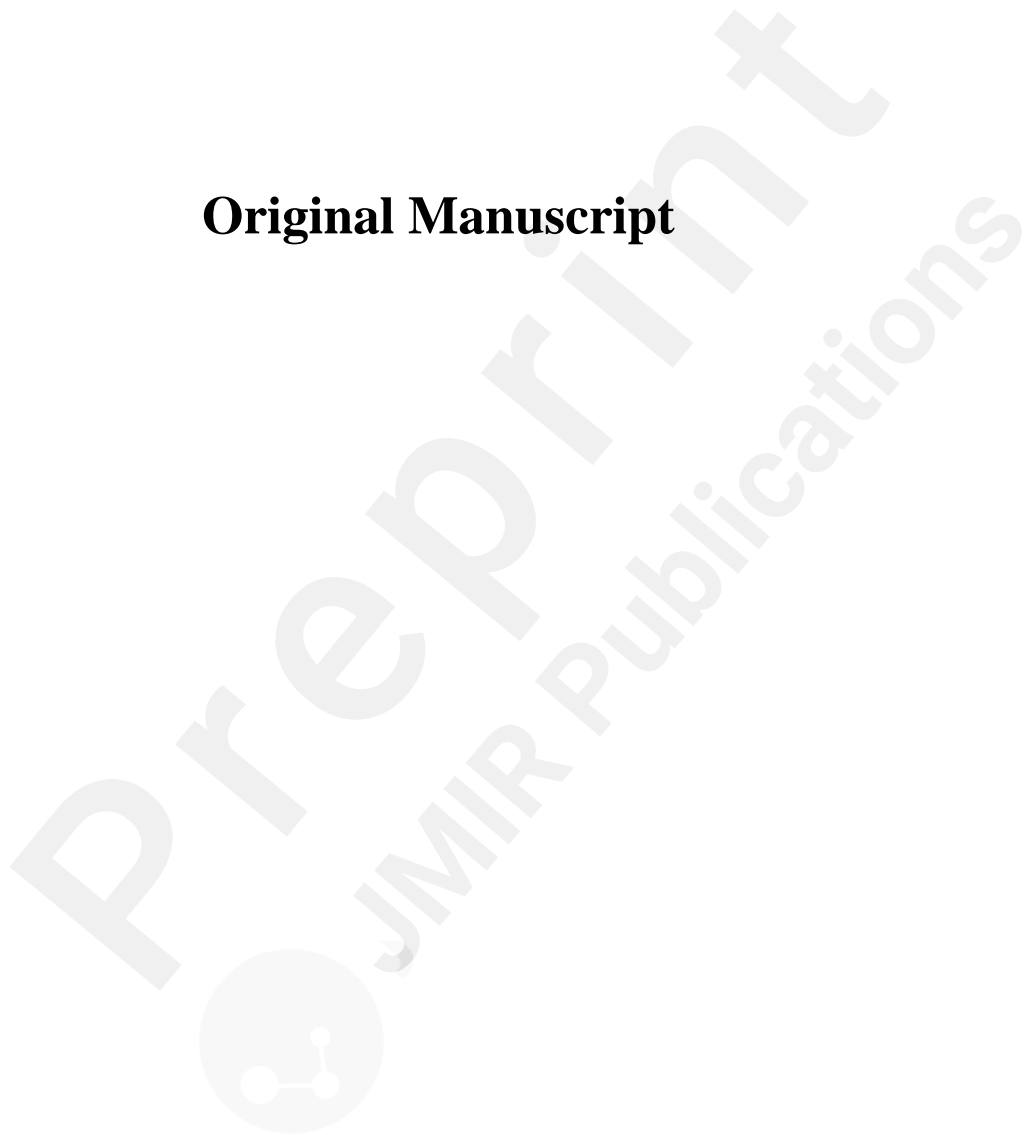
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Original Manuscript



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Trial registration: The study was approved by the Ethical Committee for Clinical Research at the Foundation University Institute for Primary Health Care Research Jordi Gol i Gurina, registration No. P19/096-P.

Keywords: teleconsultation; primary care; remote consultation; message annotation, face-to-face visits.

1. Introduction

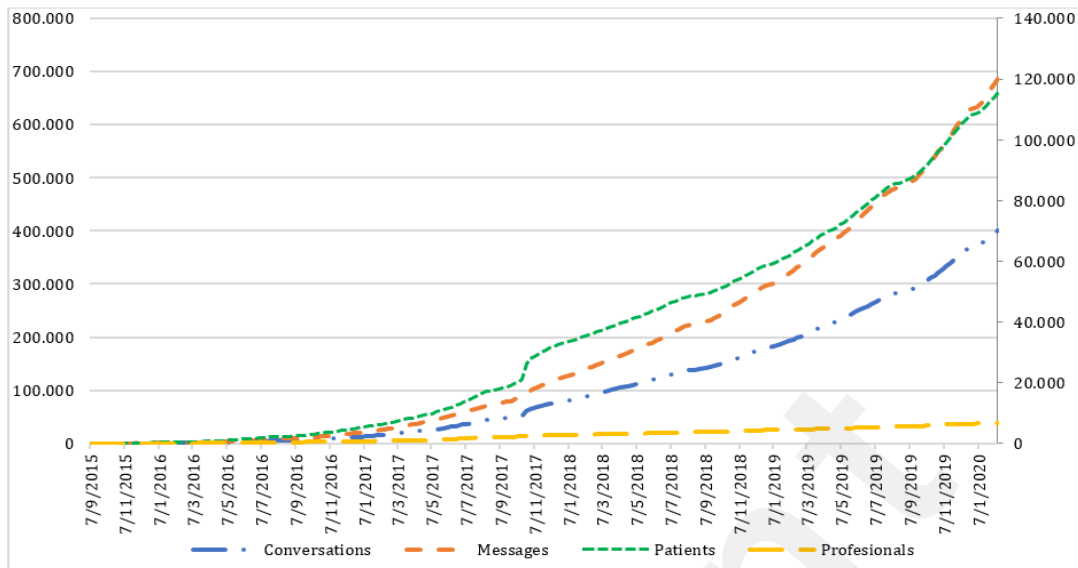
Five years of teleconsultation in the Catalan public health system

The Catalan Health Care System dispenses services for 7.6 inhabitants, providing universal coverage through a tax-based system. Administratively, it is composed by a single public payer and multiple service providers publicly or privately owned, with an integrated system, a major role of community and primary health care, and the use of information technologies and digital health [1].

The Catalan Health Institute (Institut Català de la Salut – ICS) is the provider of primary healthcare services to three quarters of the population of Catalonia [2]. Over the last decade telemedicine services have been introduced in the public healthcare systems of industrialized countries. In Catalonia, eConsulta is an asynchronous teleconsultation service integrated into the program of computerized medical records of primary care of the public health system [3]. The service was introduced in 2015 and was gradually phased in until 2017, when it became established as a service available to all Primary Care Teams (PCT) as a complement to face-to-face care. Although initially intended as a tool solely for general practitioners (GPs), eConsulta can be also used by pediatricians, gynecologists, midwives and nurses. At present, 95% (353/372) of PCTs have used the tool, although this type of consultation still accounts for less than 1% of the total in primary care [4]. From the patients' point of view, eConsulta is one of the services which forms part of their personal health folder, a tool which allows the user to access aspects of their health information, make enquiries and carry out certain administrative procedures. In this space, which is accessed via a secure authentication process, the eConsulta interface allows users to choose which health professional to direct their enquiry to and attach files, while keeping a record of previous interactions.

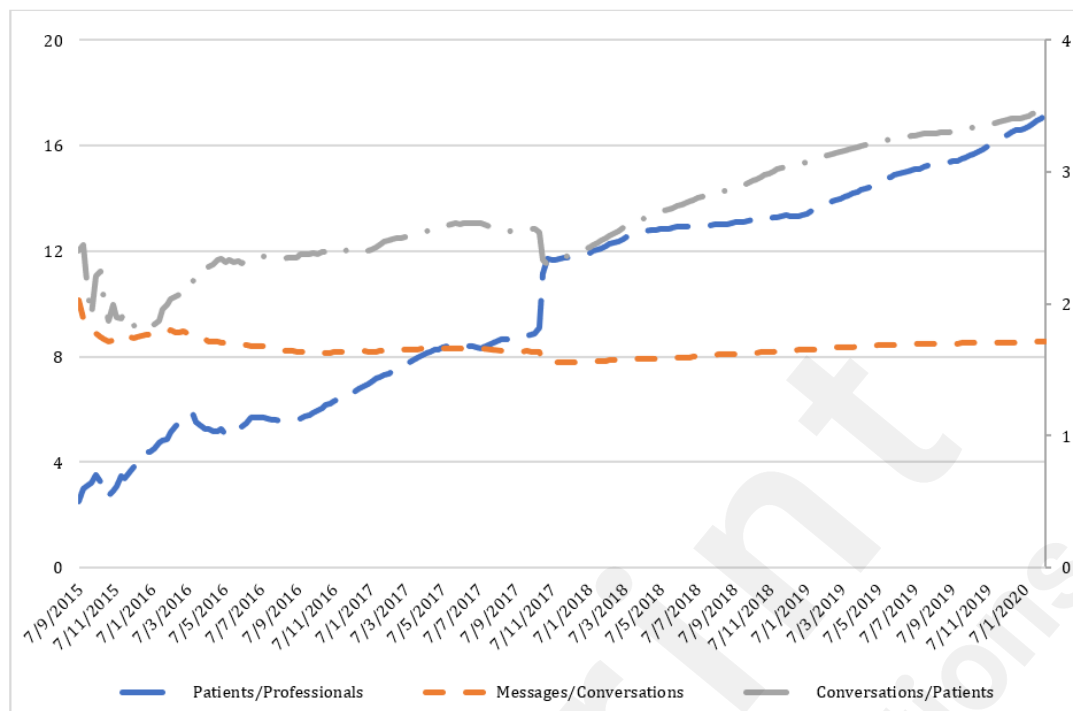
Until January 2020, the tool collected 685,573 messages corresponding to 399,926 conversations between 115,173 unique users and 6,701 primary care professionals (59% doctors, 41% nurses). eConsulta is growing at the rate of 24,000 conversations, 44,000 messages, 5,500 new users and 140 new professionals per month, representing a growth of 7%, 6%, 5% and 2% monthly, respectively (Figure 1). It is observed that the average number of messages per conversation is stable at 1.71, suggesting that many conversations contain a single message (Figure 2). Professionals and users have used the tool an average of 17.18 and 3.47 times, respectively. This figure continues to grow, showing that users are satisfied with the experience.

Figure 1. Number of messages and conversations (left axis) and patients and healthcare professional users (right axis).



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Figure 2: Patients per professional (left axis), messages per conversation and conversation per patient (right axis).



In terms of the content and impact of eConsulta on face-to-face visits, a previous analysis [5] suggested that there was a broad consensus among GPs that eConsulta has the potential to resolve patient queries (avoiding the need for a face-to-face visit in 88% of cases), but that it induced demand (queries which otherwise would not have been made) in 28% of cases, and the most common use was for the management of test results (35%), clinical enquiries (16%) and the management of repeat prescriptions (12%). However, this study is based on a very small sample of cases based on GPs who use the tool in a semirural geographical area. Other studies have analysed the predictive ability of machine learning algorithms to identify types of conversations based on body text with very few conclusive results [6]. Understanding the nature of the interaction (which are the main topics of conversation) can help to manage the tool more effectively and efficiently, which is a must considering the rate at which its usage is growing.

Study aim

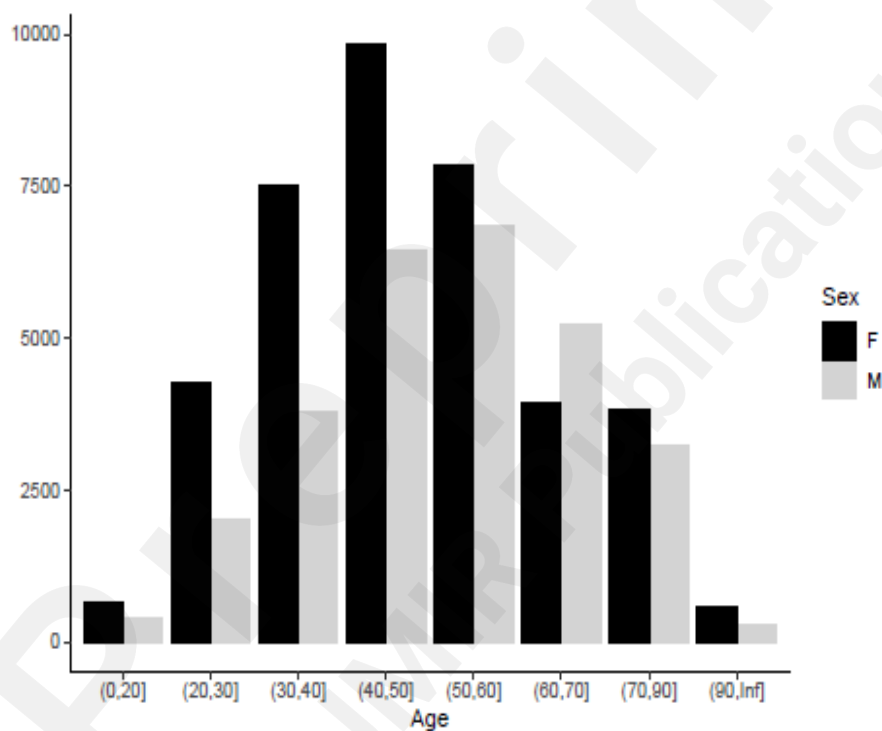
This study aims to classify a random sample of these teleconsultations according to three sets of information: the type of consultation according to 6 categories, the professional's judgement on whether a face-to-face visit was avoided or not, and whether they believed the patient would have requested a face-to-face visit had eConsulta not been available. As a secondary objective, the level of agreement among the healthcare professionals as to their annotation has been evaluated.

2. Methods

Description of the sample

The sample analysed includes teleconsultations involving Catalan Health Institute centres initiated before September 22, 2019. It consists of 403,274 messages, 236,178 conversations and 69,111 unique users from all over Catalonia. It is observed that 71.46% (168,772/236,178) of the conversations are initiated by the patient, the rest being initiated by the healthcare professional. 84.88% (187,569/220,981) of conversations have as their clinical interlocutor a GP, with the rest being nurses (14%, 31,622/220,981) or other professionals such as pediatricians and gynaecologists. Messages and their respective subject lines have an average length of 231 and 18 characters, respectively. The users of the service are mostly women (57%, 39,393/69,111) and the average age is 50.62 years (SD 16.59) (Figure 3).

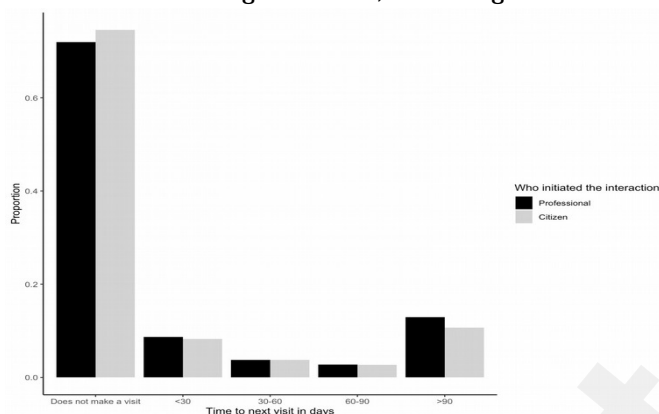
Figure 3: Age profile of patient users of the teleconsultation service, according to gender.



With regard to the use of face-to-face resources of the sample under investigation, the date of the next face-to-face visit and the total number of visits registered to the PCT during the current year are available. Regarding the first variable, the data shows that since the teleconsultation, 72% (150,135/207,910) of the cases have not subsequently visited the PCT for a face-to-face consultation (for any reason), while 16% (32,802/207,910) have had a consultation within the following three months and 12% (24,973/207,910) have done so after 90 days. According to the data, and assuming that visits made after three months may not be related to the reason for the teleconsultation, 84% (175,108/207,910) of eConsultations may not be related to a subsequent face-to-face visit, suggesting that it is an effective tool for avoiding face-to-face visits. These results are in line with previous studies [5] and do not depend on the initiator of the conversation (Figure 4). Regarding the second variable, it is observed that users of teleconsultations who engage in face-to-face visits do so an average of 2.3 times a year.

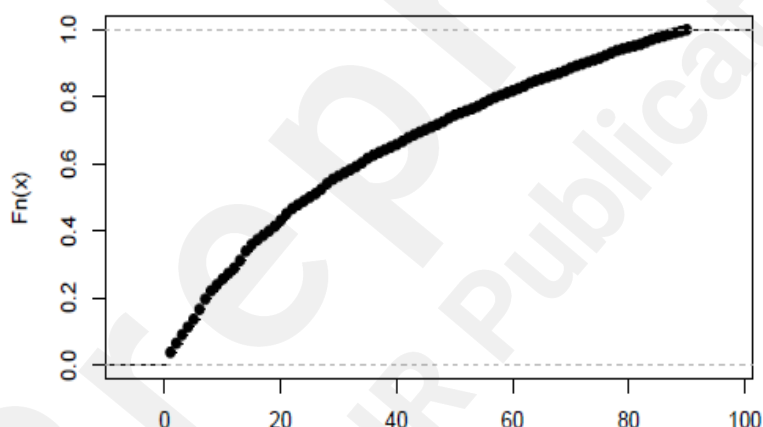
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Figure 4: Time to next face-to-face visit after using eConsulta, according to the initiator, in days.



Finally, it is observed that in most eConsultations associated with a subsequent face-to-face visit, it takes place in the first 20 days after the teleconsultation, showing that if a need exists the system offers high accessibility in order to treat the patient in person (Figure 5).

Figure 5: Days until face-to-face visit for eConsultations which result in a face-to-face visit in the following 90 days. Accumulated density.



Sample construction and variables in the analysis

A random sample of 5,460 unique conversations was generated, of which 4,200 were to be annotated only once and the remaining 1,260 were to be annotated three times in order to study the degree of consensus among professionals. A total of 7,980 ($4,200 + 1,260 \cdot 3$) conversations were randomly distributed among 20 healthcare professionals linked to the eConsulta Research Group (eHealth Office, Catalan Ministry of Health). The text in the subject line and message body was analysed once the data was anonymized. As in López (2020) [5], each GP recorded three pieces of information for each of their interactions: the type of consultation according to the 6 author-proposed categories (Multimedia Appendix 1), which is a modified version of another classification previously used by the authors; whether they believed a face-to-face visit was avoided, which was defined as the absence of the need for a face-to-face visit following the consultation; and whether they believed the patient would have requested a face-to-face visit had eConsulta not been available. The latter was used as an approximate measure of the possible increased demand resulting from the ease of access to a

GP. When accepting participation in the analysis, the participating healthcare professionals received a guide to standardise the annotation criteria as much as possible. The annotators were unaware that some of the conversations were being annotated three times.

The raw data was processed and analysed with Bash and R languages (using Rstudio version 1.2.1335 and R version 3.5.3). The R libraries used to analyse and plot were data.table, dplyr and ggplot2.

3. Results

Results of the annotation

98.57% (5,382/5,460) of the unique conversations in the sample were classified. Among these, for the subset of messages which were annotated three times (1,217/5,382), the annotation with the highest consensus was selected. Tables 1 and 2 show the results of the three annotated variables:

Table 1: Results of the annotation (1).

	Yes	No	Not sure
Has the online consultation avoided a face-to-face visit? (Yes/No/Not sure)	79.6% (4,284/5,382)	13.7% (740/5,382)	6.7% (360/5,382)
In the absence of a service like eConsulta, would the patient have had a face-to-face consultation? (Yes/No/Not sure)	65% (3,496/5,382)	30.2% (1,626/5,382)	4.8% (260/5,382)

According to the health professionals' annotation, 79.6% (4,284/5,382) of the eConsultations would have avoided a face-to-face visit. In addition, in the absence of the service the patient would have arranged a face-to-face consultation in most of them (65%, 3,496/5,382). Thus, this study shows eConsulta has the ability to decrease the number of face-to-face visit in between 55% (79% x 65%) and 79% of cases. Regarding the type of consultation, the data shows that the most frequent uses were for the management of test results (26.8%, 1,433/5,354), the management of repeat prescriptions (24.3%, 1,301/5,354) and for medical enquiries (14.2%, 762/5,354).

Table 2: Results of the annotation (2).

Type of teleconsultation	%
1. Management of test results	26.8 % (1,433/5,354)
2. Temporary disability management	5.6 % (299/5,354)

3. Management of visits/referrals	10.0 % (536/5,354)
4. Repeat prescriptions	24.3 % (1,301/5,354)
5. Medical enquiries	14.2 % (762/5,354)
6. Other	19.1% (1,023/5,354)

Table 3 shows the results of the variables “Has the online consultation avoided a face-to-face visit?” and “In the absence of a service like eConsulta, would the patient have had a face-to-face consultation?” according to the type of consultation, showing that the ability of the teleconsultation to avoid a face-to-face visit is relatively higher in types 1 (Management of test results) and 4 (Repeat prescriptions), the most frequent types of consultation, which are also the ones with lower induced demand. This implies that health professionals are using the tool in the most effective circumstances.

Table 3: Relationship between the type of consultation and the two other variables recorded N (%).

Type of teleconsultation	Has the online consultation avoided a face-to-face visit?			In the absence of a service like eConsulta, would the patient have had a face-to-face consultation?		
	Yes	No	?	Yes	No	?
1. Management of test results	1,319 (92.0)	71 (5.0)	43 (3.0)	1,105 (77.1)	323 (22.5)	5 (0.3)
2. Temporary disability management	265 (88.6)	27 (9.0)	7 (2.3)	217 (72.6)	82 (27.4)	0 (0.0)
3. Management of visits/referrals	397 (74.1)	120 (22.4)	19 (3.5)	341 (63.6)	187 (34.9)	8 (1.5)
4. Repeat prescriptions	1,223 (94.0)	50 (3.8)	28 (2.2)	988 (75.9)	311 (23.9)	2 (0.2)
5. Medical enquiries	586 (76.9)	146 (19.2)	30 (3.9)	520 (68.2)	226 (29.7)	16 (2.1)
6. Other	468 (56.1)	315 (37.8)	51 (6.1)	311 (37.3)	488 (58.5)	35 (4.2)

Results of consensus among professionals

1,217 conversations were annotated three times (96.58% of a target of 1,260). Table 4 shows the degree of consensus among professionals according to three levels, for each of the variables. In level 1, all professionals agree on the annotation. In level 2, two professionals agree on the annotation, while the third has answered differently. In level 3, all three professionals have responded differently to the same annotation.

Table 4: Consensus among annotators.

Annotated variables	Level 1: 3/3 agreement	Level 2: 2/3 agreement	Level 3: no agreement

Has the online consultation avoided a face-to-face visit? (Yes/No/Not sure)	68.0 % (827/1,217)	29.3 % (356/1,217)	2.8 % (34/1,217)
In the absence of a service like eConsulta, would the patient have had a face-to-face consultation? (Yes/No/Not sure)	39.2 % (477/1,217)	58.6 % (713/1,217)	2.2 % (27/1,217)
Type of teleconsultation (1-6/Not sure)	57.6 % (701/1,217)	36.0 % (438/1,217)	6.4 % (78/1,217)

It should be noted that the lowest level of agreement (“3”) is negligible for all three variables. It is observed that the variable “Has avoided a face-to-face visit” is the one which generates the most consensus (total consensus in 68% of cases, 827/1,217) while the variable “Has it resulted in an induced demand?” is the one which generates the least (total consensus in 39.2% of cases, 477/1,217). The latter can be attributed to confusion as to the annotation process. Finally, it is necessary to keep in mind that the variable “type of teleconsultation” has more possible answers, so an absolute consensus among annotators (3/3) is less likely. Nevertheless, in 93.6% (1,139/1,217) of cases, at least 2/3 annotators coincided at the time of classifying the query.

4. Discussion

This study analysed the use of teleconsultation in primary care in the Catalan health system by writing a total of 5,382 cases by a group of 20 healthcare professionals. In line with the results of an earlier study [5], it is observed that it is a tool which primary care professionals use mainly to inform patients of their tests results and for aspects related to the medication plan (repeat prescription, expiration, etc.), for which it shows a high rate of resolution (avoiding a face-to-face visit). “Cross-validation” among the professionals’ annotations shows a high degree of consensus.

It is noted that a significant reason for using eConsulta is for administrative or logistical reasons. This suggests that if the type of task to be performed by each professional was reformulated, some queries could be directed to nursing or even administrative staff. Given the growing pressures on primary care in Catalonia and the difficulty in recruiting GPs and paediatricians in some areas of the country, eConsulta could serve as a tool to empower other professional profiles in the management of certain cases. While it is true that the results show that healthcare professionals are able to resolve such cases efficiently through the use of this tool, freeing them from tasks which have little clinical value could increase their satisfaction and boost the efficiency of the primary healthcare system.

From the user’s point of view, the high virtual resolution of the queries also suggests a possible increase in their satisfaction [7,8]. The results show that certain queries which are made telematically would not have been made in the absence of this type of service, thus improving people’s access to the healthcare system and empowering them in the management of their

own health and care.

For future developments aimed at increasing the capacity and optimizing the use of eConsulta, the reasons for interaction should be systematically parameterized, facilitating the use of the system by the public and the development of apps based on trustable, transparent and interpretable artificial intelligence. Simultaneously, each case ought to be directed to the most appropriate professional to obtain a response, leading to better case management and more efficient use of resources from the first interaction, while generating new good habits in the relationship between the patient and the healthcare professional.

To conclude, it should be mentioned that if virtual consultations are to be used more frequently as a tool for clinical communication between health professionals and patients for healthcare reasons, other synchronous communication tools such as video conferencing ought to be developed [9]. These could be useful both for patients with mild acute pathologies and patients with chronic diseases with a high need for follow-up, avoiding this way successive face-to-face visits and improving the continuity of care [10].

Limitations

The high monthly growth of new users suggests that there are many first conversations, implying that there could be a large number of experimental queries. This would explain the fact that some of the conversations are annotated in the "Other" category. The fact that information systems do not record the reason for the teleconsultation, however, makes it very difficult to analyse their association with the use of face-to-face resources.

Finally, with regard to the variable "In the absence of a service like eConsulta, would the patient have had a face-to-face consultation?" subsequent studies ought to confirm the degree of consensus.

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Acknowledgements

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Abbreviations

GP: General Practitioner
PCT: Primary Care Teams

Conflicts of interest

None declared

Appendix: Reasons for patients and General Practitioners to use eConsulta

1. Management of test results

- The patient provides the results of tests from an external centre so they are recorded in their medical history.
- The GP provides normal test results.
- The GP deals with test-related questions from the patient.
- The GP requests tests after conducting a follow-up teleconsultation.

2. Temporary disability management

- The patient communicates changes to their health related to an upcoming temporary disability.
- The GP tracks the progress of a temporary disability in conjunction with face-to-face visits.

3. Management of visits/referrals

- The patient has an enquiry which the GP thinks ought to be dealt with by a specialist and refers them. They can also report incidents resulting from any referrals made.
- The GP resolves incidents relating to the timing of visits.
- The GP cancels visits from other clinicians in cases in which the problem has been resolved following completion of the eConsulta.
- Validation of appointments with other specialists where the patient needs more information regarding the motivation for the appointment.

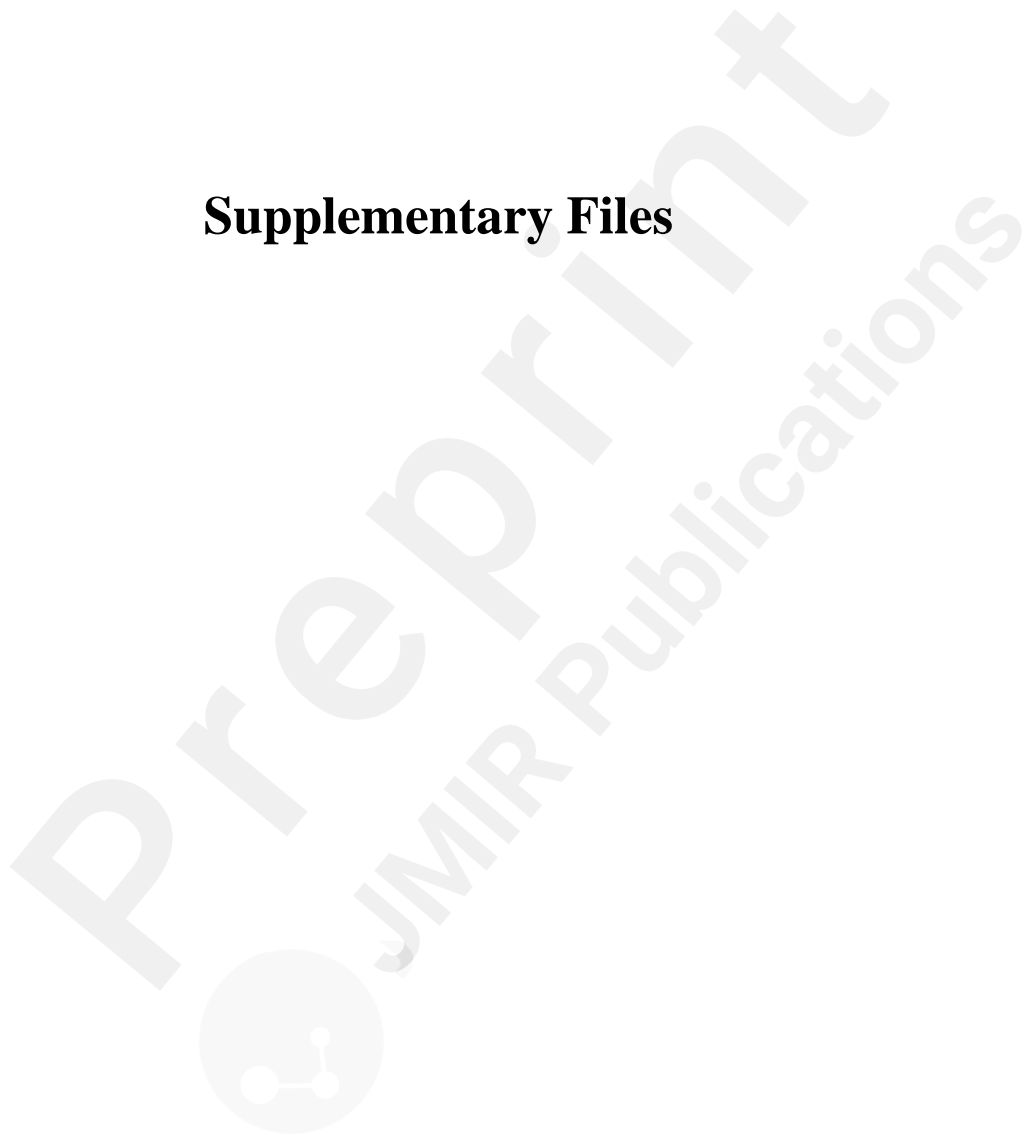
4. Repeat prescriptions

- The patient asks for their prescription to be updated if it has been modified by an external specialist, either because they do not use it or because it has expired.
- The GP warns the patient that their prescription is about to expire and updates it.
- The GP cancels an unnecessary prescription following an eConsulta.

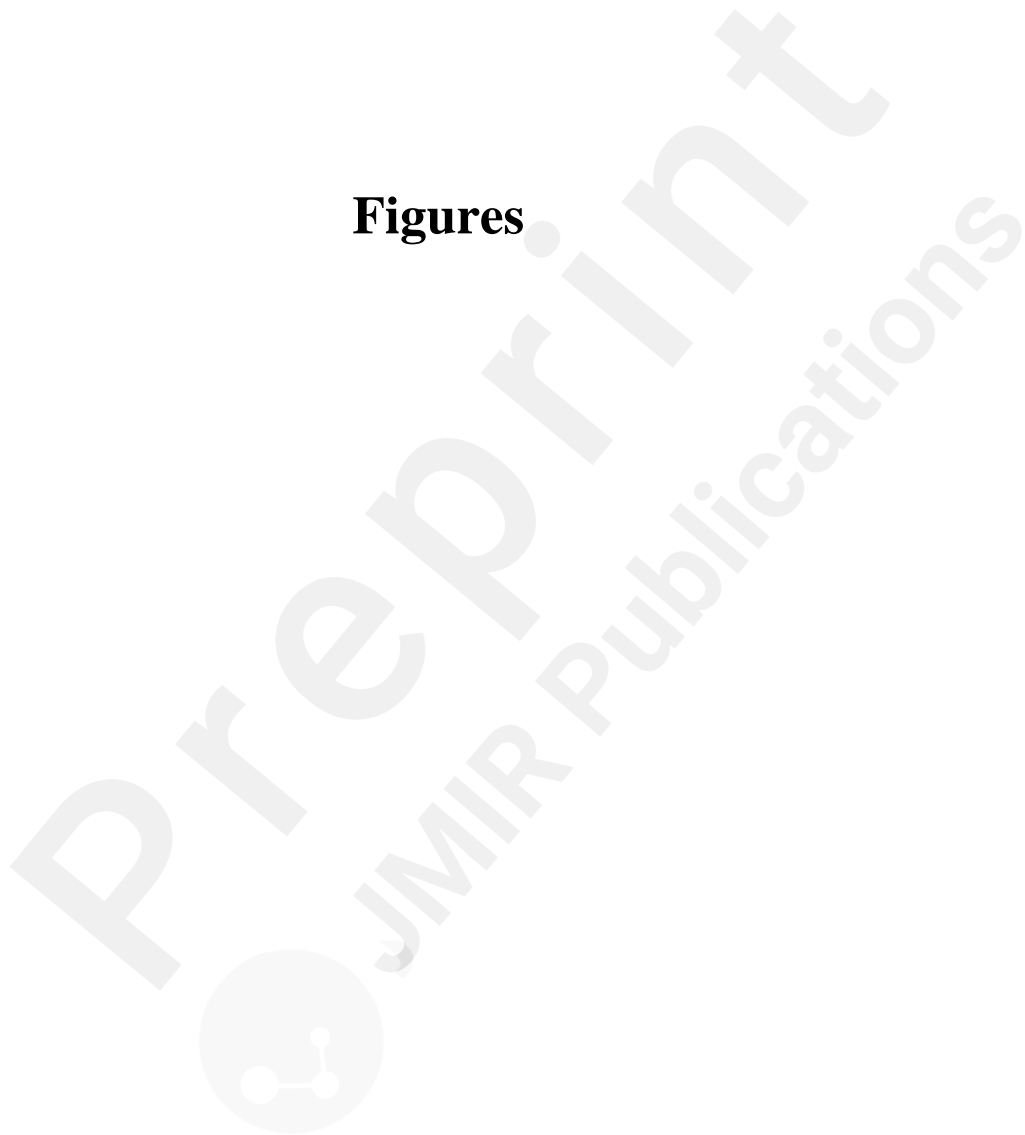
5. Medical enquiries: the patient has a question about their health that can be resolved without a physical examination. They can also attach photographs to accompany the description.

6. Other: any other type not covered by this classification.

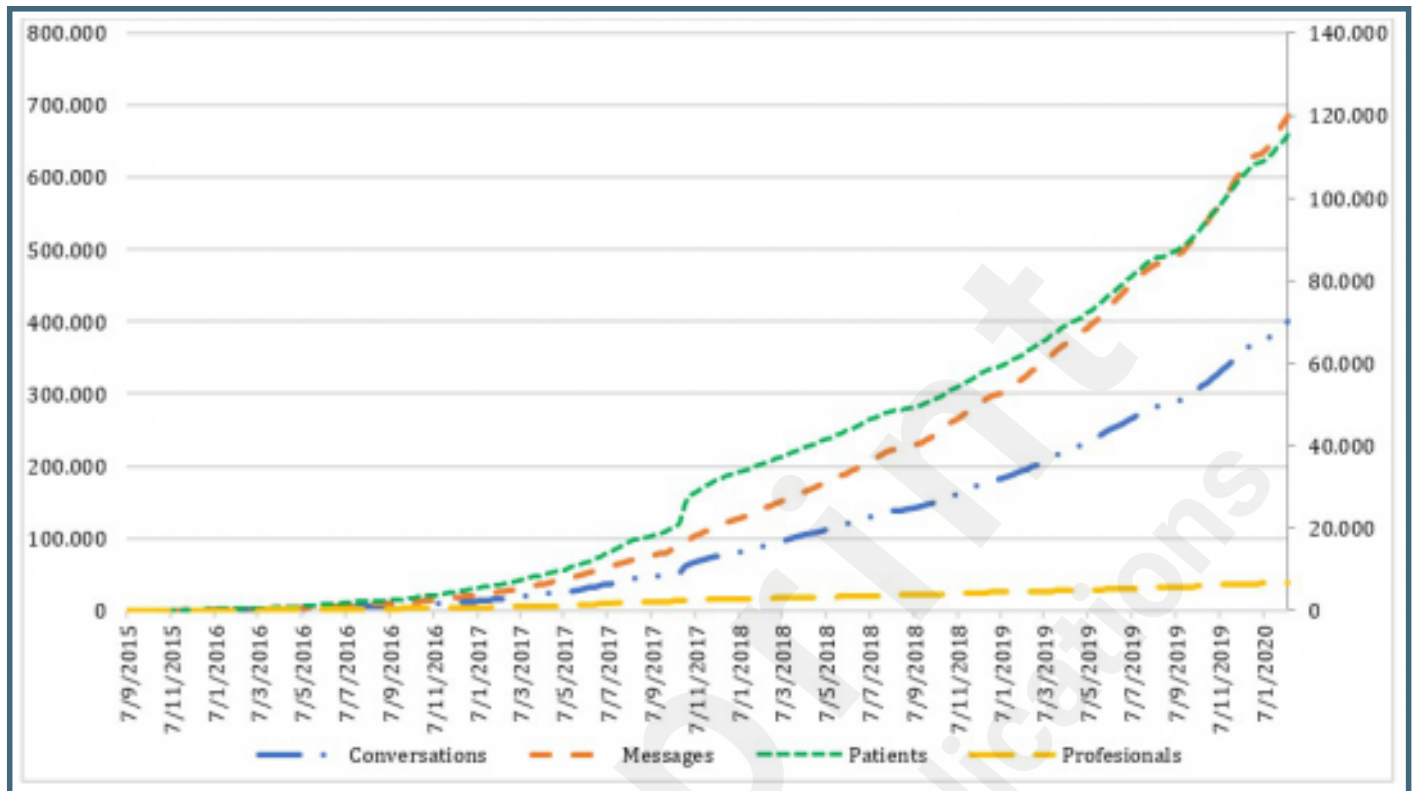
Supplementary Files



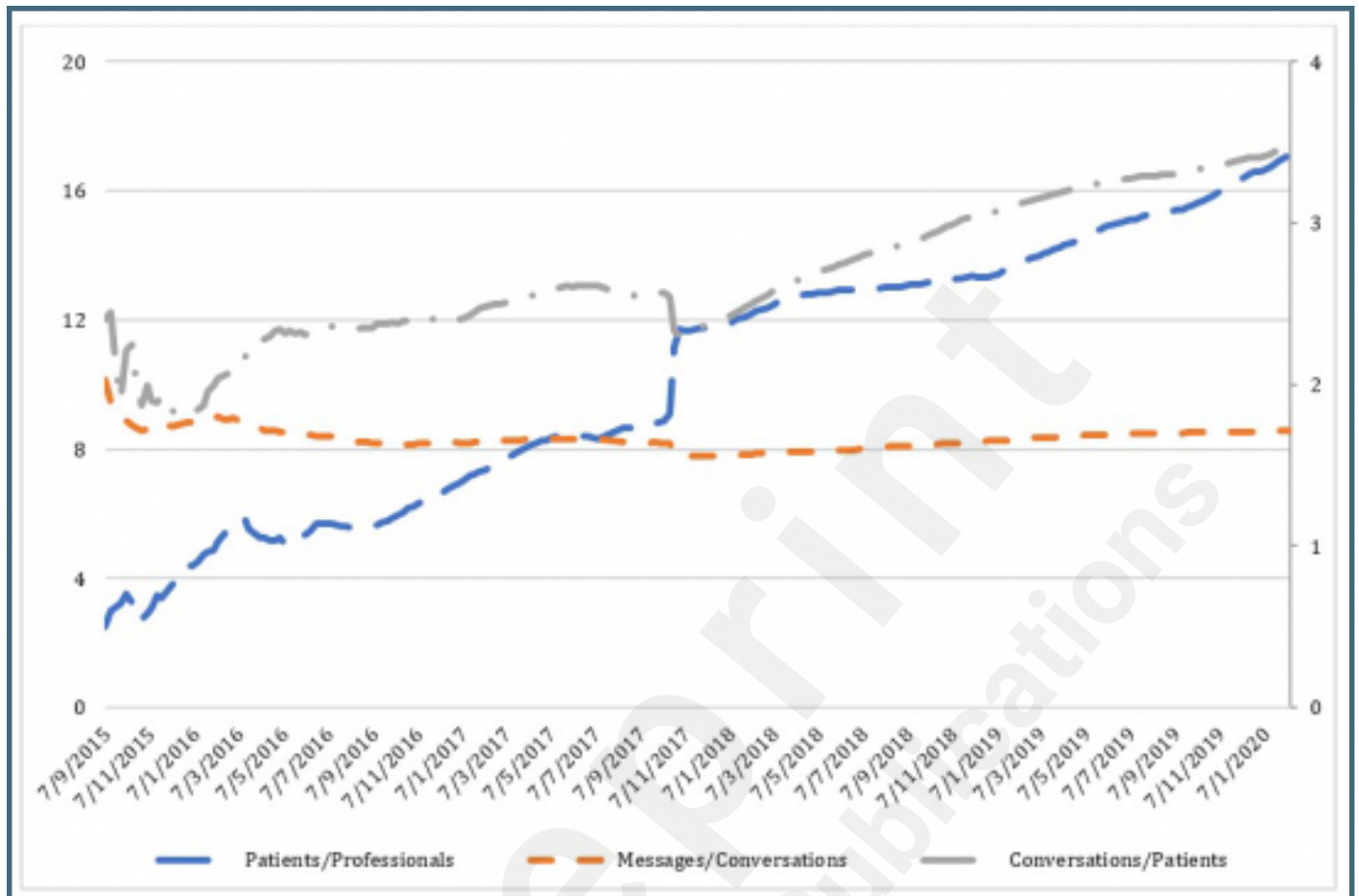
Figures



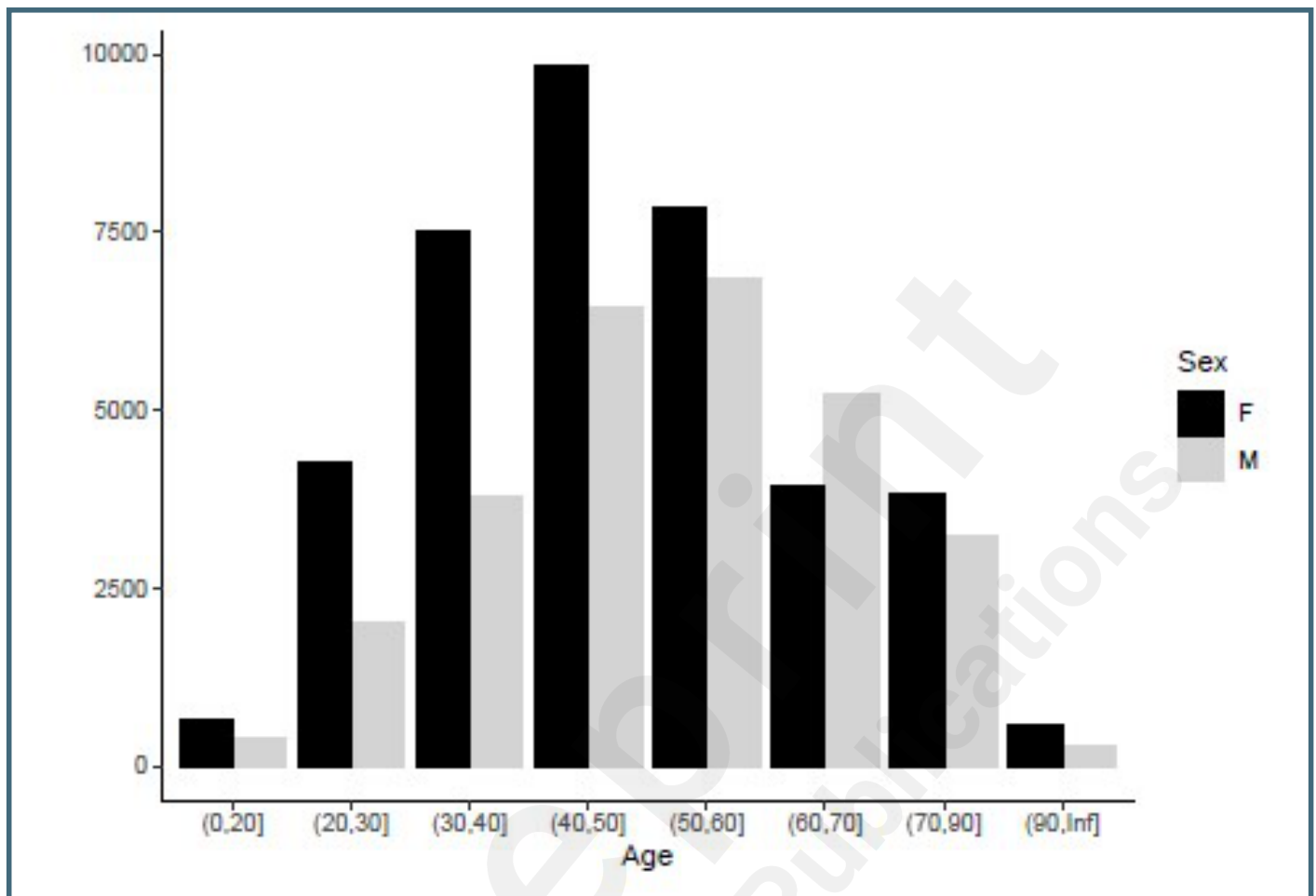
Number of messages and conversations (left axis) and patients and healthcare professional users (right axis).



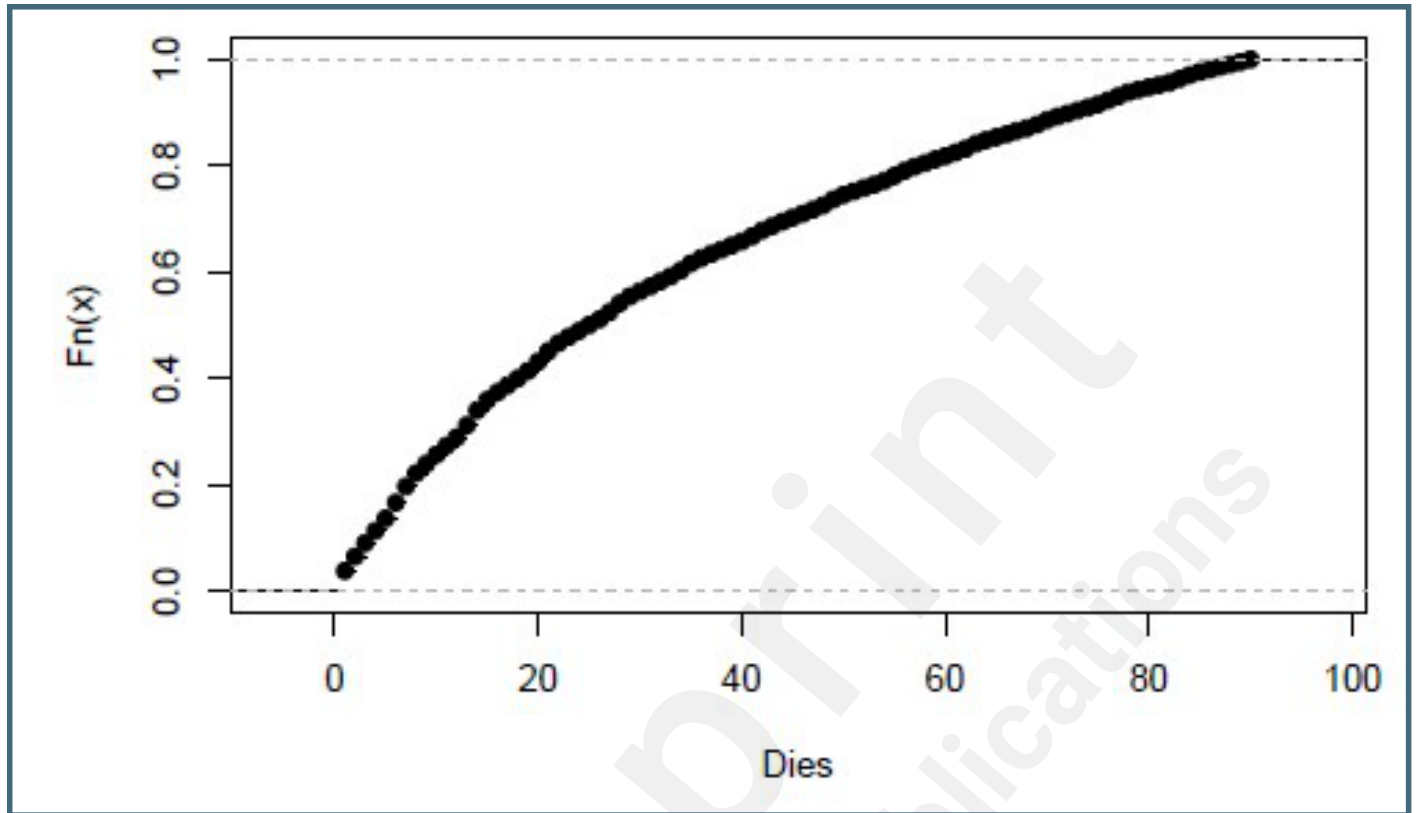
Patients per professional (left axis), messages per conversation and conversation per patient (right axis).



Age profile of patient users of the teleconsultation service, according to gender.



Days until face-to-face visit for eConsultations which result in a face-to-face visit in the following 90 days. Accumulated density.



Time to next face-to-face visit after using eConsulta, according to the initiator, in days.

