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# Bibliométrie et établissements de santé français de 2004 à 2014

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*Bibliometrics and French healthcare institutions from 2004 to 2014*

***Emeline Blanc<sup>1\*</sup>, Roselyne Boulieu<sup>2</sup>, and Delphine Bertram<sup>1</sup>***

<sup>1</sup> Hospices Civils de Lyon, Direction de la Recherche Clinique et de l'Innovation (DRCI), 3 quai des célestins, 69002, Lyon, France.

<sup>2</sup> Université de Lyon, Université Lyon 1, UMR CNRS 5305, Faculté de Pharmacie, Pharmacie Clinique, Pharmacocinétique et Evaluation du Médicament, 8 Avenue Rockefeller, 69003, Lyon, France.

**\* Corresponding author :** Emeline Blanc ,  
Hospices Civils de Lyon, Direction de la Recherche Clinique et de l'Innovation (DRCI),  
3 quai des célestins, 69002, Lyon, France.  
e-mail : emeline.blanc@chu-lyon.fr

**Conflit d'intérêt : aucun.**

# Bibliometrics and French healthcare institutions from 2004 to 2014

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## *Bibliométrie et établissements de santé français de 2004 à 2014*

### ABSTRACT

**Introduction:** Research activity evaluation in French hospitals is based on the number of publications, author position (first, second, third, second-to-last, last, investigator list, and *Other*) and journal category (A being the highest category followed by B, C, D, E, and NC). **Methods:** The profile of publications over the 2004-2014 period in terms of these indicators was evaluated. Hospitals were classified into six groups according to administrative status. Time trends were analysed by three models. One-way ANOVA followed by Tukey's test was performed. **Results:** A total of 192886 publications were analysed. The increase in the number of publications ranged from 628% for for-profit private hospitals to 141% for public teaching hospitals. The most frequent category was B for cancer centres (25%), whereas this was E in public teaching (22%) and non-teaching hospitals (28%), in not-for-profit private hospitals (25%), in the military hospital (30%), and in for-profit private hospitals (24%). The first position was the most frequent for public teaching hospitals (38%) and the military hospital (44%), whereas the *Other* position was the most frequent in cancer centres (26%), in public non-teaching hospitals (28%), in not-for-profit private hospitals (27%), and in for-profit private hospitals (29%). **Discussion:** Different patterns were identified. The author position indicated that all types of hospital are involved in research projects. This study also found that public non-teaching hospitals, not-for-profit private hospitals, for-profit private hospitals, and cancer centres collaborated with other institutions which were often distinguished by publishing in high-category journals.

**KEYWORDS:** bibliometrics; publications; impact factor journal; PubMed; SIGAPS.

### RESUME

**Introduction :** L'évaluation de la recherche des hôpitaux français est basée sur le nombre de publications, la position d'auteurs (première, deuxième, troisième, avant-dernière, dernière, liste investigateurs, *Autres*) et la catégorie de revue (A, B, C, D, E, NC). **Méthodes :** Le profil des publications sur la période 2004-2014 en fonction de ces indicateurs a été évalué. Les hôpitaux ont été classés en six groupes selon leur statut administratif. Les tendances temporelles ont été analysées par trois modèles. Une ANOVA à un facteur suivi du test de Tukey a été effectuée. **Résultats :** 192886 publications sont analysées. L'augmentation du nombre de publications varie de 628% pour les hôpitaux-à-but-lucratif à 141% pour les hôpitaux universitaires. La catégorie B est la plus fréquente pour les centres contre le cancer

(25%), tandis que c'est la catégorie E dans les hôpitaux universitaires (22%), les centres hospitaliers (28%), les hôpitaux-à-but-non-lucratif (25%), l'hôpital militaire (30%) et les hôpitaux-à-but-lucratif (24%). La première position est la plus fréquente pour les hôpitaux universitaires (38%) et l'hôpital militaire (44%), tandis que c'est la position *Autre* pour les centres contre le cancer (26%), les centres hospitaliers (28%), les hôpitaux-à-but-non-lucratif (27%) et les hôpitaux-à-but-lucratif (29%). **Discussion** : Différents modèles sont identifiés. La position d'auteur indique que tous les types d'hôpitaux participent à des projets de recherche. Cette étude a également révélé que les centres hospitaliers, les hôpitaux-à-but-non-lucratif, les hôpitaux-à-but-lucratif et les centres contre le cancer collaboraient avec d'autres ; ces derniers se distinguent en publiant dans des revues de haute catégorie.

**Mots-clés:** bibliométrie ; publications ; impact factor ; PubMed ; SIGAPS

## 1. INTRODUCTION

The funding of research in public teaching hospitals in France evolved to an activity based system in 2006. Gradually, the funding system was enlarged to include the other types of hospital, *i.e.* cancer centres, public non-teaching, not-for-profit private, public military hospitals, and, later, for-profit private hospitals [1, 2]. The funding of research uses bibliometric indicators such as number of publications, journal Impact Factor (IF) [3].

The public teaching hospital of Lille developed software (*Système d'Interrogation, de Gestion et d'Analyse des Publications Scientifiques* [SIGAPS]) to identify the publications where at least one author is affiliated to a hospital. This is then used to share ministerial funding (MERRI) of more than 800 million euros per year among eligible institutions. The SIGAPS score is a composite indicator of publication that takes into account the journal IF and author position over four years. For example, in the 2017 MERRI budget, publications that were taken into account corresponded to the 2016 export (*i.e.* the 2012–2015 period). A total score is attributed to each hospital yearly that is used to allocate a funding. The total MERRI budget is divided according to hospital scores; institutions that have a score that corresponds to less than 250000€ do not receive this funding that is subsequently redistributed to the other

hospitals to avoid dispersion of funding. When several researchers of the same institution are co-authors of the same publication, the highest score is attributed and the publication is counted once for the institution. However, if a publication has authors who are affiliated to different institutions, the publication is counted once for each institution; thus a single publication does not contribute several times to the score of a given institution.

The SIGAPS score has been analysed in several studies. For example, Rouvillain *et al.* evaluated the effect of changing the language of publication by comparing the Revue de Chirurgie Orthopédique with that of the English language journal that replaced it, Orthopaedics and Traumatology: surgery research [4]. Furthermore, Mancini *et al.* highlighted that journals that are considered in several Journal Citation Report (JCR) disciplines may be unfavourably classified according to the SIGAPS, and they also noted that funding allocation based on the SIGAPS score did not encourage to national collaboration with other French teams [5]. However, although it is known that French public teaching hospitals are at the heart of research activities [6] the funding system includes institutions of smaller size and different missions, yet little is known of the publication activities of these. This study therefore aimed to describe the publication patterns of different types of hospitals by analysing the number of publications, the categories of journal, and the position of the author in France from 2004 to 2014.

## **2. METHODS**

### **2.1. SIGAPS database**

In the SIGAPS database, journals are classified into six categories based on the IF distribution within each research discipline, as defined by the JCR Science Edition [7]. The top 10% are category A (scored 8), those above the third quartile not including the top 10% are category B

(scored 6), those above the second quartile are C (scored 4), those above the first quartile are D (scored 3), and those below the first quartile are E (scored 2). Other journals not in the JCR, but which are indexed in PubMed, are categorised NC (scored 1).

In PubMed, journals are indexed according to a procedure. The director of the National Library of Medicine (NLM) decides whether to index a journal, based on a review of the scientific quality and scientific policy of the NLM. The NLM Literature Selection Technical Review Committee (LSTRC) reviews and assesses the quality of the journals, while the NLM Board determines the assortment of journals that will be indexed, depending on the relevance to their respective journals. Critical elements which are analysed are scope and coverage, quality of content, quality of editorial work, production quality, audience, types of content, foreign language journals, geographic coverage, and application process [8]. The journal category is updated every year with the citation index of a journal calculated by the Institute for Scientific Information (ISI) available in the JCR.

In addition to journal category, a score is also attributed to author position. The first and last authors are the best positions (scored 4) and are followed by second and second-to-last author positions (scored 3), third position (scored 2), *Other* position, and investigator list (both scored 1). The investigator list represents all principal investigator(s) or collaborators who contributed to the research according to PubMed [8]. If several authors belong to the same institution, the best position is selected. If there are authors from different institutions on the same paper, the paper is attributed to each of these considering the best position of authors from individual institutions.

The funding system was implemented in 2006, and for this year publications of the two previous years (2004 and 2005) were considered. Data for years 2004 through to 2014 were extracted from the SIGAPS database in September 2015 (under special authorization by the

Ministry of Health, *Bureau Innovation et Recherche Clinique*, issued on 22 December 2014). All institutions using the database were extracted irrespective of whether or not they received MERRI funding (*i.e.* SIGAPS score corresponding to less than 250000€); the objective of the study was to evaluate production of scientific articles by hospitals in France. The following data were extracted: institution of affiliation, year of publication, category of journal (A, B, C, D, E, or NC), author position (first, second, third, *Other*, investigator list, Second-to-Last, or last), type of publication (comment, editorial, erratum, meeting, letter, original article, other, review). Investigator list is only available since 2008 (year of introduction by PubMed). Data are presented for all hospital types combined as well as for each hospital type. The category of a publication is fixed and therefore is counted once for a given hospital type, however, although each author has one affiliation, there may be two or more affiliations to different hospital types and thus a given publication may contribute to as many hospital types. As author position is taken into account, in cases where there are affiliations to two (or more) different hospitals of the same type, then the publication is counted as many times for the given hospital type.

## [2.2. Statistical analysis](#)

For data analysis, only publications classified as original articles, editorials, and reviews were retained as these represent the greatest amount of work than the other types, *i.e.* comments, errata, letters, meetings. Hospitals were classified into six groups, based on their administrative status: public teaching hospital, cancer centre, public non-teaching hospital, not-for-profit private hospital, public military hospital, and for-profit private hospital. The institutions included in each group are homogenous in terms of size and missions and therefore cannot be compared. The statistical analysis considered that the six groups were independent.

Time trends in the annual number of publications over the 2004-2014 period were analysed by multiple regression. The absolute number of publications for each hospital type was fitted using a polynomial equation from one to third degree. Student t-test was performed on  $a^3$  for third degree,  $a^2$  for second degree, and  $a$  for first degree coefficients of the polynomials.

When the p-value of  $a^3$  is not significant, we can consider that the coefficient is null and is not a third degree polynomial. We applied the same rational for  $a^2$  for second degree, and  $a$  for first degree coefficients. The same analysis was performed excluding authors in the investigator list in order to verify the influence of this position.

Normal distribution was assessed by Shapiro-Wilk tests. In order to respect this application condition, outliers were eliminated and if the normal distribution was not respected, a logarithmic scale was used. One-way analysis of variance (ANOVA) was performed using Rstudio software (version 3.2.2) at a 5% significant level [9]. ANOVA is a hypothesis-testing statistical method that tests the equality of two or more population means by examining the variances of the samples used determining whether the differences between the samples are due to random error or they can be attributed to systematic treatment effects, causing the mean value in one group to differ from the mean value in another. After ANOVA, Tukey's honest significant difference post-hoc test was also performed, when the null hypothesis in ANOVA was rejected, to determine which of the studied groups (*i.e.* category and author position) differed significantly from 5%. In the same hospital group, the comparison was made between the mean number of articles per year in category A compared to that of B, that of category A compared with that of category C of the group, *etc.* The same test was applied to author position.



### **3. RESULTS**

#### **3.1. Data description**

A total of 211715 publications between 2004 and 2014 in which at least one author was affiliated to a SIGAPS-eligible hospital were extracted. Only the 192886 publications related to editorials, original articles, or reviews were retained for analysis in this study. These publications corresponded to authors with affiliations to a total 217 hospitals (figure 1).

Between the year 2004 and the year 2014, the number of publications increased from 13987 to 20210 (144%); the number of hospitals producing at least one publication in 2004 was 174 and in 2014 this was 208 (120%), and there was a notable increase over the same period of for-profit private hospitals [26 to 48 (185%)]. It is of note that not all 217 hospitals produced a publication each studied year (table 1).

Between the year 2004 and the year 2014, the number of publications increased from 12780 to 18080 (141%) for public teaching hospitals, corresponding to a mean increase of 530 publications per year; from 1353 to 2548 (188%) for cancer centres, corresponding to a mean increase of 120 publications per year; from 1047 to 2095 (200%) for public non-teaching hospitals, corresponding to a mean increase of 105 publications per year; from 550 to 1223 (222%) for not-for-profit private hospitals, corresponding to a mean increase of 67 publications per year; from 247 to 391 (158%) for the public military hospital, corresponding to a mean increase of 14 publications per year; and from 101 to 634 (628%) for-profit private hospitals, corresponding to a mean increase of 53 publications per year. When the investigator list was excluded from the analysis, the number of publications increased from 13987 to 19853 (142%) for all hospitals, from 12780 to 17737 (139%) for public teaching hospital, from 1353 to 2477 (183%) for cancer centre, from 1047 to 1933 (185%) for public non-teaching hospital, from 550 to 1105 (201%) for not-for-profit private hospital, from 247 to

378 (153%) for the public military hospital, and from 101 to 584 (578%) for-profit private hospital (figure 2).

Among the analysed publications, 35452 (18%) were in category A, 40069 (21%) in category B, 34852 (18%) in category C, 24285 (13%) in category D, 42059 (22%) in category E, and 16169 (8%) in category NC. Among all hospitals the best author position was the first position for 97497 (36%) publications, the last position for 59316 (22%), and the *Other* position for 45207 (17%). The *Other* position was the most frequent in cancer centres (26%; n=6852), in public non-teaching hospitals (28%; n=5332), in not-for-profit private hospitals (27%; n=2907), and in for-profit private hospitals (29%; n=1123; table 2).

In analyses considering publications including those in which an author in the investigator list is the only author affiliated to the hospital type, the number of publications by year and by hospital type was modelled using linear regression, except for the public military hospital and for for-profit private hospitals which were fitted with a third degree. Over the period considered, the annual number of publications increased by 558 publications per year for public teaching hospitals, by 139 publications per year for cancer centres, by 111 publications per year for public non-teaching hospitals and, by 73 publications per year for not-for-profit private hospitals. For the public military hospital, the number of publications decreased after 2011. According to the mathematical model, for for-profit private hospitals, the rate of increase in the number of publications will decrease after 2014. In analyses considering publications excluding those in which an author is only in the investigator list, the same models were used, and the same trends found (figure 3).

### [3.2. Journal category](#)

Among all included hospitals, and over the study period, the number of publications was significantly greater in category A, B, C, E compared to D and NC. For individual hospital

types, public teaching hospitals followed the same pattern as that found for all included hospitals except for category D publications which were more frequent than NC. In cancer centres, the number of publications in category B was significantly greater than category C, D, E and NC. In public non-teaching hospitals, as well as for the public military hospital, the number of category E publications was significantly greater than the other categories of publications. In not-for-profit private hospitals, the number of category E publications was significantly greater than that of category C, D, and NC publications. For for-profit private hospitals, there was no significant difference between each of the categories except between category E and NC publications (figure 4).

### 3.3. Author position

Among all included hospitals, the first position was significantly the most frequent position found over the study period, followed by the last position, and then the *Other* position. There was no significant difference between second, third, and second-to-last author positions. The investigator list was the least frequent position. Among individual hospital types, public teaching hospitals followed the same pattern as that found among all included hospitals. For cancer centres, there was no significant difference between first and *Other* positions, but *Other* position was significantly more frequent than second, third, second-to-last, last positions, and investigator list. In public non-teaching hospitals, as well as in not-for-profit private hospitals, the first or *Other* position was significantly more frequent than second, third, second-to-last, last positions, and investigator list. For these hospitals, there was no significant difference between first, and *Other* positions. In the public military hospital, the first position was significantly the most frequent position found over the study period. In for-profit private hospitals, there was no significant difference between first, and *Other* positions. *Other* position was significantly more frequent than second, third, second-to-last, last

positions, and investigator list. For first position the only significant result was with second-to-last author (figure 5).

#### **4. DISCUSSION**

The present study describes the number of publications included in the SIGAPS database for all types of hospitals in France from 2004 to 2014. SIGAPS is a tool that was implemented by the public teaching hospital of Lille with the ministry of health in the context of the new hospital funding scheme which is partially based on research activity quantified by the number and the quality of publications. The results of the study show an increase of the number of publications published by all types of French hospitals over recent years, and that all types of hospital publish scientific articles.

The number of publications in the SIGAPS database is complete for public teaching hospitals, cancer centres, and the public military hospital. However, the number of publications from the other types of hospital, *i.e.* public non-teaching hospitals, not-for-profit private hospitals, and for-profit private hospitals included in the SIGAPS database are far from complete; for example, in 2012, only 10% of public non-teaching hospitals, 4% of not-for-profit private hospitals, and 4% for-profit private hospitals were included in SIGAPS database compared to data from *Institut national de la statistique et des études économiques* [10]. It is potentially a source of bias herein but as the publication-based system allocates funding for all types of hospital, all hospitals concerned by publications are included in SIGAPS database, and this is unlikely to greatly affect the conclusions. For public teaching hospitals, the number of publications is approximately the same as that reported in another study [6], which provides a certain external validation to the results for public teaching hospitals, but also this validation may be extrapolated to other hospital groups as the data were from the same extraction.

Another potential source of bias could be that information became more complete and precise over the study period, which could be due to more attention paid by researchers to mention more carefully all participant institutions and authors. In the SIGAPS database, each author confirms that each publication is his/hers. An author knows his/her publications and if a publication does not appear in the database he/she will notice it and rectify the error. Hence, we can consider that all publications were present in the SIGAPS database. In contrast, after the creation of SIGAPS, it is possible this led to greater interest in being cited in a publication as this will contribute to hospital funding.

A more general point is that we used the SIGAPS to evaluate publication production in France as this is used for funding allocation, yet other methods could be employed. For example Aggarwal *et al.* employed an annual average percentage growth on publications extracted from Web of Science [11]; Fan *et al.* described the top 10 journals, top 10 authors, and top 10 medical fields according to the number of publications [12]; and Wang *et al.* analysed publications per population and publications per gross domestic product [13].

For all types of hospital, the number of publications between the year 2004 and the year 2014 increased by 144% (mean 622 publications/year; n=13987 to n=20210). The number of publications with an author only in the investigator list cannot explain this increase because the same profile of increase was found when considering publications with and without investigator list from 2004 to 2014. As explained in the Methods section, the investigator list has been available since 2008, however some publications from 2004 to 2007 do have an author in the investigator list, which can be explained by author groups included in the author list; this affected only a few publications (1 in 2005, 9 in 2006, and 5 in 2007). It has to be noted that the increase we found cannot be explained by non-indexed online journals as the SIGAPS database only considers journals with an IF or those that are indexed in PubMed and

meet rigorous selection criteria [8]. The general increase in the number of publications over the study period can, however, be explained by the fact that a non-negligible part of the hospital research funding, irrespective of the type of hospital, is based on the number of publications resulting in a strong motivating factor for publication. Moreover, this increase is greater than that reported in France for all types of scientific publications (136% increase from 2004 to 2014, corresponding to a mean increase of 2004 publications per year [14]), but less important than that found world-wide (all disciplines; 165% increase from 2004 to 2014 corresponding to a mean increase of 61593 publications per year) that is mainly attributable to the emerging countries such as China, Brazil, and India [14], as well as the increase of the number of journals [15].

At the level of individual hospital types, it is interesting to note that, as expected, public teaching hospitals are the most important producers of research but more importantly other hospitals also publish. To provide a more general perspective of this, at the national level and including both hospital and non-hospital research structures there were 738304 indexed original articles published in research fields during the 2004-2014 period [14]. From the extraction of the SIGAPS database used herein there were 117648 (16% of the total production) indexed original articles published by public teaching hospitals and 35955 (5%) such articles published by other hospitals. This includes a certain overlap in cases when both teaching and non-teaching hospitals participated to the studies (data not shown). This is of importance as these non-teaching structures do not have an objective to publish, yet the present study did find important increases in production over the studied period. For instance the number of publications in 2014 was 6-fold greater than that in 2004 among for-profit private hospitals, the validity of which could be brought into question as at the same time the number of centres also increased (from 26 to 48). However, the greater number of centres

does not fully explain the increase in publications as the ratio of the number of publications to the number of centres in 2004 was 4, while the number increased to 13 in 2014 (data not shown). The strong increase of publications produced by for-profit private hospitals (628%) can be explained by their eligibility for funding in 2012 [1] and will decrease after 2014 according to the mathematical model.

For all included hospitals, over the period considered, the first position was more frequent than the last position, which may be in relation to young researchers being more willing to produce publications and at the same time more frequently being the first author. Surprisingly, there were a greater number of publications in E category compared with the D category. We could have expected to find the opposite as publishing in D category lead to more hospital funding. An explanation could be that researchers initially target category D journals but following rejection are finally accepted for publication in an E category journal.

With the exception of public teaching hospitals, which followed the same pattern described above, several patterns regarding author position and categories can be observed. It is of note that the first position was frequent for each type of institution, which reflects that all types of institution lead research projects. For cancer centres, publications were mainly published in category B journals and the most frequent author position was the *Other* position. Regarding the journal categories, it has been shown that there is a bias among oncology publications whereby the most prestigious general and oncological medical journals mainly published on 5 types of cancer only [16]. It is possible that this may have led to a dispersion of publications to research disciplines, but this was not investigated in the present study. Concerning the author position, the dominance of the *Other* position can be explained by the active participation of cancer centres in international clinical trials. The dominance of the first position indicated that cancer centres led research projects.

For public non-teaching and, not-for-profit private hospitals, publications were mainly published in E category journals. An interpretation could be that this kind of hospital is less structured especially in terms of clinical trial management and medical research and less informed about the funding aspect than the large public teaching hospitals. Concerning the author position in these hospital types, as for for-profit private hospitals, the preponderance of the *Other* position for authors highlights collaboration between the different types of hospital, especially in clinical trials. Whereas public teaching hospitals, where the first author position dominated, often initiate medical research and seek collaboration with the other types of hospital for patient recruitment. A specific pattern was found for the public military hospital, which published most frequently in E category journal and in first position that indicates they perform independent research. This suggests that the research conducted concerned specific medical fields or situations.

## **5. CONCLUSION**

Quantitatively, analysis of the profile of scientific publications in France found an increase for each type of hospital from 2004 to 2014. Qualitatively, the author position indicated that all types of hospital are involved in research projects. This study also found that public non-teaching hospitals, not-for-profit private hospitals, for-profit private hospitals, and cancer centres collaborated with other institutions which were often distinguished by publishing in high-category journals.



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## FIGURE CAPTION

### Figure 1. Flow-chart of publication selection

Among the publications identified in the SIGAPS database published between 2004 and 2014, only editorials, original articles, and reviews were retain for analysis.

### Figure 2. Percentage of increase in number of publications between 2004 and 2014 for each type of hospital with and without the author in investigator list (IL) position

The blue bars represent the increase between 2004 and 2014 in the number of publications including those in which an author in the investigator list (IL) is the only author affiliated to the hospital for each hospital type. The orange bars represent the increase between 2004 and 2014 in the number of publications excluding those in which an author is only in the IL for each hospital types.

### Figure 3. Number of publications per year for each type of hospital with and without the author in investigator list position

The number of publications including those in which an author in the investigator list (IL) is the only author affiliated to the hospital (blue line) and the associated linear or polynomial (Poly.) trend line (black continuous line) for (A) public teaching hospital, (B) cancer centre, (C) public non-teaching hospital, (D) not-for-profit private hospital, (E) the public military hospital, and (F) for-profit private hospital is shown. The number of publications excluding those in which an author is only in the IL (red discontinuous line) and the associated trend line (black discontinuous line) are also shown. Of note, the scales used in the different panels are different to aid visualisation. Each trend line is describe by it equation.

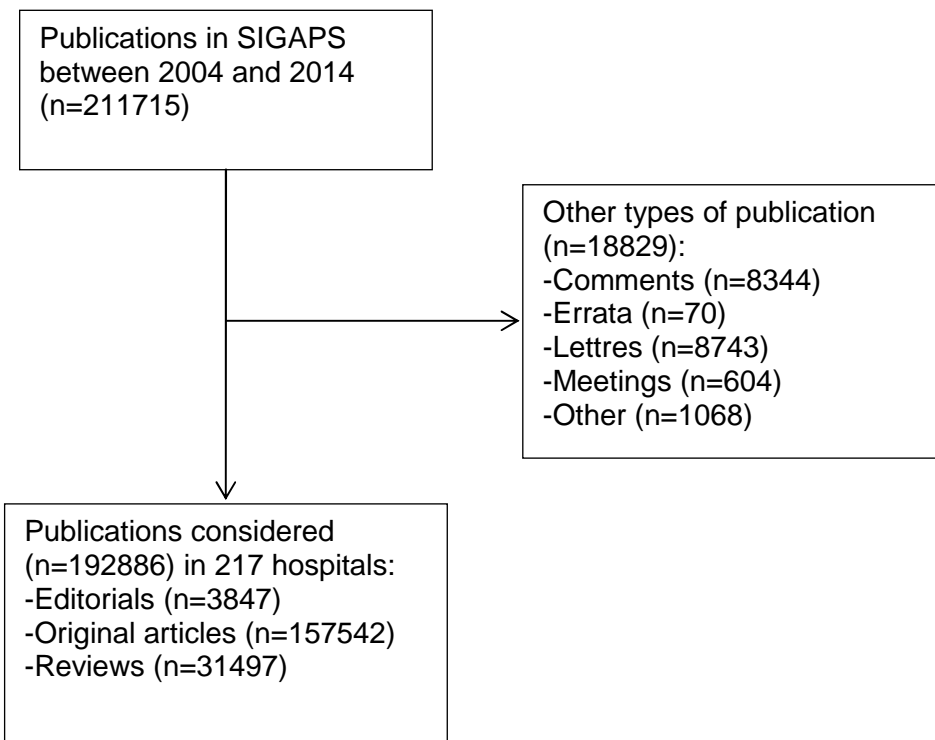
**Figure 4. Differences in the number of publications according to journal categories and hospital types**

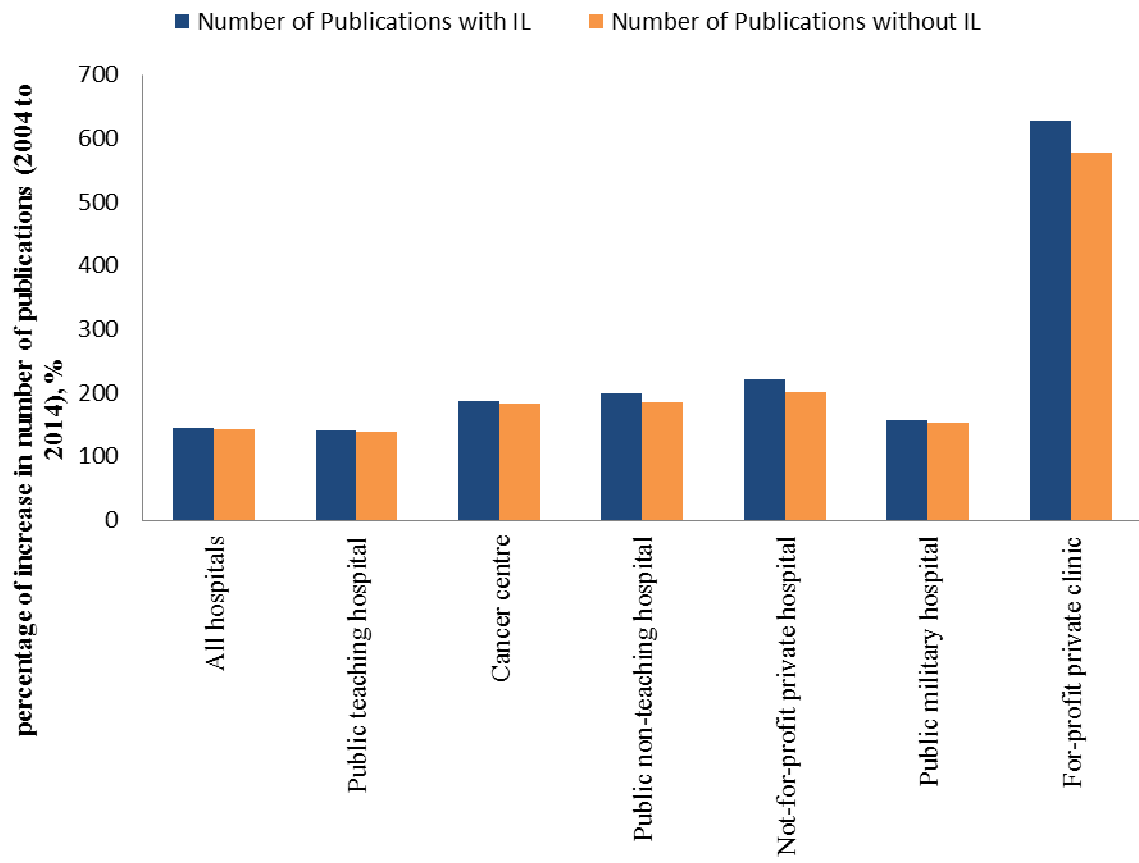
The difference between the number of publications in journal categories is the difference between the two mean number of publications from 2004 to 2014, represented by the first category minus the second. The result of the subtraction is a positive value with a significant p-value in favour of the first category (orange filled circles); a positive value with a non-significant p-value (orange circle); a negative value with a significant p-value in favour of the second category (blue filled circle) and, a negative value with a non-significant p-value (blue circle).

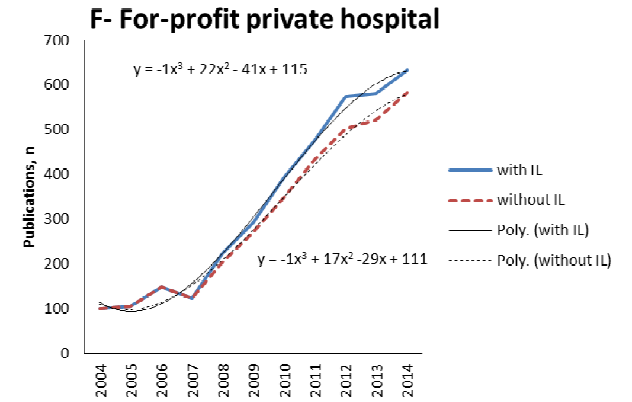
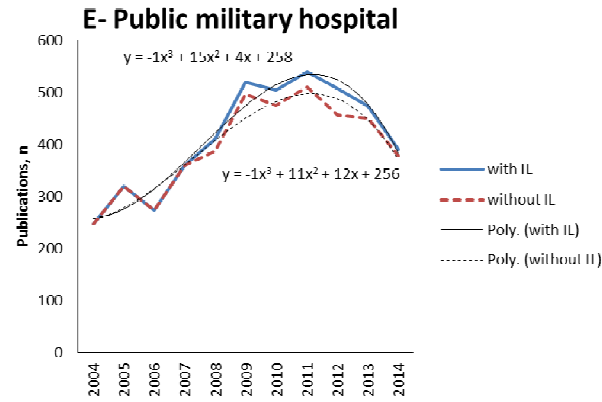
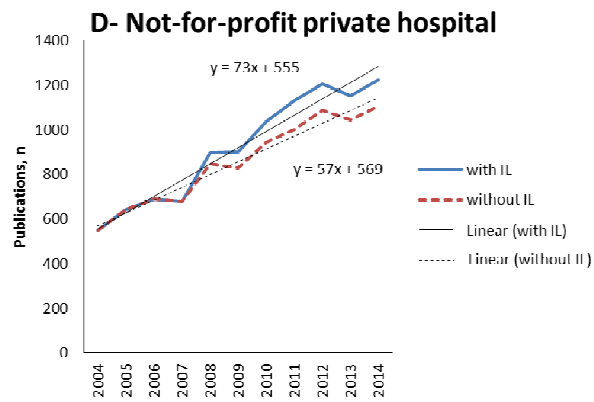
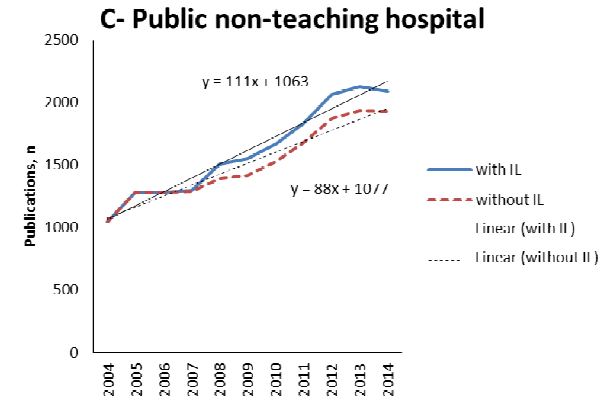
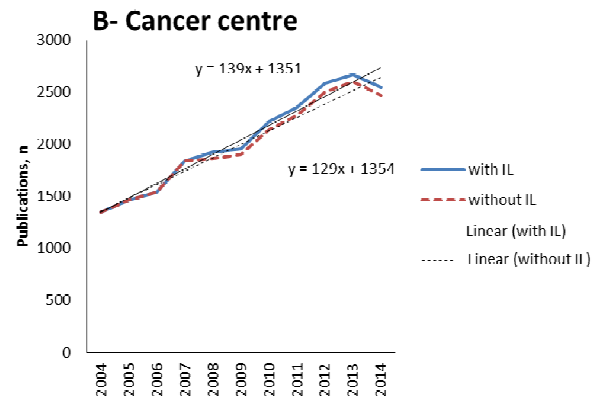
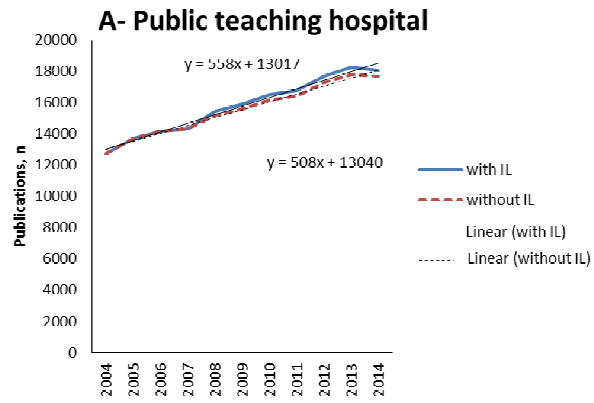
**Figure 5. Differences in the number of publications according to author positions and different hospital types**

The difference between the number of publications in author positions is the difference between the two mean number of publications from 2004 to 2014, represented by the first position minus the second. The result of the subtraction is a positive value with a significant p-value in favour of the left position (orange filled circles); a positive value with a non-significant p-value (orange circle); a negative value with a significant p-value in favour of the right position (blue filled circle) and, a negative value with a non-significant p-value (blue circle).

**Conflit d'intérêt : aucun.**



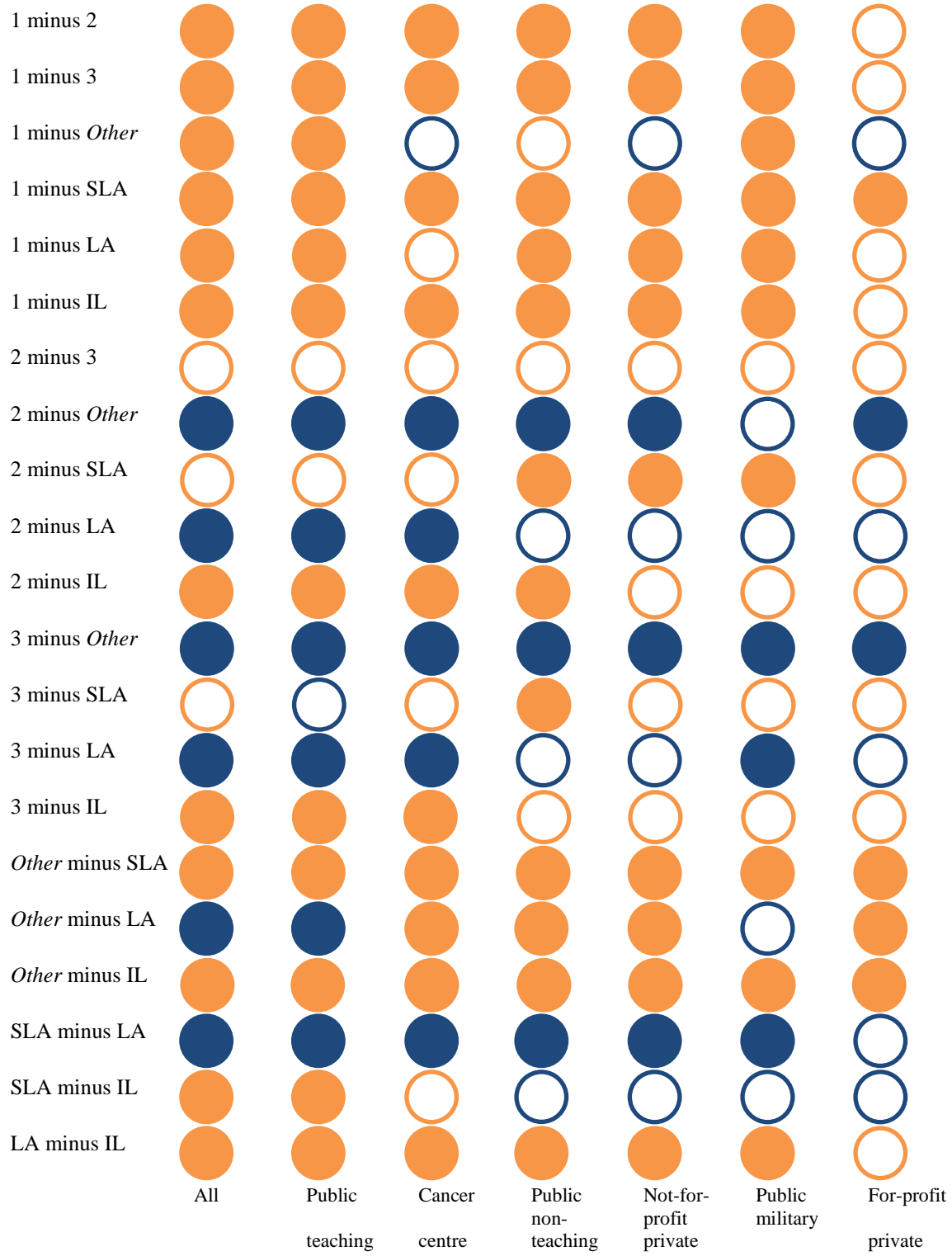






|   |                 |        |   |
|---|-----------------|--------|---|
|   |                 | Result |   |
|   |                 | +      | - |
| p | Significant     | ●      | ● |
|   | Non-significant | ○      | ○ |

**Number of publications**





**Table 1. Publications according to hospital type for the years 2004 to 2014**

|                                 |                            | 2004  | 2005  | 2006  | 2007  | 2008  | 2009  | 2010  | 2011  | 2012  | 2013  | 2014  |
|---------------------------------|----------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| All hospitals                   | Publications, n            | 13987 | 15095 | 15619 | 15981 | 17163 | 17709 | 18352 | 18680 | 19703 | 20387 | 20210 |
|                                 | Publications without IL, n | 13987 | 15094 | 15610 | 15976 | 16893 | 17406 | 18002 | 18301 | 19280 | 19935 | 19853 |
|                                 | Centres, n                 | 174   | 176   | 191   | 186   | 190   | 203   | 207   | 207   | 211   | 204   | 208   |
| Public teaching hospital        | Publications, n            | 12780 | 13713 | 14195 | 14341 | 15465 | 15953 | 16531 | 16808 | 17733 | 18283 | 18080 |
|                                 | Publications without IL, n | 12780 | 13712 | 14186 | 14337 | 15195 | 15649 | 16204 | 16440 | 17314 | 17846 | 17737 |
|                                 | Centres, n                 | 32    | 32    | 32    | 32    | 32    | 32    | 32    | 32    | 32    | 32    | 32    |
| Cancer centre                   | Publications, n            | 1353  | 1469  | 1547  | 1842  | 1925  | 1961  | 2220  | 2357  | 2587  | 2676  | 2548  |
|                                 | Publications without IL, n | 1353  | 1469  | 1547  | 1841  | 1865  | 1904  | 2145  | 2285  | 2506  | 2608  | 2477  |
|                                 | Centres, n                 | 19    | 19    | 20    | 20    | 20    | 20    | 20    | 20    | 20    | 20    | 20    |
| Public non-teaching hospital    | Publications, n            | 1047  | 1290  | 1289  | 1297  | 1509  | 1555  | 1674  | 1841  | 2067  | 2135  | 2095  |
|                                 | Publications without IL, n | 1047  | 1290  | 1287  | 1296  | 1397  | 1424  | 1528  | 1683  | 1876  | 1939  | 1933  |
|                                 | Centres, n                 | 69    | 71    | 73    | 73    | 76    | 77    | 76    | 78    | 78    | 76    | 76    |
| Not-for-profit private hospital | Publications, n            | 550   | 643   | 689   | 678   | 896   | 900   | 1035  | 1129  | 1205  | 1150  | 1223  |
|                                 | Publications without IL, n | 550   | 643   | 689   | 678   | 847   | 830   | 942   | 1002  | 1087  | 1043  | 1105  |
|                                 | Centres, n                 | 27    | 27    | 31    | 30    | 31    | 31    | 33    | 33    | 33    | 33    | 31    |
| Public military hospital        | Publications, n            | 247   | 320   | 273   | 360   | 410   | 519   | 504   | 539   | 507   | 474   | 391   |
|                                 | Publications without IL, n | 247   | 320   | 273   | 360   | 388   | 497   | 475   | 510   | 456   | 450   | 378   |
|                                 | Centres, n                 | 1     | 1     | 1     | 1     | 1     | 1     | 1     | 1     | 1     | 1     | 1     |
| For-profit private hospital     | Publications, n            | 101   | 105   | 148   | 123   | 224   | 293   | 393   | 476   | 575   | 582   | 634   |
|                                 | Publications without IL, n | 101   | 105   | 148   | 123   | 205   | 272   | 349   | 433   | 503   | 523   | 584   |
|                                 | Centres, n                 | 26    | 26    | 34    | 30    | 30    | 42    | 45    | 43    | 47    | 42    | 48    |

IL: Investigator List; centre: individual institution

**Table 2. Publications according to category, author position, and type for the different hospital types**

|                             | Publication, n; |      |                          |      |               |      |                              |      |                                 |      |                          |      |                             |      |
|-----------------------------|-----------------|------|--------------------------|------|---------------|------|------------------------------|------|---------------------------------|------|--------------------------|------|-----------------------------|------|
|                             | All hospitals   |      | Public teaching hospital |      | Cancer centre |      | Public non-teaching hospital |      | Not-for-profit private hospital |      | Public military hospital |      | For-profit private hospital |      |
| Journal category, n (%)     |                 |      |                          |      |               |      |                              |      |                                 |      |                          |      |                             |      |
| A                           | 35452           | 18%  | 32234                    | 19%  | 5209          | 23%  | 3137                         | 18%  | 1909                            | 19%  | 462                      | 10%  | 678                         | 19%  |
| B                           | 40069           | 21%  | 35966                    | 21%  | 5686          | 25%  | 3175                         | 18%  | 1926                            | 19%  | 784                      | 17%  | 604                         | 17%  |
| C                           | 34852           | 18%  | 31438                    | 18%  | 4188          | 19%  | 2842                         | 16%  | 1646                            | 16%  | 753                      | 17%  | 669                         | 18%  |
| D                           | 24285           | 13%  | 22187                    | 13%  | 2444          | 11%  | 2301                         | 13%  | 1263                            | 13%  | 610                      | 13%  | 548                         | 15%  |
| E                           | 42059           | 22%  | 38023                    | 22%  | 3693          | 16%  | 5061                         | 28%  | 2554                            | 25%  | 1366                     | 30%  | 886                         | 24%  |
| NC                          | 16169           | 8%   | 14034                    | 8%   | 1265          | 6%   | 1283                         | 7%   | 800                             | 8%   | 569                      | 13%  | 269                         | 7%   |
| Total                       | 192886          | 100% | 173882                   | 100% | 22485         | 100% | 17799                        | 100% | 10098                           | 100% | 4544                     | 100% | 3654                        | 100% |
| Best author position, n (%) |                 |      |                          |      |               |      |                              |      |                                 |      |                          |      |                             |      |
| First                       | 97497           | 36%  | 82943                    | 38%  | 6756          | 25%  | 4843                         | 25%  | 2627                            | 25%  | 2010                     | 44%  | 795                         | 21%  |
| Second                      | 25331           | 9%   | 18764                    | 9%   | 2672          | 10%  | 2285                         | 12%  | 1215                            | 11%  | 478                      | 11%  | 452                         | 12%  |
| Third                       | 19718           | 7%   | 14287                    | 6%   | 2236          | 8%   | 1843                         | 10%  | 1046                            | 10%  | 303                      | 7%   | 390                         | 10%  |
| <i>Other</i>                | 45207           | 17%  | 36017                    | 16%  | 6852          | 26%  | 5332                         | 28%  | 2907                            | 27%  | 644                      | 14%  | 1123                        | 29%  |
| Second-to-last              | 17761           | 7%   | 14288                    | 6%   | 1988          | 7%   | 948                          | 5%   | 506                             | 5%   | 161                      | 4%   | 203                         | 5%   |
| Last                        | 59316           | 22%  | 49639                    | 23%  | 5411          | 20%  | 2607                         | 14%  | 1535                            | 15%  | 758                      | 17%  | 538                         | 14%  |
| Investigator list           | 4794            | 2%   | 4416                     | 2%   | 661           | 2%   | 1297                         | 7%   | 741                             | 7%   | 190                      | 4%   | 325                         | 8%   |
| Total                       | 269624          | 100% | 220354                   | 100% | 26576         | 100% | 19155                        | 100% | 10577                           | 100% | 4544                     | 100% | 3826                        | 100% |
| Publication type, n (%)     |                 |      |                          |      |               |      |                              |      |                                 |      |                          |      |                             |      |
| editorial                   | 3847            | 2%   | 3520                     | 2%   | 235           | 1%   | 205                          | 1%   | 130                             | 1%   | 47                       | 1%   | 37                          | 1%   |
| original article            | 157542          | 82%  | 142086                   | 82%  | 18699         | 83%  | 15478                        | 87%  | 8667                            | 86%  | 3938                     | 87%  | 3210                        | 88%  |
| review                      | 31497           | 16%  | 28276                    | 16%  | 3551          | 16%  | 2116                         | 12%  | 1301                            | 13%  | 559                      | 12%  | 407                         | 11%  |
| Total                       | 192886          | 100% | 173882                   | 100% | 22485         | 100% | 17799                        | 100% | 10098                           | 100% | 4544                     | 100% | 3654                        | 100% |

Journals are categorised in function of the quartiles and percentiles of the impact factor value of a given discipline. Journal categories: A top 10%; B above third quartile, C, above second quartile, D above first quartile, E below the first quartile. NC other journals not in the Journal Citation Report, but which are indexed in PubMed. The category of a publication is fixed and therefore is counted once for a given hospital type, however, although each author as one affiliation, there may be two or more affiliations to different hospital types and thus a given publication may contribute to as many hospital types. As author position is taken into account, in cases where there are affiliations to two (or more) different hospitals of the same type, then the publication is counted as many times for the given hospital type