CWTS BIBLIOMETRIC REPORT
Meaningful metrics

Bibliometric report of STZ (Samenwerkende Topklinische Ziekenhuizen 2013-2022/23)

October 18, 2024

Universiteit Leiden

Bibliometric report of STZ (Samenwerkende Topklinische Ziekenhuizen 2013-2022/23)

Report for STZ

Bestuur STZ
E-mail s.vanaken@stz.nl

CWTS

Carole de Bordes & Ed Noyons
E-mail info@cwts.nl

CWTS B.V.
P.O. Box 905
2300 AX Leiden, The Netherlands
Tel +31 71 527 5806
Fax +31 71 527 3911
Webpage http://www.cwtsbv.nl/
E-mail info@cwts.nl

General parameters of the bibliometric report

Parameters

Database	:	Web of Science (Articles, Reviews in the SCIE, SSCI, AHCI, and CPCI)
Version	:	CWTS WOS_2413
Classification system	:	Publication-level classification system (about 4000 fields)
Publication window	:	2013–2022
Citation window	:	Maximum 4 years (and until 2023)
Counting Method	:	Full counting for citation impact measurement
Self-citations	:	Excluded
Top indicators	:	Top 10%

Contents

List of indicators

Output

IntCov Estimated WoS coverage. Based on the number of references in a WoS publication that is also covered by WoS.

N pubs The number of publications included in the output analyses.

P[full] The number of publications, full counting, included in the citation analyses. This is the reason why the numbers may differ from N pubs.

P[OA] The number of publications, full counting, in Open Access(OA), using different kinds of OA: Gold, Hybrid, Bronze or Green. A publication is tagged by one type only. Gold and Hybrid overrule Green. P[OA] is the proportion of publications in Gold, Hybrid, Bronze or Green OA.

PP[OA] Proportion of publication output, full counting, in Open Access(OA): ratio P[OA] to P[full] (only publications for which OA info is available, which covers 99% of P[full]).

Citation-based impact

TCS The total citation score. This represents the total number of citations accumulated within the citation window (see parameters), excluding author self-citations.

MCS The average number of citations received by a publication (TCS/P[full]).

MNCS The mean normalised citation score. This represents the field and year normalised average citation score per publication. Normalisation is based on a detailed publication classification system of CWTS, consisting of about 4000 fields and the year in which it was published. The average MNCS in the entire database is 1. Scores higher than 1 reflect a citation-based impact that is higher than the world average.

MNJS The mean normalised journal score. This represents a normalised citation-based journal impact score. The MNJS is an average score for all publications in the same journals in which a unit published. The normalisation is based on the same principles as the MNCS. The average MNJS in the entire database is 1. Scores higher than 1 reflect a journal citation impact that is higher than the world average.

P[top10%] (not always included but the basis of the different PP[top10%] indicators) The number of publications, that belong to the top 10% of their field. The field is determined on the basis of a detailed publication classification system of CWTS, consisting of about 4000 fields (See Annex B).

PP[top10%] The proportion of publications (P[full]) belonging to the top 10% most cited of their field and in the same year. The field is determined on the basis of a detailed publication classification system of CWTS, consisting of about 4000 fields. The PP[top10%] in the entire database is 0.10 (or 10%). A score above 0.10 represents impact that is higher than the world average.

For more details about the normalised citation indicators, please refer to Waltman et al. (2012). More information about the mentioned publication-level classification is in Annex B.

STZ hospitals

The list below contains the names of the 27 hospitals included in the study and a 2-4 letters acronym used in tables and graphs.

STZ hospitals

Hospital	Acronym
Albert Schweitzer Ziekenhuis	ASZ
Amphia Ziekenhuis	AMPH
Canisius Wilhelmina Ziekenhuis	CWZ
Catharina Ziekenhuis	CATH
Deventer Ziekenhuis	DZ
Elisabeth TweeSteden Ziekenhuis	ETZ
Franciscus Gasthuis & Vlietland	SFG
Gelre Ziekenhuizen	GELR
Haaglanden Medisch Centrum	HMC
HagaZiekenhuis	HAGA
Isala Zwolle	ISAL
Jeroen Bosch Ziekenhuis	JBZ
Maasstad Ziekenhuis	MAAS
Martini Ziekenhuis	MART
Maxima Medisch Centrum	MMC
Meander Medisch Centrum	MEAN
Medisch Centrum Leeuwarden	MCL
Medisch Spectrum Twente	MST
Noordwest Ziekenhuisgroep	NWZ
OLVG	OLVG
Reinier de Graaf Ziekenhuis	RDGG
Rijnstate Arnhem	RIJN
Spaarne Gasthuis	SG
St. Antonius Ziekenhuis	ANTO
VieCuri Medisch Centrum	VIEC
Ziekenhuis Groep Twente	ZGT
Zuyderland Medisch Centrum	ZUYD

1 Introduction

The study on the hospitals organized under the umbrella of STZ relates to 27 research intensive non-academic (top clinical) hospitals. The current report provides bibliometric evidence to assess the performance of those 27 hospitals. By means of advanced bibliometric methods and tools, CWTS assesses and characterizes their scientific output, citation-based impact, research and collaboration profiles. It is a quantitative analysis using the oeuvre as far as covered by Web of Science (WoS), a bibliographic database covering international peer refereed journals in all fields of science. This database discloses bibliographic data (including references and citations) of all articles in journals and is processed by CWTS for bibliometric analysis. Back in 2020, CWTS conducted the previous full bibliometric performance analysis of the STZ hospitals. A regular update of this analysis is valuable for evaluation and management purposes of STZ. This report is in line with the structure of the previous report.

We have also generated collaborative network maps that show the collaboration between the STZ hospitals and their partners. These networks are available on the online web-based version of VOSviewer (https://tinyurl.com/2bgcemdx and https://tinyurl.com/24kfluyt). For each hospital, this collaboration network map consists of the STZ hospital linked up with co-authoring institutions. The network analysis is made for all 27 STZ hospitals (see Section 5).

In Section 2, we discuss the way data has been collected. In Section 3, we discuss the methodological approach in brief. More details about the methods and data is presented in the Annexes. In Section 4, we present and discuss the results for STZ at large. In Section 5, we present the main results for each STZ hospital as background information. Two pages per hospital, one with the main statistics and profiles and one with the co-author network. These results underlie the results of STZ at large (Section 4). Please note that for the results in Section 4 publications are deduplicated.

2 Data collection

In phase 1 of the project, publication data of the individual STZ hospitals and bibliometric data were collected to compile the dataset. This dataset is the basis for calculating the main indicator set and performing advanced bibliometric analyses. In this project, CWTS used the address-based data collection methodology. This means that we collected publications from our CI-system [i.e. CWTS in-house version of the Web of Science (WoS) online database] by looking at the address affiliations of the publications using known name- and address- variants of each of the 27 individual hospitals. In this study, only journal articles and reviews indexed in the Web of Science core collection (WoS) were used. CWTS also studied the most recent changes (names, mergers, addresses, etc.) carefully prior to the start of the project. The results included all name variances based on recent changes and previous study were shared with each individual STZ hospital for verification before starting the analysis. By matching the provided feedback received by each individual hospital (additional or removal of publication data) against the CWTS CI system, we generated a final set of publications for each individual STZ hospital for the period 2012-2022. CWTS added a number of bibliometric information to each publication record. This additional data is all CI-based, they are necessary for the citation analysis and, particularly, the field-specific impact normalization procedures. The collected publication data together with the additional bibliometric data constitute the final dataset input for analysis.

Coverage of CI Publications

As in previous studies, we have studied the references of the publications produced by the STZ hospitals. We have matched STZ hospital's output references with our extended CI-system publication database (1980-2023). The objective is to determine to what extent these researchers themselves also cite CI Web of Science papers, and to what extent other, non-CI-system documents, thus providing some indication of how relevant the CI-system literature for their research topics and areas is. The internal coverage for the CI-system covered publications from the STZ hospitals as a whole (aggregated) is around 90%. This means that 90% of the references in STZ hospital's publications are also covered by the CI-system, at least since 1980. This is a very high internal coverage that indicates that a bibliometric analysis for STZ hospitals is suitable.

3 Method in brief

In this section, we discuss the methods underlying the bibliometric analysis developed. Additional and more detailed information about methods and data can be found in the Annexes.

3.1 Indicators

In bibliometric analyses regarding research performance we usually discern two types of indicators: size-dependent and size-independent. This is done to cover the fact that the objects of investigations (institutions, organisations, countries etc.) differ in size. Therefore, larger units will be involved in more publications than smaller ones. Subsequently, this will affect the absolute number of top 10% publications. In Figure 3.1.1 we illustrate the correlation between the two indicators for a set of anonymous institutions.

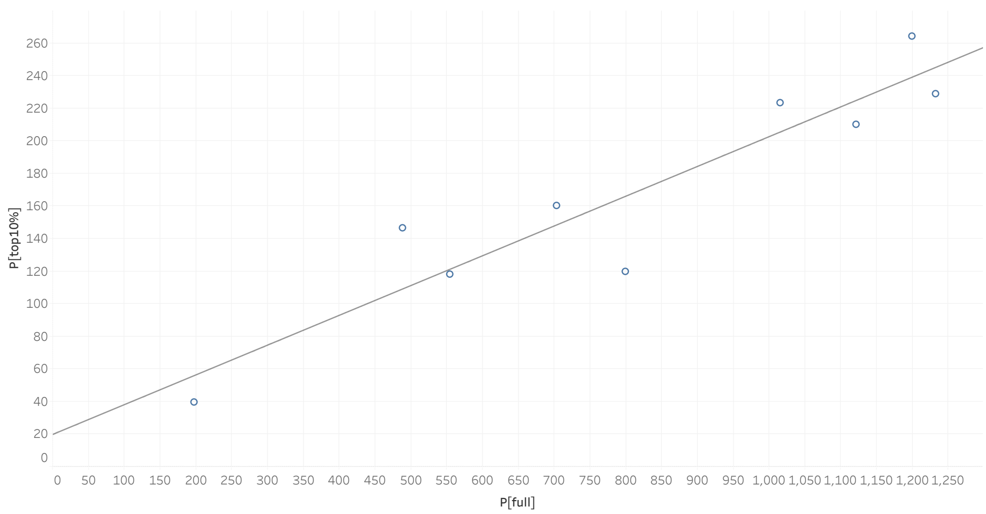


Figure 3.1.1: P[full]vs.P[top10%] by example institution

Proportion indicators (PP[OA], PP[top10%]) and average indicators (MCS, MNCS, MNJS) are size-independent, others used in this study (P[full], TCS) are size-dependent. In the reports we will primarily discuss the results using the size-independent indicators to account for the size differences of the organisations. Moreover, the results for size-independent indicators can, in most cases, be related to the world average.

Output indicators

Size-dependent

The basic output measure regards the number of publications (**P[full]**, i.e. full counting). This indicator reflects the number of publications in which a unit was involved as (co-)author. In addition we present the number of publications published in Open Access (P[OA]).

Size-independent

The size independent indicator for P[OA] is PP[OA], proportion of the output published in Open Access. For the OA indicators latter we can discern different types: OA gold, OA hybrid, OA bronze and OA green]. The definition of the types used in this report are:

- Gold: The publisher makes all articles and related content available for free immediately on the journal's website.
- Hybrid: published in journals that contain a mixture of open access articles and closed access articles
- Bronze: published in a subscription journal that are open access without a license that allows the publication to be reused
- Green: Self-archived by authors (in repositories). Independently from publication by a publisher

Publications without a DOI are discarded (OA unknown) as a DOI is needed to identify whether a publication is open access or not (e.g. from OpenAlex).

Impact indicators

Size-dependent

The scientific impact of a unit's output is measured by citations. We calculate the total number of citations received (**TCS**) in the period of 4 years after publication, up to 2022, for papers published from 2017 to 2021, excluding author self-citations and independent of the field to which publications belong. Another size-dependent indicator of impact is P[top10%], i.e. the absolute number of publications belonging to the top 10% most cited publications (in their field and from the same year).

It should be noted that all citation based indicators (including TCS), are calculated using a limited and fixed time-window of four years. Publications older than 5 years may therefor have received more citations until 2023, but these are not included in our analyses for any publication.

Size-independent

Furthermore, we provide the normalised average (Mean Normalised Citation Score, **MNCS**). The citation impact as measured by MNCS is normalised by research area and year. The research area to which a publication belongs is defined by a publication-level classification (for details, see Annex B). In this classification each publication is in a cluster (class) of similar publications. The similarity is defined by their citation environment (cited and citing publications). This classification is more fine-grained and is considered more accurate than a journal classification (c.f. Ruiz-Castillo and Waltman (2015)). In a journal classification all publications from one journal are in the same class. Similar journals are in the same class and journals may belong to more than one class. We use this journal classification to characterise a unit's output in research profiles but not to normalise impact.

In addition, we provide the proportion of publications in the top 10% most cited publications (within their research area, i.e. class, and in the same year, **PP[top10%]**).

This indicator correlates strongly with the MNCS but is not sensitive to outliers. The MNCS can sometimes be biased by one paper being cited many times. This may particularly occur in cases where there are smaller numbers of papers. It cannot be ignored, of course, and readers should be made aware of this. The PP[top10%] is not influenced by this one paper, as it is 'just' one of the top 10% or not. If the MNCS is much higher than the 'matching' PP[top10%], this is due to such a skewed distribution and can thus be identified.

Finally, we also use an indicator measuring the impact of journals, the Mean Normalised Journal Score (**MNJS**). This indicator assesses the journals (aggregated) used by the unit in terms of citation-based impact, using the same normalisation as we use for measuring the unit's impact (MNCS). As such, the MNJS does not measure the (average) impact of a unit's publications, but rather the impact of the journals in which a unit publishes.

3.2 Profiles

For each unit of analysis (STZ and the 27 hospitals), we also provide two profiles. These profiles provide more insight and background on the overall output and impact statistics.

In each of these profile the output is divided in sets or publications. We discern the following categorizations:

- Subject, in which publications of a unit are allocated to journal-based categories. This classification is the journal-based subject classification in Web of Science (WOS);
- Collaboration type, in which publications are tagged as international, national collaboration or single institution.

In each profile we list the key categories and provide output and impact statistics for each of them. Thus, the subject profile provides insight into the prominent research subjects for a unit (by output or impact) but may also point to key gaps in a unit's research agenda. The collaboration profile provides more detail about the contribution of each type of collaboration to the overall output and impact.

4 Results STZ at large

In this section, we discuss the results for STZ at large. In the first subsection, we provide an overview of the basic for the studied period with a short description of each indicator and its meaning in the study. In the second subsection, we focus on the output, in the third on the impact as measured by citations. In the fourth subsection, we discuss the results in two profiles (based on subjects and and based on collaboration type). The results as discussed in this section for STZ at large, also serve as an example or illustration to read and interpret the results for the individual hospitals, as presented in Section 5.

4.1 Publication output

In this section we discuss the publication output for STZ at large. This should shed light on its involvement in research activity. A first overview is provided for the types of output, covered by WoS core collection. The results in Table 4.1.1, show the distribution across types of publications provided by the 27 STZ hospitals.

Table 4.1.1: Output overview STZ (2013-2022)

Document Type	N pubs
Article	25,262
Review	3,113
Biographical-Item	7
Book Review	2
Correction	232
Editorial Material	1,473
Letter	1,883
Meeting	1
Meeting Abstract	8,005
News Item	4
Reprint	1
Retraction	1
Proceedings Paper	196

Another 2,464 publications were found in the Emerging Sources Citation Index (ESCI). As the sources (journals) in which these are published are not yet included in the core and verified Citation sources (Arts & Humanities Citation Index, Social Sciences Citation Index, Science Citation Index expanded and Conference Proceedings Citation Indexes), these were not included in the study. In the core of the report, we processed more than 25,000 publications (articles and reviews) for STZ. Publications from 2023 which do not yet have the required year to get cited nor those that were not included in the CWTS publication classification are excluded from the analyses. We consider that a full year is required to foster a robust citation impact analysis. Also, publications that were not included in the CWTS publication classification are excluded from the analysis (e.g. excluding all publications beside articles and reviews, excluding publications found in Emerging Sources).

The above indicates that we are working with a sample of the total output of STZ. The question then is how representative this sample is. To assess its representation, we use the indicator Internal Coverage (IntCov). It shows that the estimated coverage of output in this study is 0.88. This means that all output and impact measures are based on a sample that should represent 88% of the total output, which is considered high. The internal coverage shows the percentage of references in STZ publications that point to prior studies also covered in WoS. This indicator is used as a proxy of the extent to which the publications analysed in this study are representative of the overall scientific outputs of STZ. A score of 0.88 suggests that we are capturing a very important share of the scientific outputs generated by STZ.

Trends

Confining our analysis to those publications for which we can calculate all indicators included in this report (P[full]), the output trends are as listed in the table below (Table 4.1.2) and Figure 4.1.1. The table below uses a trend analysis of a 4-years period to have a robust depiction of the (impact) indicators.

Researchers in STZ hospitals are involved in an increasing number of publications in scholarly journals (P[full]), ranging from 8,592 in 2013-2016 up to 11,830 in 2020-2022. In total, the output adds up to 25,344 in the period 2013-2022.

Table 4.1.2: Output trends STZ (2013-2022)

Indicator	2013-2016	2014-2017	2015-2018	2016-2019	2017-2020	2018-2021	2019-2022	Total
P [full]	8,592	9,068	9,487	10,026	10,522	11,227	11,830	25,344
Internal Coverage	0.89	0.89	0.89	0.88	0.88	0.88	0.88	0.88
P [OA]	4,531	5,140	5,835	6,672	7,502	8,505	9,353	17,170
PP [OA]	0.53	0.57	0.62	0.67	0.71	0.76	0.79	0.68

The IntCov indicates that the coverage of WoS remains stable throughout at 88%.

As at present, publicly funded research, should be published in Open Access, we investigated the measure to which this is actually established. The P[OA] and PP[OA] clearly illustrate the compliance of STZ researchers with this regulation.

The output in Open Access (P[OA]) aligns with the actual output growth, while the share of OA publications (PP[OA]) increases from 0.53 to 0.79, which means that in the most recent period almost 80% was published in Open Access. This development is nicely depicted in Figure 4.1.1

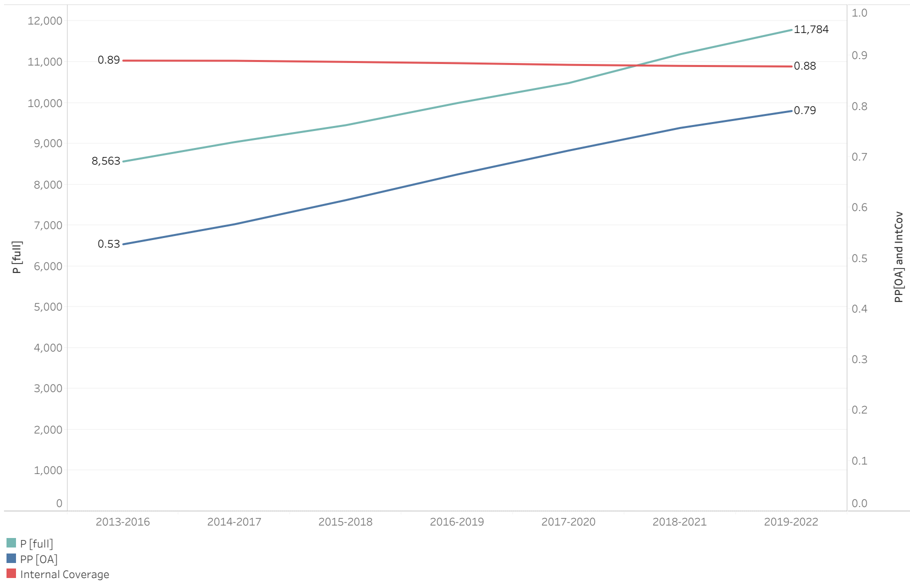


Figure 4.1.1: Research output trends STZ (2013-2022)

Table 4.1.3, we present the results by individual hospital. This provides a coarse overview of the contribution of each hospital to the STZ results, at a high level. Looking at the results, we see large differences in number of publications produced (P[full]). It is clear that this depends mainly on the available staff and FTE at each individual hospital. Therefore, we look at these figures as a given. A comparison among hospitals is therefore not relevant. In Section 4.4, we present more information about the STZ collaboration networks.

In Section 5, more detail is provided per hospital. We provide main statistics for two periods to monitor main trends, subject and collaboration profiles and a network of co-authoring partners.

Table 4.1.3: Main output statistics per hospital 2013-2022

Hospital	P [full]	IntCov	P [OA]	PP [OA]
AMPH	1,700	0.89	1,214	0.71
ANTO	3,341	0.90	2,271	0.68
ASZ	792	0.89	556	0.70
CATH	2,644	0.89	1,869	0.71
CWZ	1,460	0.88	1,032	0.71
DZ	520	0.88	392	0.75
ETZ	1,784	0.87	1,249	0.70
GELR	692	0.88	490	0.71
HAGA	1,521	0.90	1,084	0.71
HMC	1,709	0.88	1,150	0.67
ISAL	2,232	0.89	1,639	0.73
JBZ	1,209	0.87	898	0.74
MAAS	1,152	0.89	833	0.72
MART	771	0.87	583	0.76
MCL	1,203	0.87	925	0.77
MEAN	920	0.90	638	0.69
MMC	1,586	0.87	1,121	0.71
MST	1,581	0.89	1,298	0.82
NWZ	1,213	0.89	812	0.67
OLVG	2,709	0.88	1,796	0.66
RDGG	717	0.90	524	0.73
RIJN	1,639	0.89	1,144	0.70
SFG	913	0.90	665	0.73
SG	1,045	0.88	702	0.67
VIEC	753	0.87	570	0.76
ZGT	365	0.88	273	0.75
ZUYD	2,199	0.88	1,571	0.71

4.2 Impact

The impact in this section refers to the scholarly impact based on citation received. In total, STZ publications received over 300,000 citations (TCS: 308,941). On average, a STZ publication received just over 12 citations (MCS). It should be mentioned that the MCS drops in the more recent period, with the number of years available to get cited becomes less.

Table 4.2.1: Citation-based impact trend STZ (2013-2022)

indicator	2013-2016	2014-2017	2015-2018	2016-2019	2017-2020	2018-2021	2019-2022	Total
P [full]	8,592	9,068	9,487	10,026	10,522	11,227	11,830	25,344
TCS	107,994	118,004	129,085	135,043	153,620	152,013	132,393	308,941
MCS	12.6	13.0	13.6	13.5	14.6	13.5	11.2	12.2
MNCS [full]	1.53	1.55	1.58	1.52	1.54	1.52	1.49	1.53
MNJS [full]	1.43	1.44	1.47	1.45	1.45	1.42	1.42	1.43
PP [top 10% full]	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16

Looking at the normalized citation-based impact of publications in which STZ was involved, we see a similar result for three indicators: a stable impact at a level well above the world average (MNCS around 1.50, MNJS around 1.40 and PP[top10%] 0.16). The increase of output, as noticed in the previous section, does not seem to have an effect on the impact, neither positive nor negative.

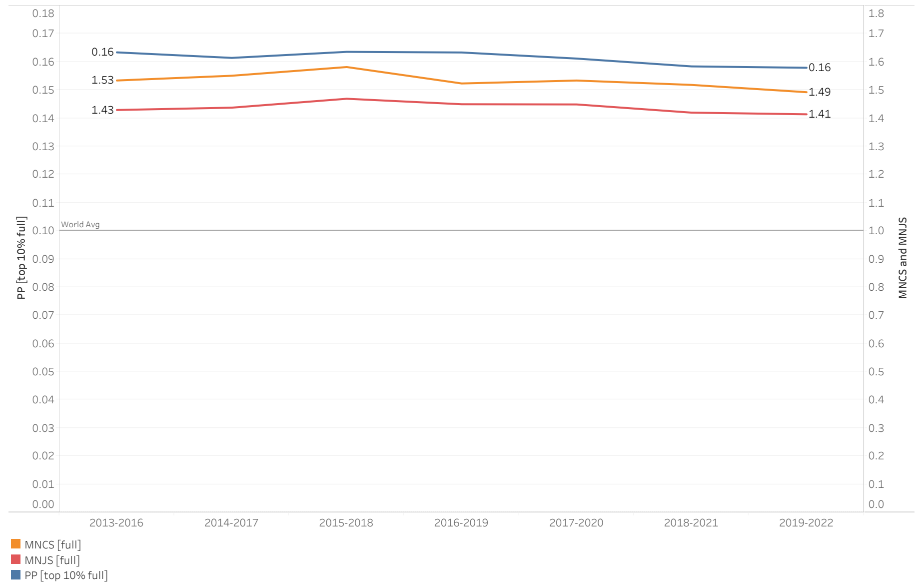


Figure 4.2.1: Research impact STZ

The lines in Figure 4.2.1 nicely illustrate this steady impact throughout. Both actual impact indicators (MNCS and PP[top10%]) are well above world average (the reference line), and somewhat above the impact of journals in which STZ researchers publish (MNJS).

4.3 Profiles

In this section we present the results for subsets of STZ publications. We discern two types of subsets:

- By subject (journal categories); and
- By type of collaboration (co-authorship).

Both profiles are depicted in Figure 4.3.1 on the next page. In this way, we provide more insight in the specific subject fields and their contribution to the output and impact of STZ. Specific subjects stand out in terms of output, while others stand out because of STZ impact.

Looking at the Subject profile, the upper part of Figure 4.3.1, we see that *Surgery*, *Cardiac & Cardiovascular Systems* and *Oncology* stand out in terms of output (the brown bars). These are the most prominent subjects covering individually 7% or more of STZ output. Also, important to mention, is that the impact in these three subjects is high. Based on MNCS (the orange bars) the impact is between 1.33 and 1.62, i.e., between 33% and 62% higher than world average. The impact according to PP[top10%] (the blue bars) is between 0.16 and 0.20 for these three subjects.

The second tier of subjects with a share between 2.5% and 5% regards *Medicine, General & Internal*, *Clinical Neurology*, *Gastroenterology & Hepatology*, *Radiology, Nuclear Medicine & Medical Imag*, *Orthopedics*, (*Multidisciplinary Sciences*), *Obstetrics & Gynecology*, *Rheumatology*, *Pharmacology & Pharmacy* *Respiratory System*and *Peripheral Vascular Disease*. In all these 6 subjects the impact is well above world average. In *Medicine, General & Internal*, the impact according to MNCS and PP[top10%] stands out.

Further down the list of most prominent subjects, we mention *Critical Care Medicine*, *Urology & Nephrology*, *Microbiology*, *Infectious Diseases*, and *Immunology* with a high impact, but in fact all other subjects in this list with at least 1% of the STZ output have also a high impact.

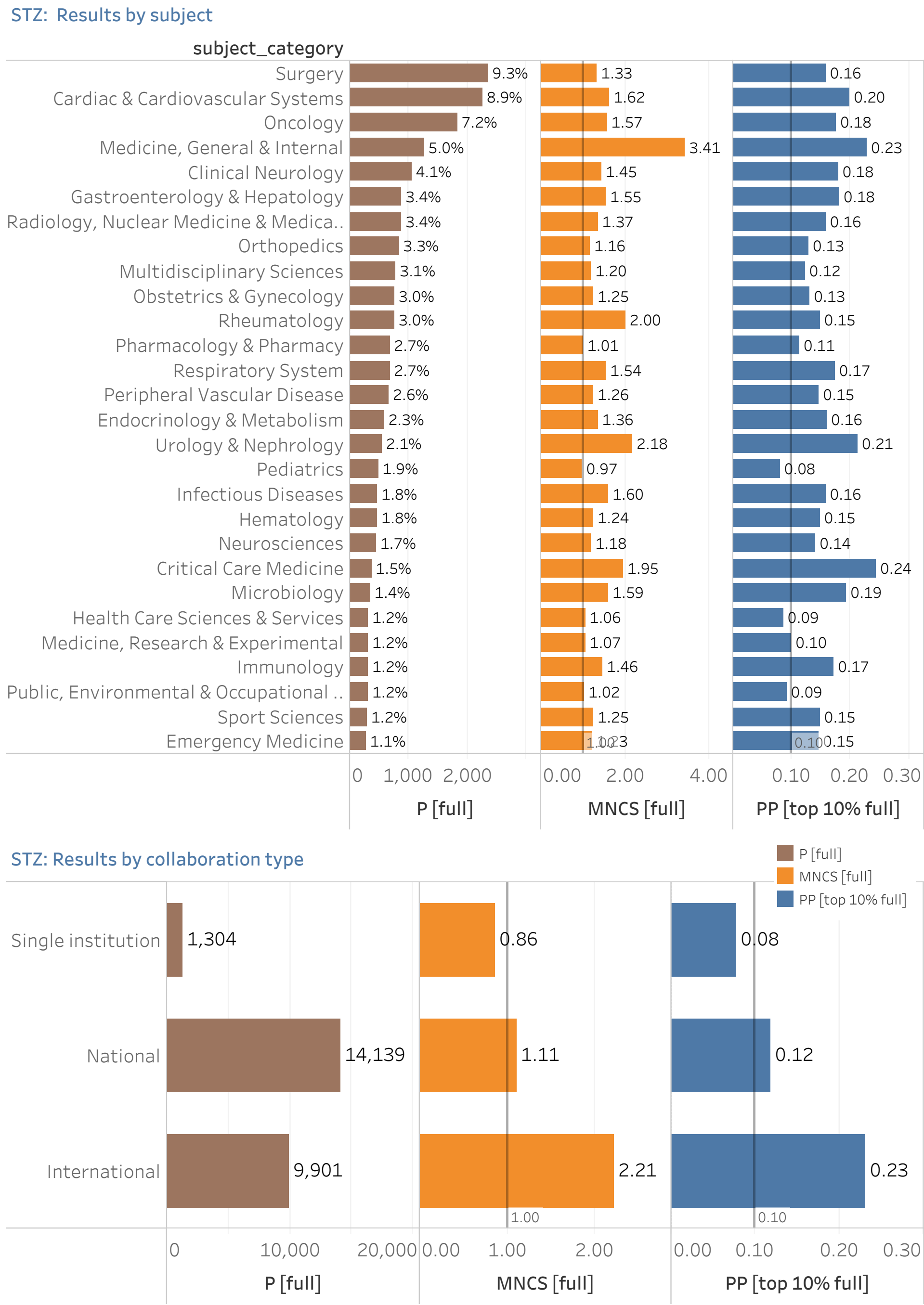


Figure 4.3.1: Research and collaboration profile STZ

The lower part of Figure 4.3.1 reflects the contribution to STZ output and impact by collaboration type (single institution, national or international collaboration). With more than 14,000, the output of STZ at large regards national co-authored publications. The second productive type regards international collaboration, with just almost 10,000 publications. The latter has the highest impact (MNCS: 2.21 and PP[top10%]: 0.23). For the other types we found an impact around world average.

4.4 Co-author networks

In this section, we discuss the collaboration network (as represented by co-authored publications) for the 27 STZ hospitals only and for the STZ hospitals and their most prominent partners.

The first network regards the STZ hospitals only. By counting the number of times the individual hospitals co-authored a publication in the period of analysis, we created a co-author network of 27 by 27. This information is used to draw-up the network, which was then visualized using the VOSviewer software. The network is presented in Figure 4.4.1. The network includes all 27 hospitals and the 100 most important relations, indicated by the connecting lines. Moreover, a color-coding of main clusters was suggested based on their co-authorships as an attempt to map relatedness of hospitals. The position of each of the hospitals is defined here by the geographical longitude and latitude information of the main location of each of them. An interactive version of the network is available at https://tinyurl.com/2bgcemdx.

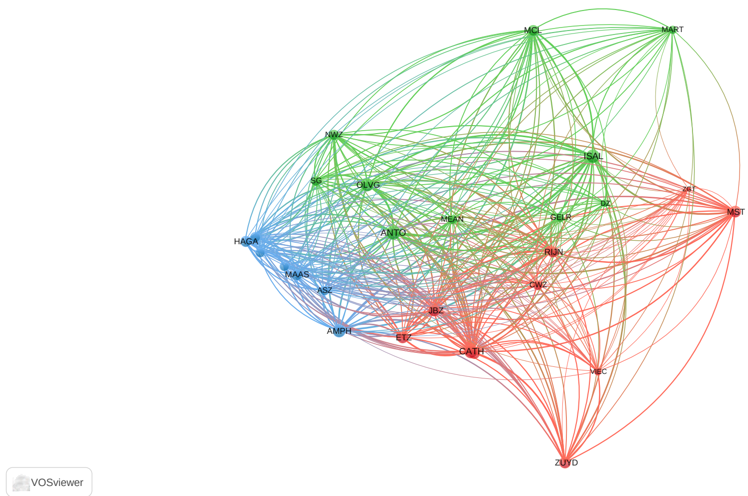


Figure 4.4.1: Co-author network of the 27 STZ hospitals (2013-2022)

One could say that the network shows a preference of the STZ hospitals to collaborate with geographically closest partners. In other words, proximity is a key factor. We see a blue cluster of hospitals in the province of South-Holland and Breda, a green cluster of hospitals in the middle, north of the Netherlands and in the province of North-Holland, Furthermore, we see a red cluster of hospitals south and south-east of the Netherlands. Overall, we clearly see a dense collaboration between all hospitals on top of that. All hospitals co-author with each other.

The second network we created regards the 27 STZ hospitals and the most prominent partners. We selected all those partners with at least 100 co-publications with STZ at large (see Figure 4.4.2). An interactive version of this network is available at https://tinyurl.com/24kfluyt.

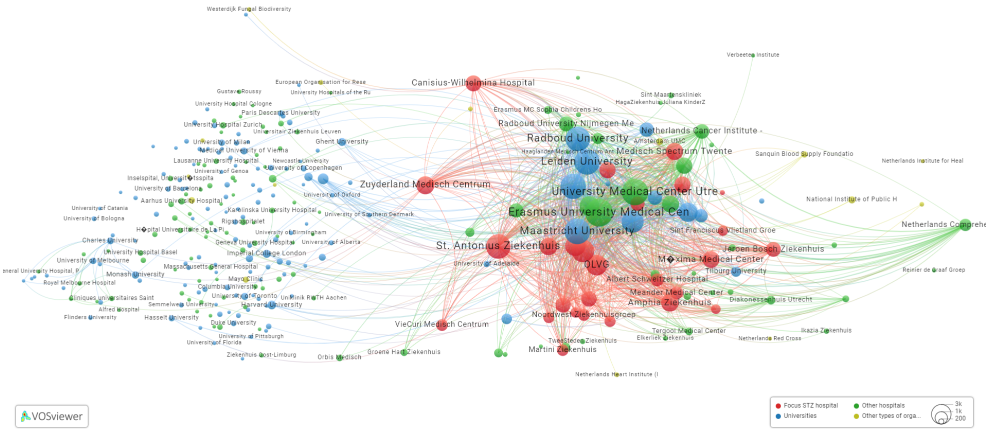


Figure 4.4.2: Co-author network of STZ hospitals and their main external partners (2013-2022)

In this network, the position of each item is defined by VOSviewer based on the number of co-authored publications in a 2-dimensional space. If two institutions have many co-authored papers they are in each other vicinity, while those that have hardly co-published or not co-published at all are located remote from each other. Furthermore, we color-coded the items by the type of organisation. STZ hospitals are in red, other hospitals are in green, universities are in blue, while other types of organisations (most often research institutes) are in yellow.

As first observation, we can see that this network shows primarily Dutch partners on the right and foreign institutes on the left. Furthermore, we can see that in the Dutch region of the network, academic hospitals and universities play a core role for the partnerships of the STZ hospitals.

Furthermore, we see a few STZ hospitals that seem to act to some extend as a hub between Dutch and foreign organisations, being at the centre (left) of the Dutch region in the network (e.g. Zuyderland Medisch Centrum, St. Antonius Ziekenhuis). On the right hand-side of the Dutch region in the network, we find the Netherlands Comprehensive Cancer Organisation (IKNL), which is one of the furthest away from the foreign institute's side. This indicates that research published with IKNL does not (or hardly) include foreign organisations.

5 Results per hospital

This section contains the main statistics, profiles and networks for each STZ hospital. In this network, the position of each item is defined by VOSviewer based on the number of co-authored publications in a 2-dimensional space. Partners involved in at least 2% of the output are included and color-coded by type of organisation. In this section, the trend analysis in the stats tables depicts two main periods: 2013-2017 and 2018-2022 using a 5-years period as the number of publications per hospital may be too low to allow a more fined period of analysis as previously for the STZ as a whole.

The bibliometric results per hospital underlie the results of STZ at large (Section 4). Please note that for the results in Section 4 publications are duplicated in the analysis for STZ at large.

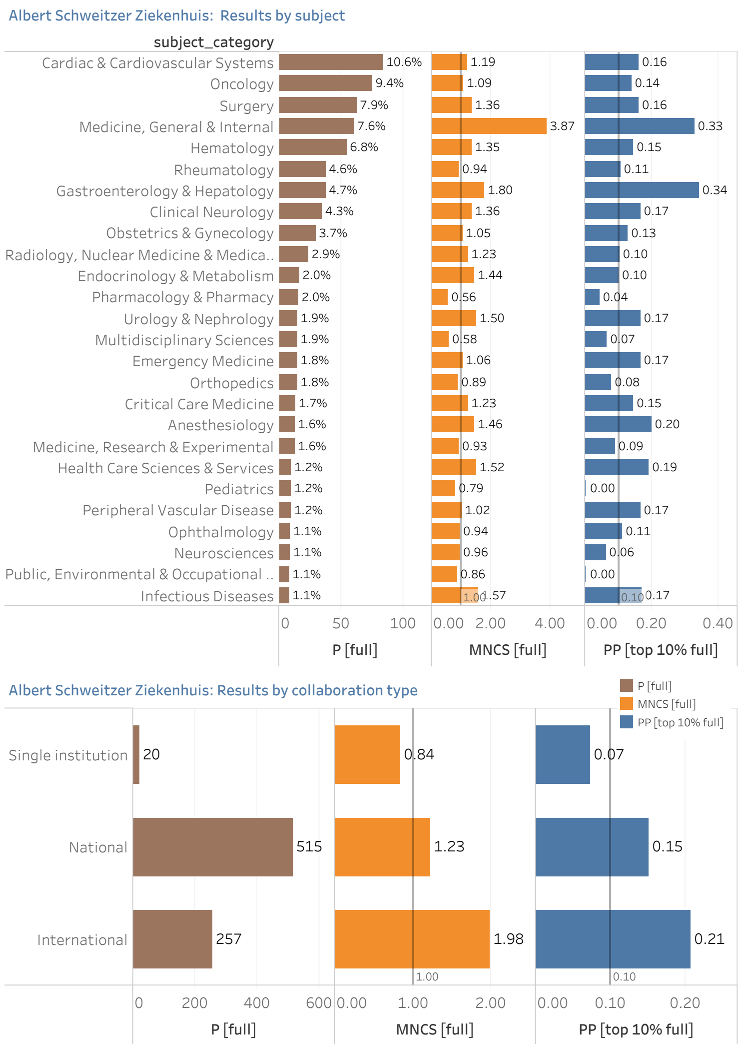
These results can be further explored using dashboards created in combination with this report. Contact STZ to access those.

5.1 Albert Schweitzer Ziekenhuis (ASZ)

Table 5.1.1: Stats Albert Schweitzer Ziekenhuis

Indicator	2013-2017	2018-2022	Total
P [full]	278	514	792
PP [OA]	0.53	0.79	0.70
PP [top 10% full]	0.15	0.18	0.17
MNCS [full]	1.41	1.49	1.46
MNJS [full]	1.47	1.73	1.64

Figure 5.1.1: Research and collaboration profile Albert Schweitzer Ziekenhuis



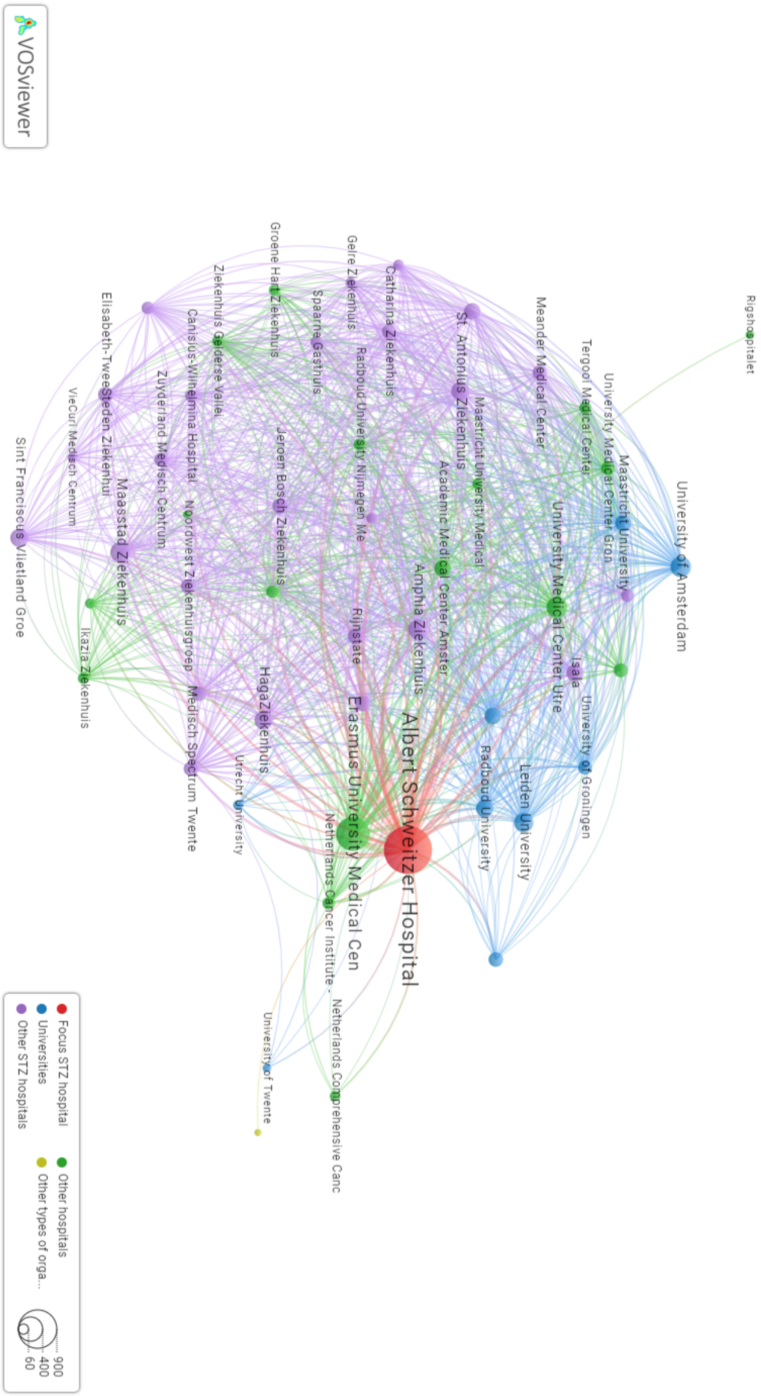


Figure 5.1.2: Co-author network Albert Schweitzer Ziekenhuis with partners co-authoring in at least 2% of the output

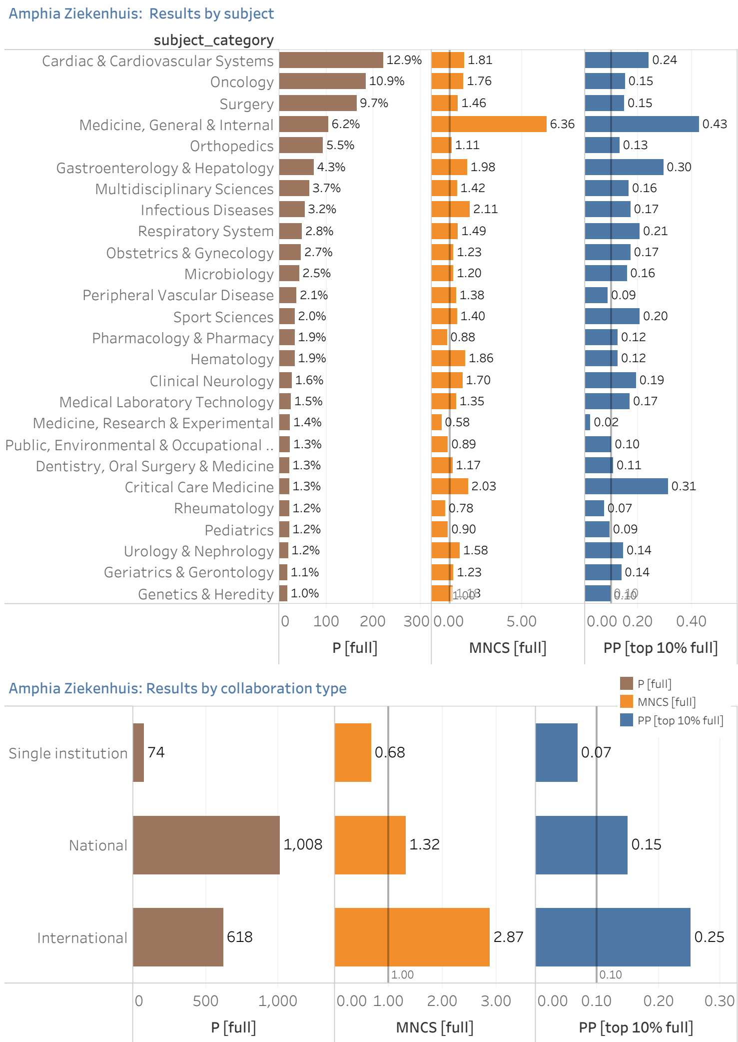
Interactive VOSviewer network at https://tinyurl.com/2asb56m6

5.2 Amphia Ziekenhuis (AMPH)

Table 5.2.1: Stats Amphia Ziekenhuis

Indicator	2013-2017	2018-2022	Total
P [full]	704	996	1,700
PP [OA]	0.57	0.82	0.71
PP [top 10% full]	0.18	0.18	0.18
MNCS [full]	1.85	1.85	1.85
MNJS [full]	1.71	1.84	1.79

Figure 5.2.1: Research and collaboration profile Amphia Ziekenhuis



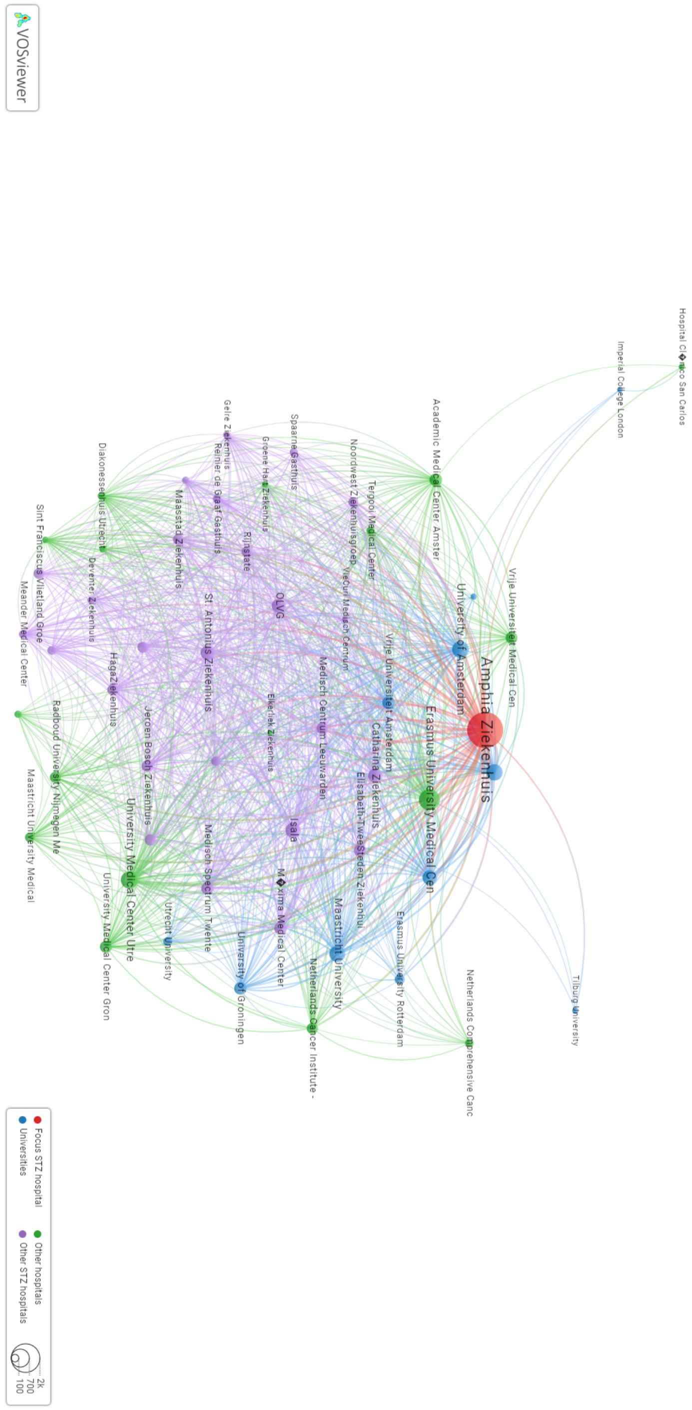


Figure 5.2.2: Co-author network Amphia Ziekenhuis with partners co-authoring in at least 2% of the output

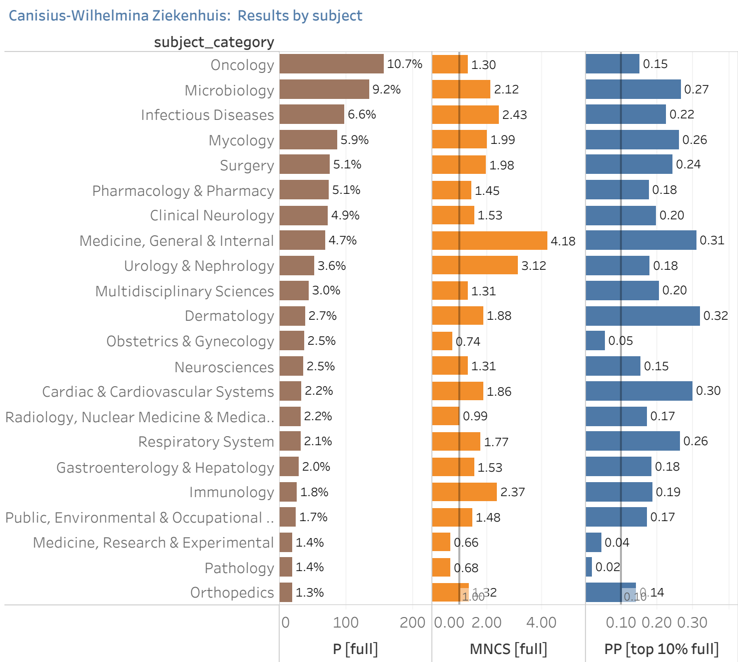
Interactive VOSviewer network at https://tinyurl.com/25brxdez

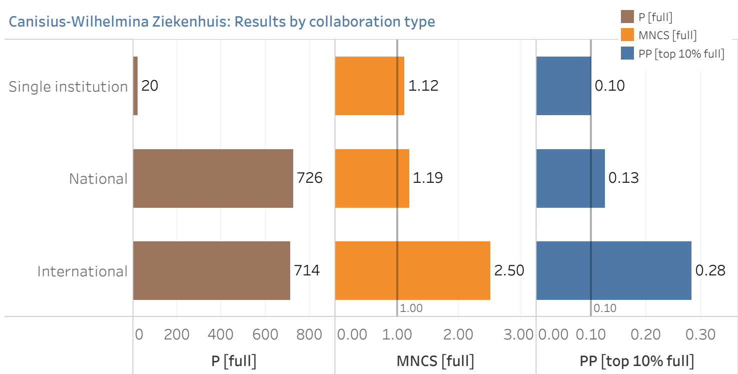
5.3 Canisius Wilhelmina Ziekenhuis (CWZ)

Table 5.3.1: Stats Canisius Wilhelmina Ziekenhuis

Indicator	2013-2017	2018-2022	Total
P [full]	682	778	1,460
PP [OA]	0.63	0.77	0.71
PP [top 10% full]	0.22	0.19	0.20
MNCS [full]	2.17	1.54	1.83
MNJS [full]	1.66	1.48	1.56

Figure 5.3.1: Research and collaboration profile Canisius Wilhelmina Ziekenhuis





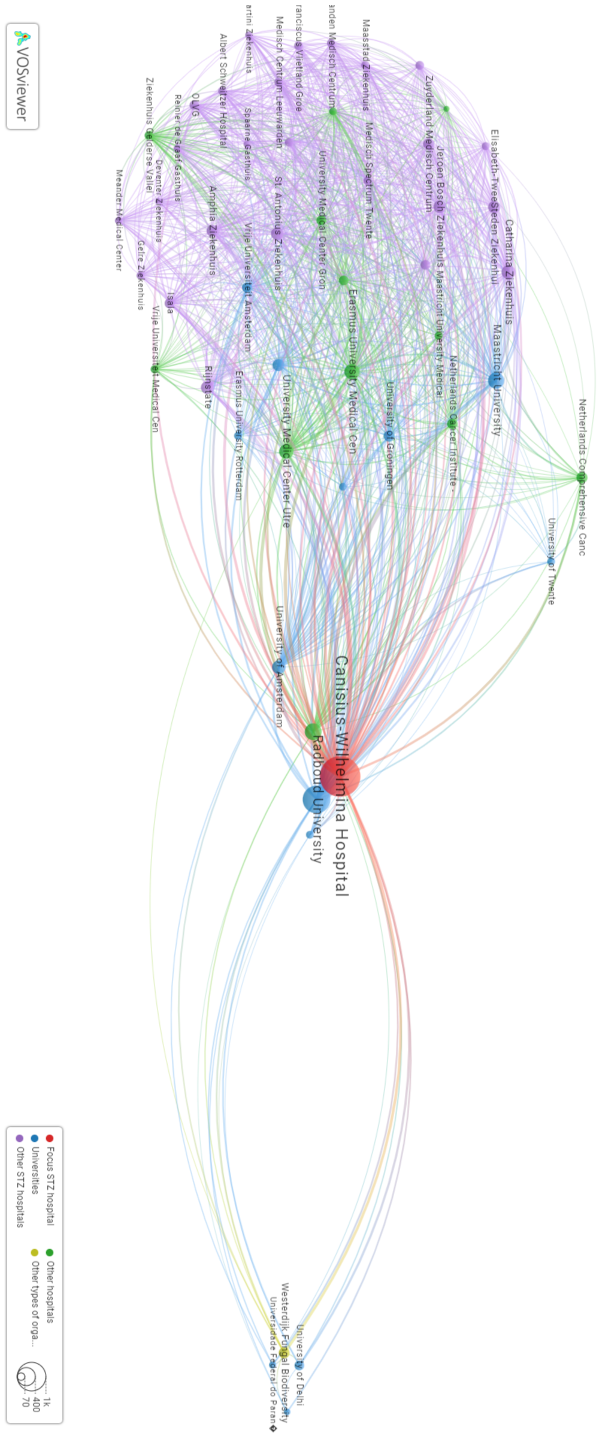


Figure 5.3.2: Co-author network Canisius Wilhelmina Ziekenhuis with partners co-authoring in at least 2% of the output

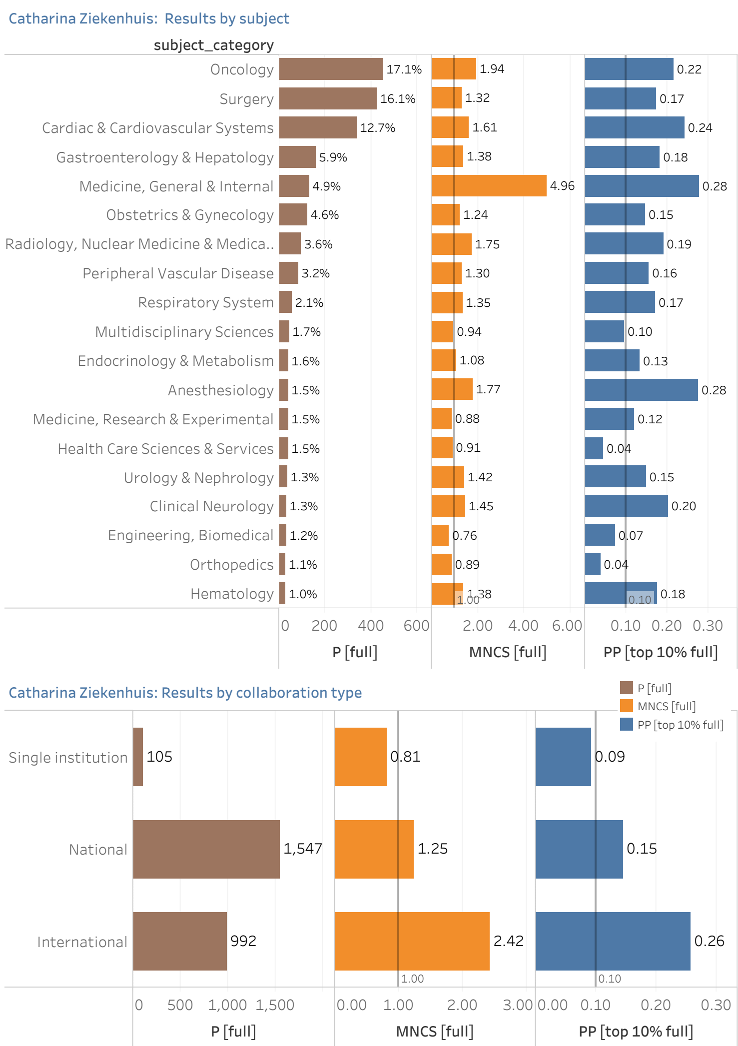
Interactive VOSviewer network at https://tinyurl.com/2a7ao8aj

5.4 Catharina Ziekenhuis (CATH)

Table 5.4.1: Stats Catharina Ziekenhuis

Indicator	2013-2017	2018-2022	Total
P [full]	1,032	1,612	2,644
PP [OA]	0.56	0.80	0.71
PP [top 10% full]	0.18	0.19	0.19
MNCS [full]	1.76	1.61	1.67
MNJS [full]	1.66	1.63	1.64

Figure 5.4.1: Research and collaboration profile Catharina Ziekenhuis



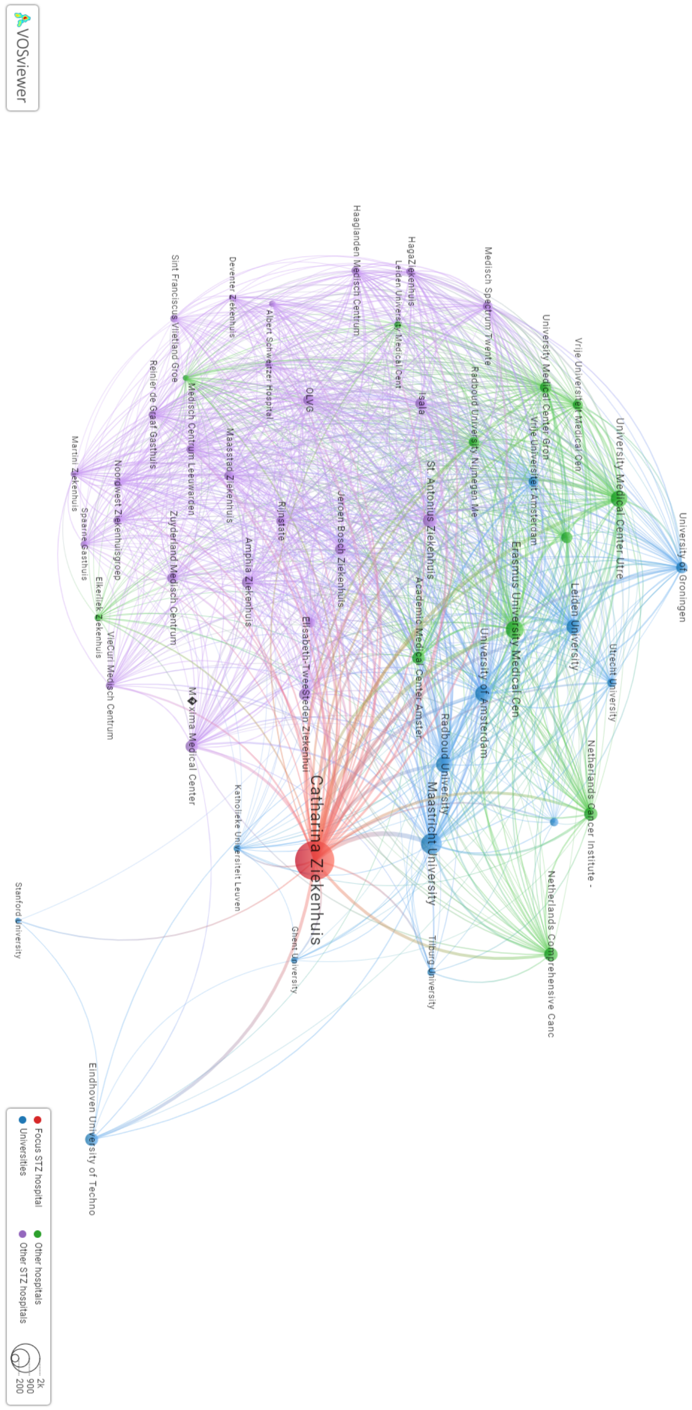


Figure 5.4.2: Co-author network Catharina Ziekenhuis with partners co-authoring in at least 2% of the output

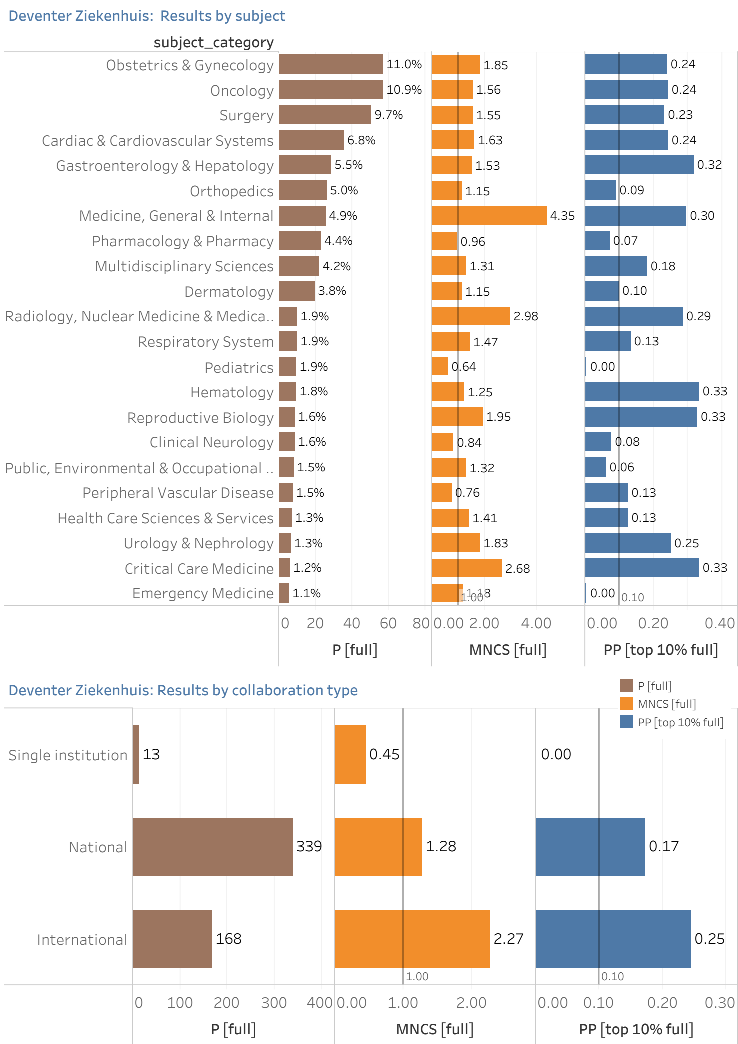
Interactive VOSviewer network at https://tinyurl.com/2buera8k

5.5 Deventer Ziekenhuis (DZ)

Table 5.5.1: Stats Deventer Ziekenhuis

Indicator	2013-2017	2018-2022	Total
P [full]	220	300	520
PP [OA]	0.64	0.84	0.75
PP [top 10% full]	0.21	0.18	0.19
MNCS [full]	1.63	1.54	1.58
MNJS [full]	1.70	1.73	1.72

Figure 5.5.1: Research and collaboration profile Deventer Ziekenhuis



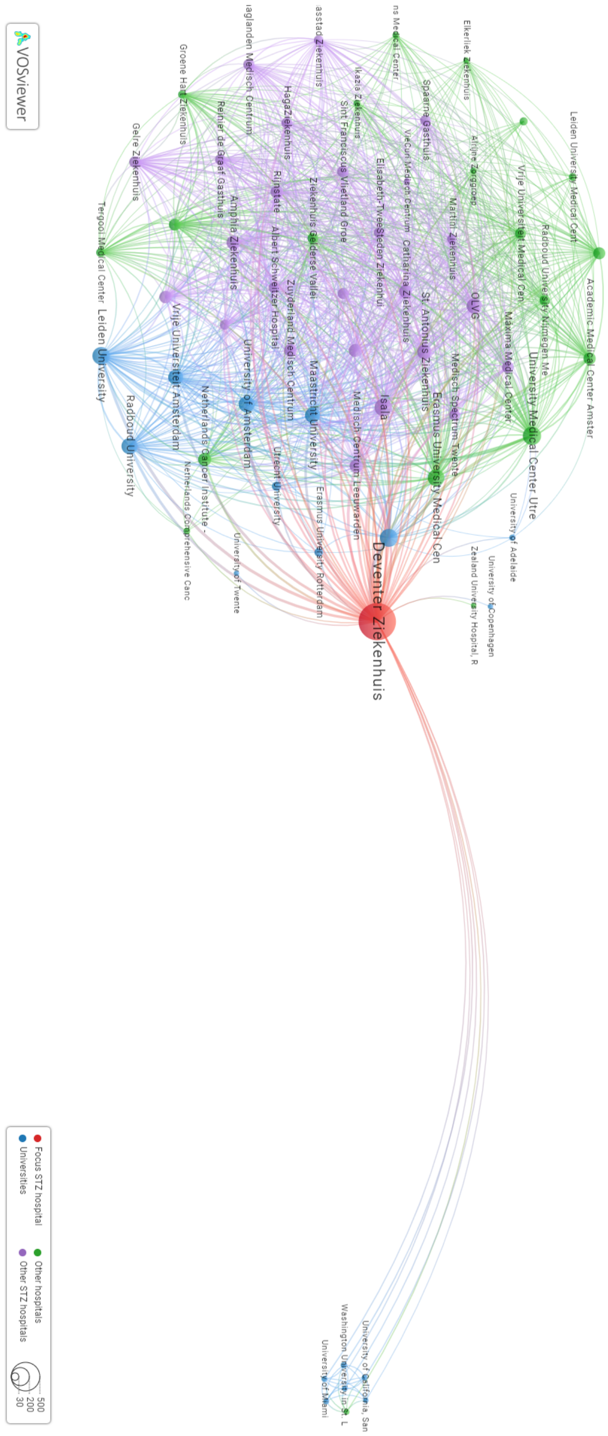


Figure 5.5.2: Co-author network Deventer Ziekenhuis with partners co-authoring in at least 2% of the output

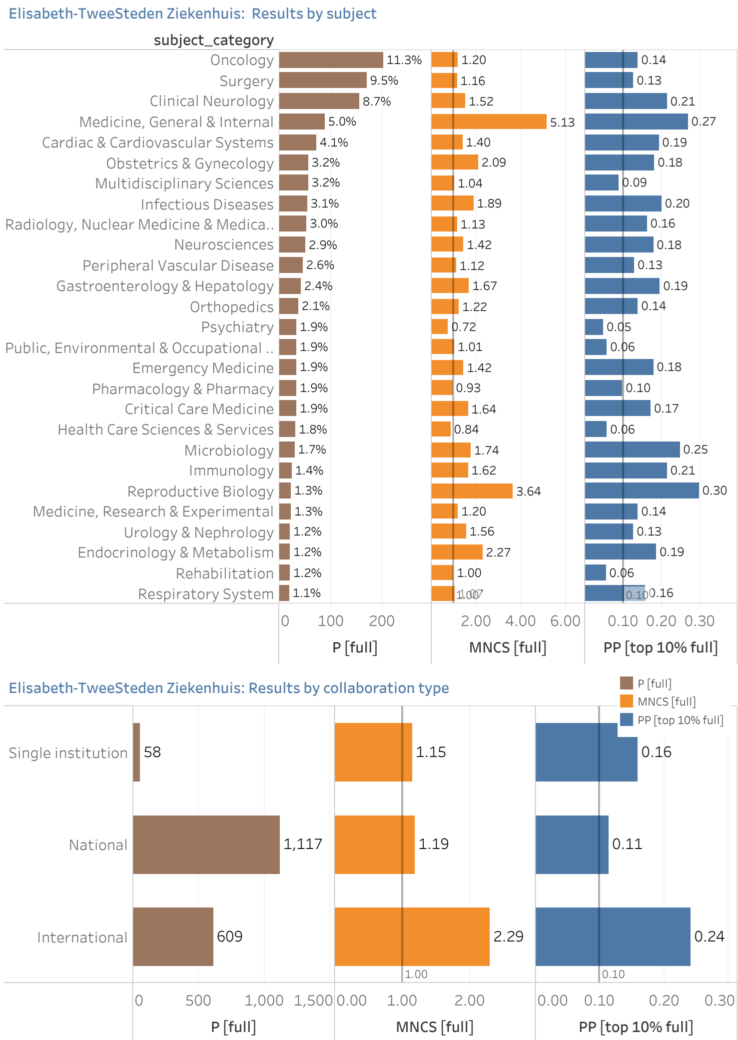
Interactive VOSviewer network at https://tinyurl.com/26h9x7qn

5.6 Elisabeth TweeSteden Ziekenhuis (ETZ)

Table 5.6.1: Stats Elisabeth TweeSteden Ziekenhuis

Indicator	2013-2017	2018-2022	Total
P [full]	731	1,053	1,784
PP [OA]	0.58	0.79	0.70
PP [top 10% full]	0.16	0.16	0.16
MNCS [full]	1.71	1.46	1.56
MNJS [full]	1.58	1.53	1.55

Figure 5.6.1: Research and collaboration profile Elisabeth TweeSteden Ziekenhuis



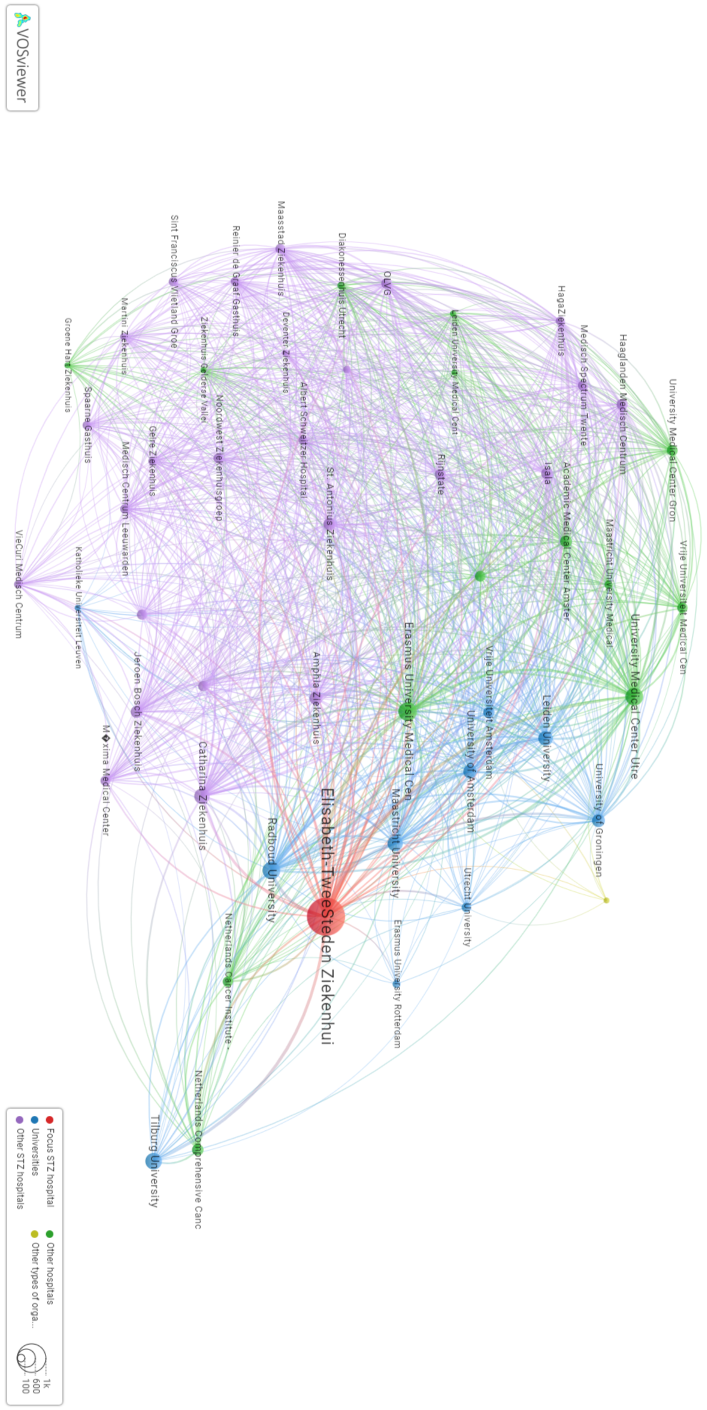


Figure 5.6.2: Co-author network Elisabeth TweeSteden Ziekenhuis with partners co-authoring in at least 2% of the output

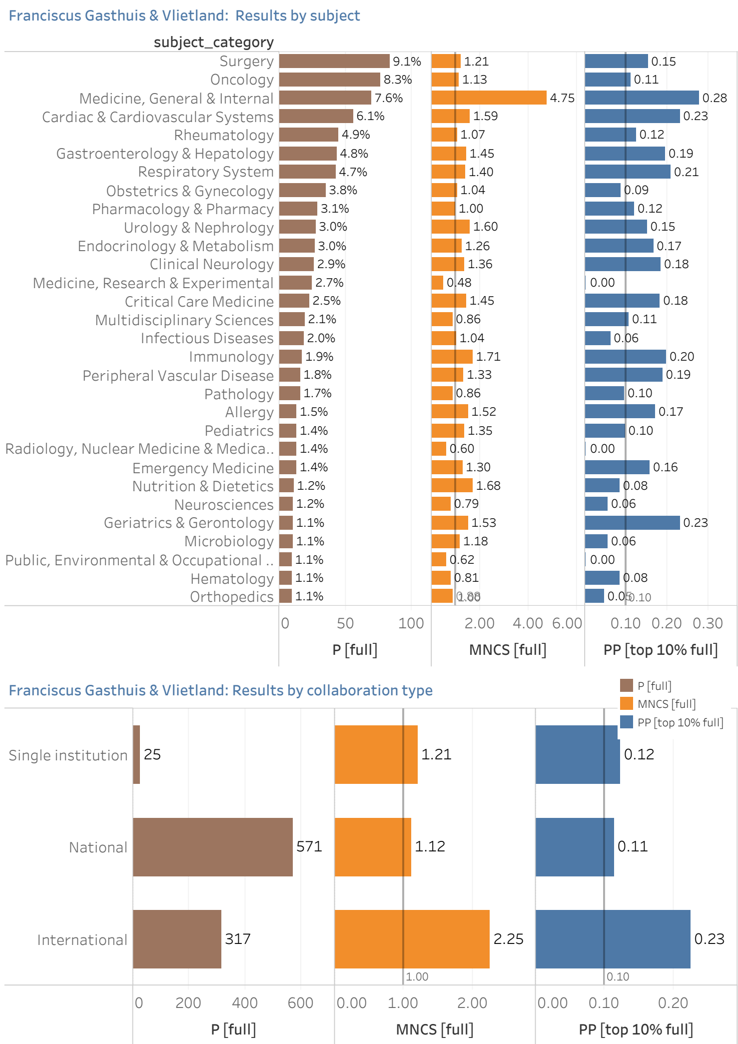
Interactive VOSviewer network at https://tinyurl.com/2yuchvbz

5.7 Franciscus Gasthuis & Vlietland (SFG)

Table 5.7.1: Stats Franciscus Gasthuis & Vlietland

Indicator	2013-2017	2018-2022	Total
P [full]	335	578	913
PP [OA]	0.56	0.83	0.73
PP [top 10% full]	0.16	0.15	0.15
MNCS [full]	1.75	1.38	1.51
MNJS [full]	1.77	1.77	1.77

Figure 5.7.1: Research and collaboration profile Franciscus Gasthuis & Vlietland



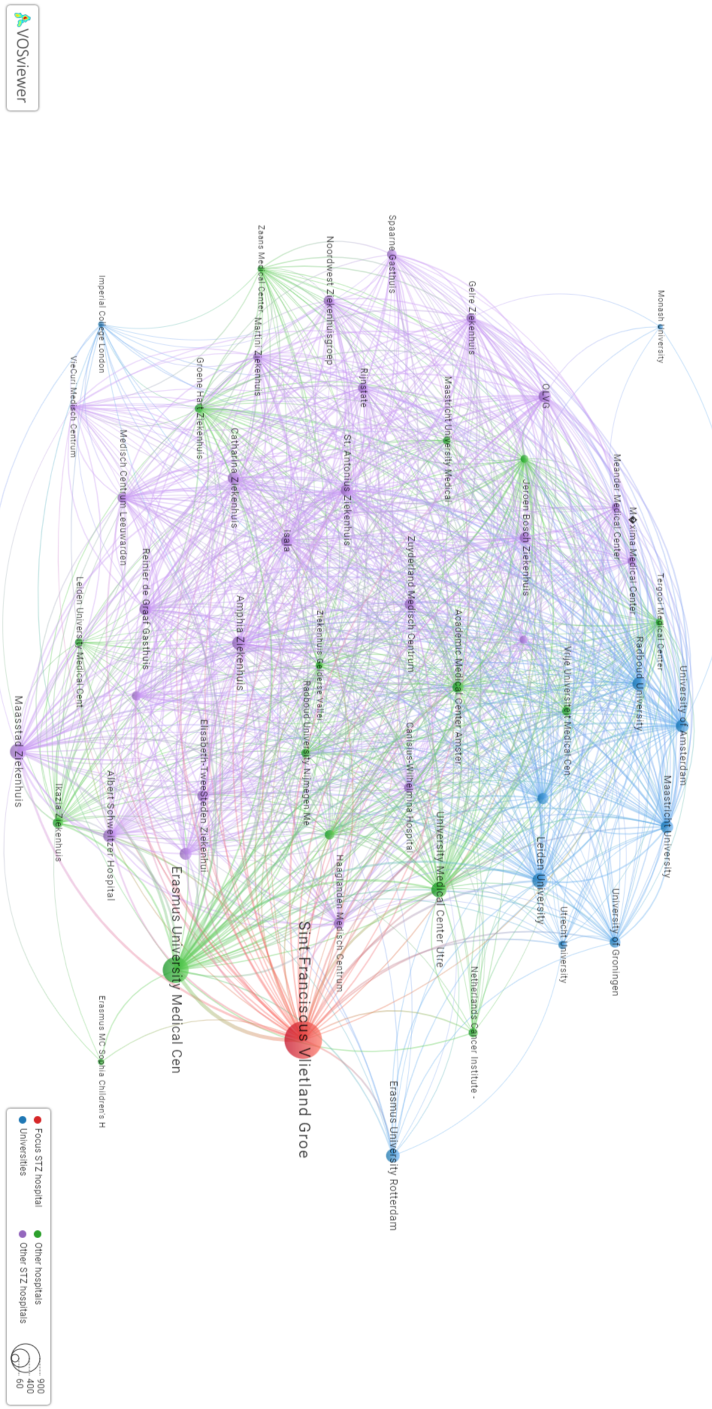


Figure 5.7.2: Co-author network Franciscus Gasthuis & Vlietland with partners co-authoring in at least 2% of the output

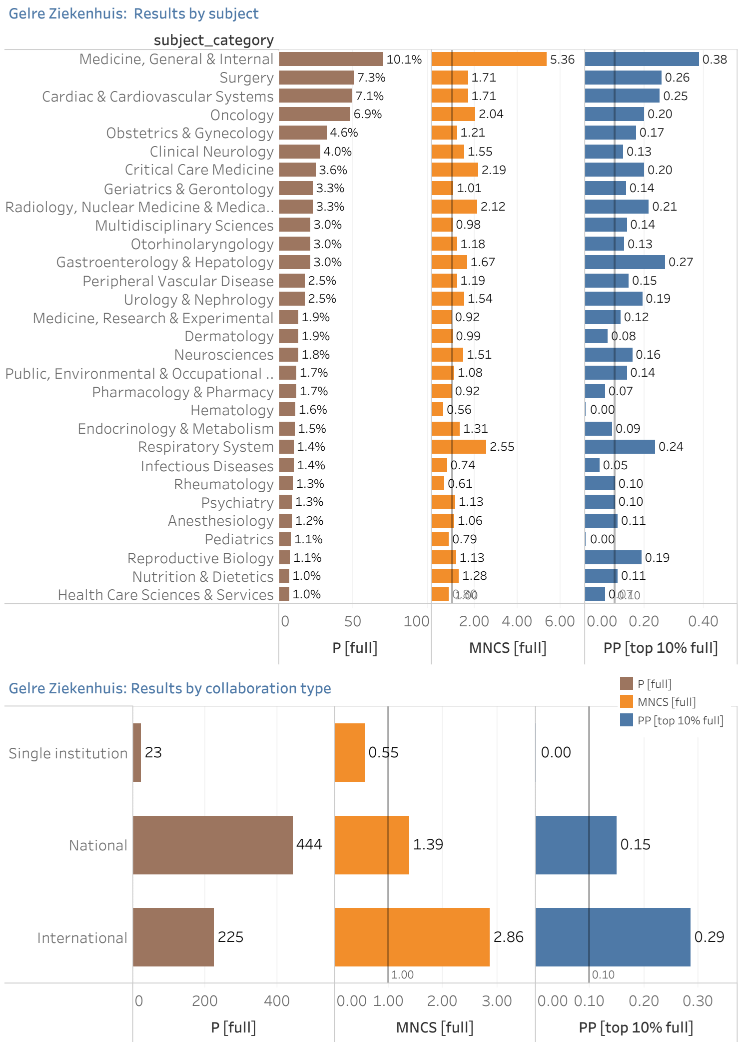
Interactive VOSviewer network at https://tinyurl.com/23mpdzlz

5.8 Gelre Ziekenhuizen (GELR)

Table 5.8.1: Stats Gelre Ziekenhuizen

Indicator	2013-2017	2018-2022	Total
P [full]	293	399	692
PP [OA]	0.57	0.81	0.71
PP [top 10% full]	0.17	0.21	0.19
MNCS [full]	1.76	1.90	1.84
MNJS [full]	1.65	2.21	1.98

Figure 5.8.1: Research and collaboration profile Gelre Ziekenhuizen



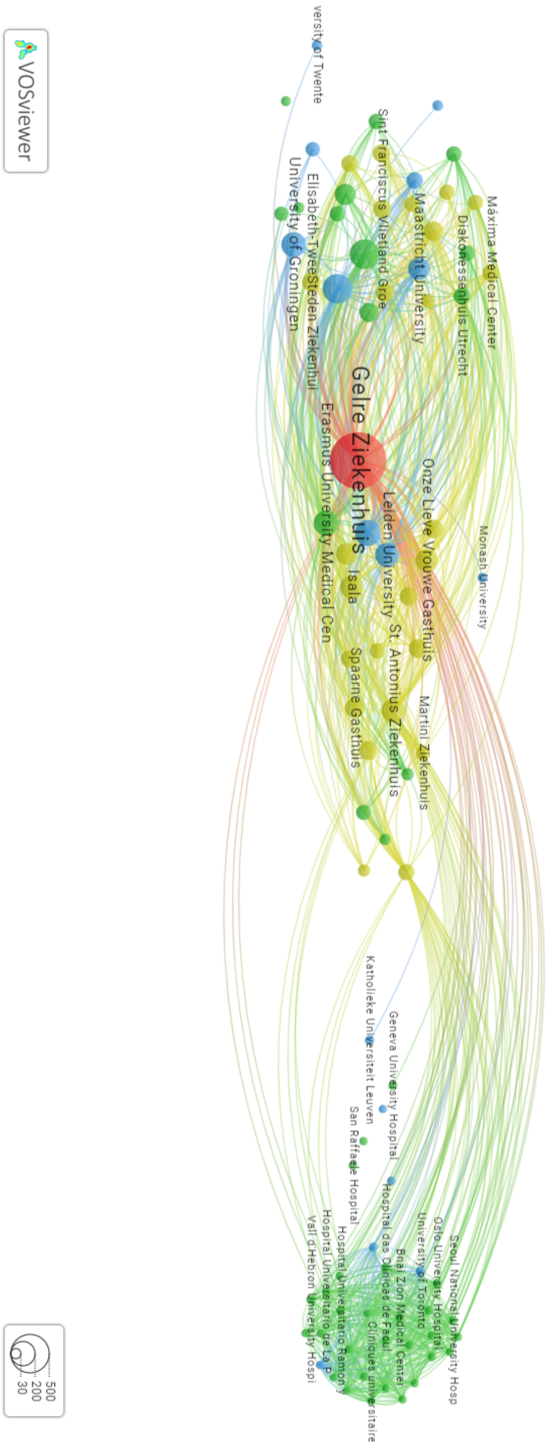


Figure 5.8.2: Co-author network Gelre Ziekenhuizen with partners co-authoring in at least 2% of the output

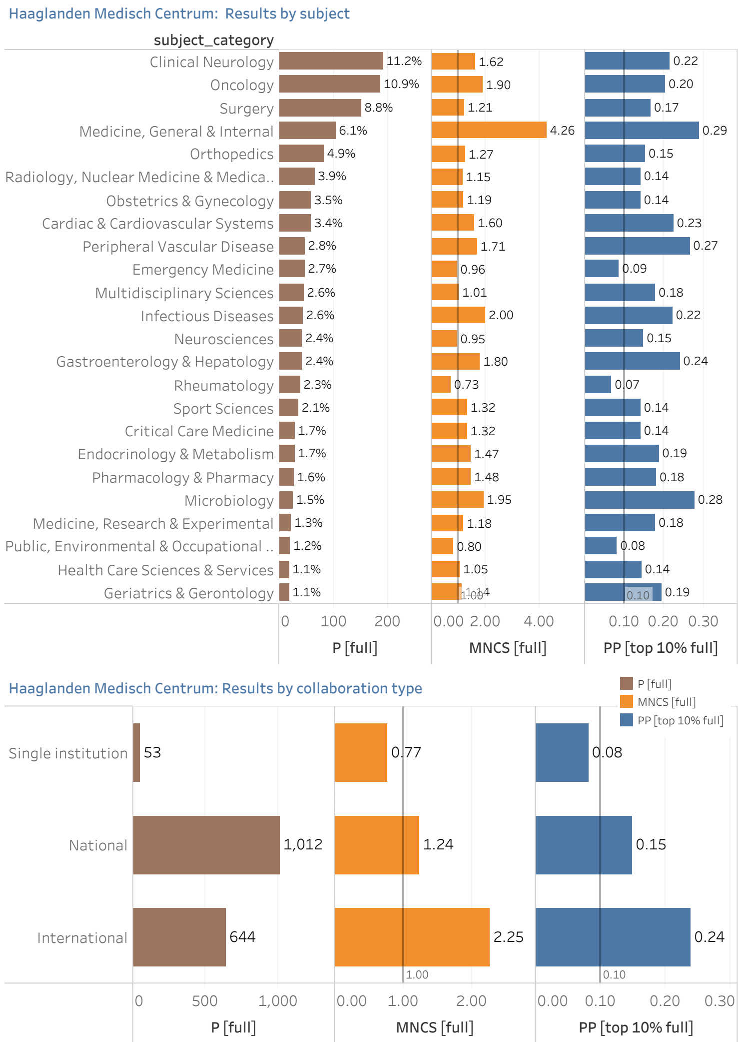
Interactive VOSviewer network at https://tinyurl.com/26kpv2nd

5.9 Haaglanden Medisch Centrum (HMC)

Table 5.9.1: Stats Haaglanden Medisch Centrum

Indicator	2013-2017	2018-2022	Total
P [full]	659	1,050	1,709
PP [OA]	0.50	0.78	0.67
PP [top 10% full]	0.17	0.19	0.18
MNCS [full]	1.75	1.51	1.61
MNJS [full]	1.64	1.49	1.55

Figure 5.9.1: Research and collaboration profile Haaglanden Medisch Centrum



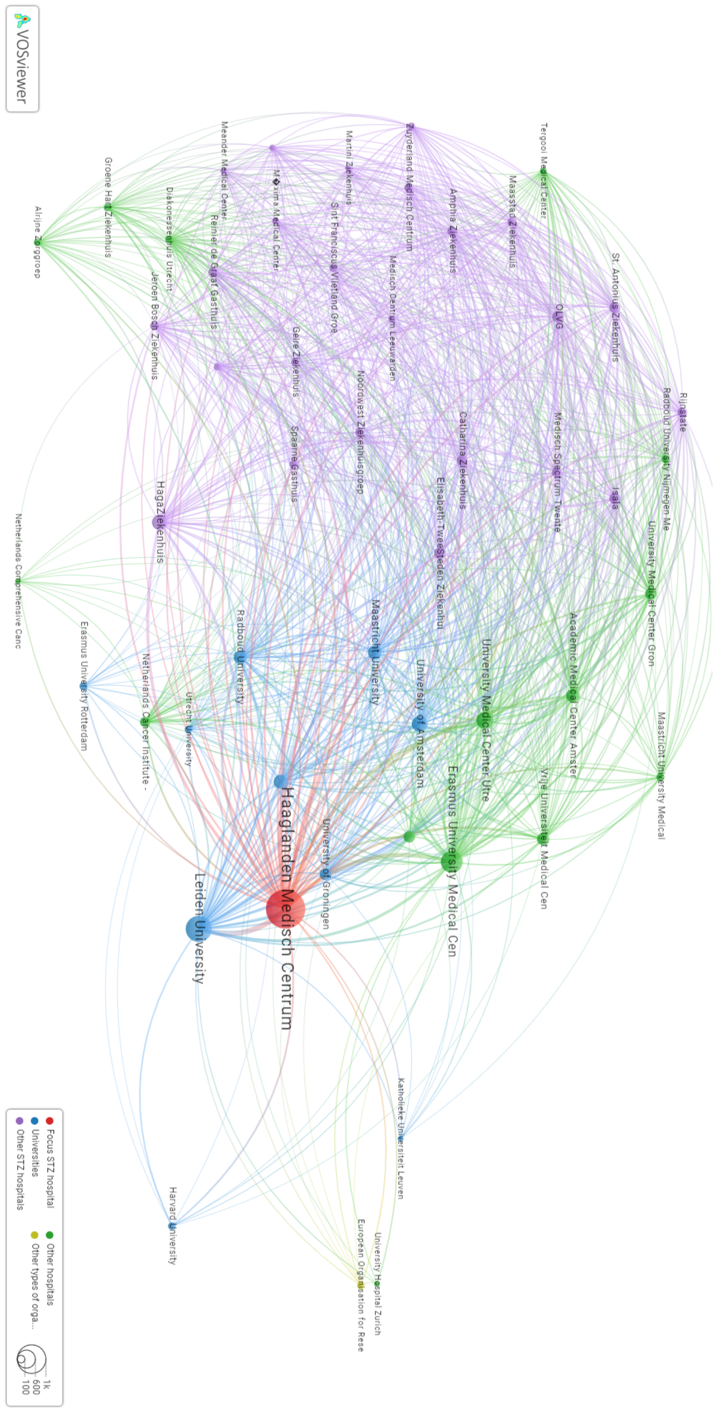


Figure 5.9.2: Co-author network Haaglanden Medisch Centrum with partners co-authoring in at least 2% of the output

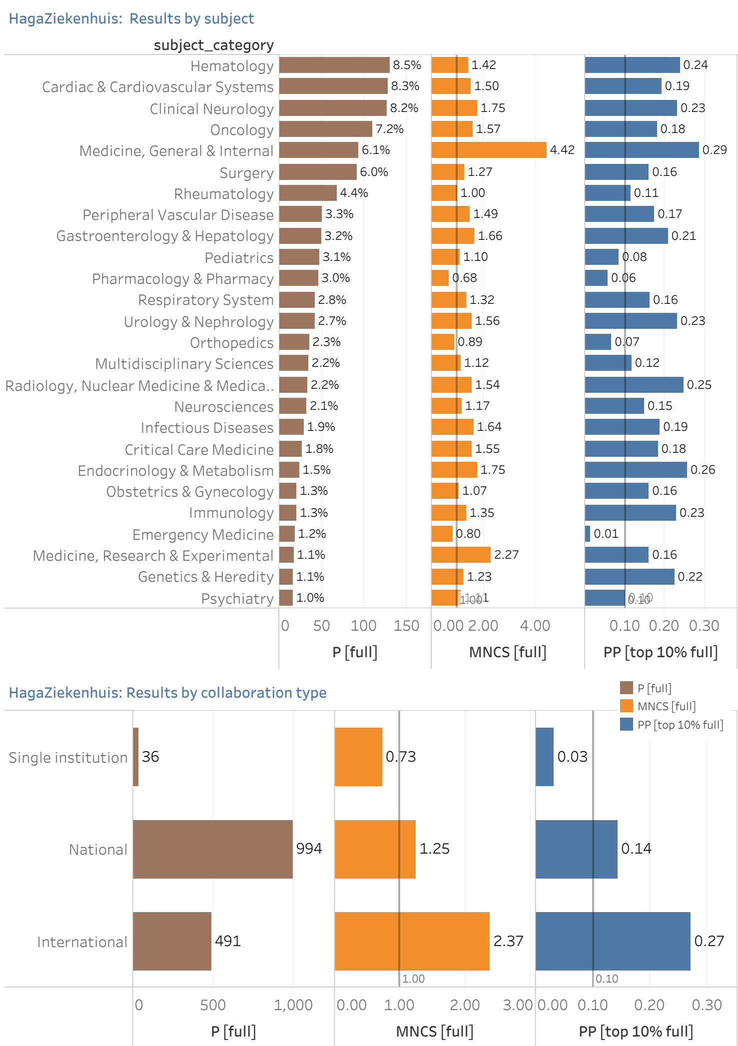
Interactive VOSviewer network at https://tinyurl.com/22v5v9qg

5.10 HagaZiekenhuis (HAGA)

Table 5.10.1: Stats HagaZiekenhuis

Indicator	2013-2017	2018-2022	Total
P [full]	581	940	1,521
PP [OA]	0.54	0.82	0.71
PP [top 10% full]	0.19	0.18	0.18
MNCS [full]	1.79	1.48	1.60
MNJS [full]	1.69	1.57	1.62

Figure 5.10.1: Research and collaboration profile HagaZiekenhuis



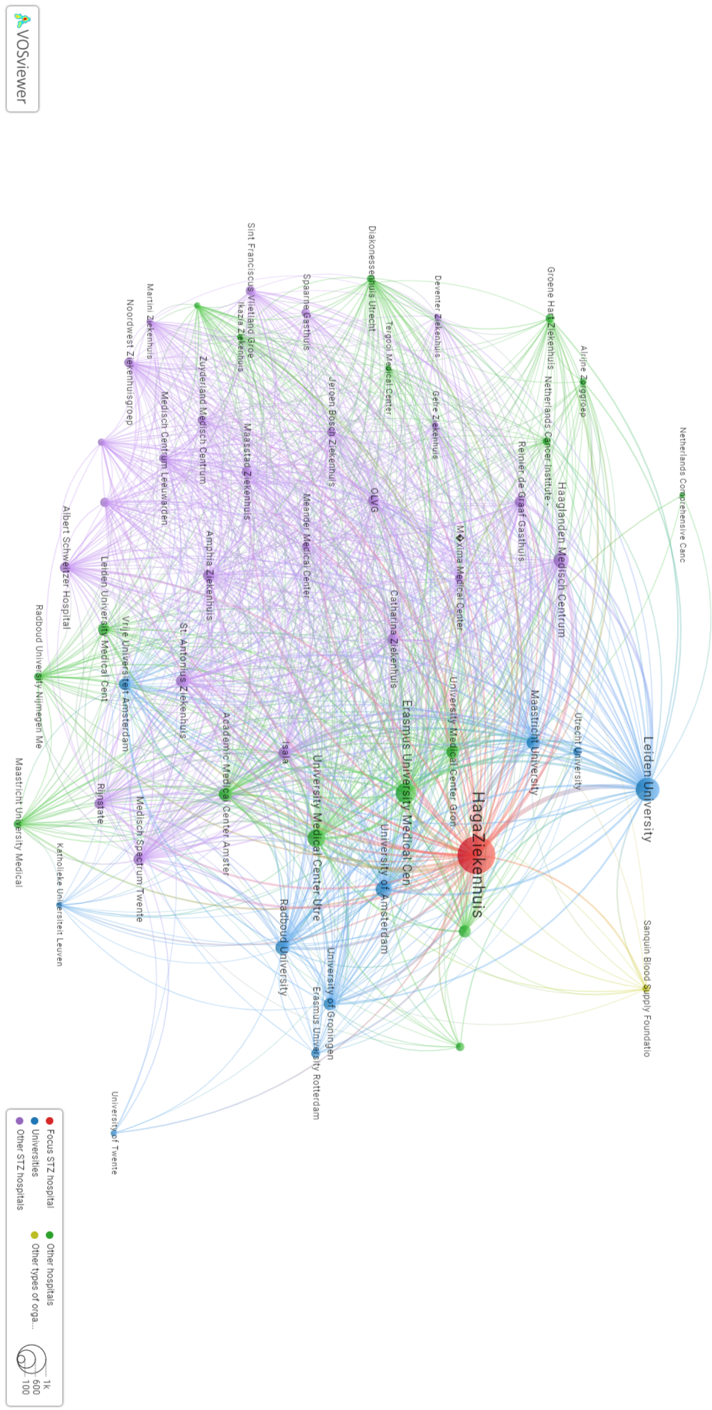


Figure 5.10.2: Co-author network HagaZiekenhuis with partners co-authoring in at least 2% of the output

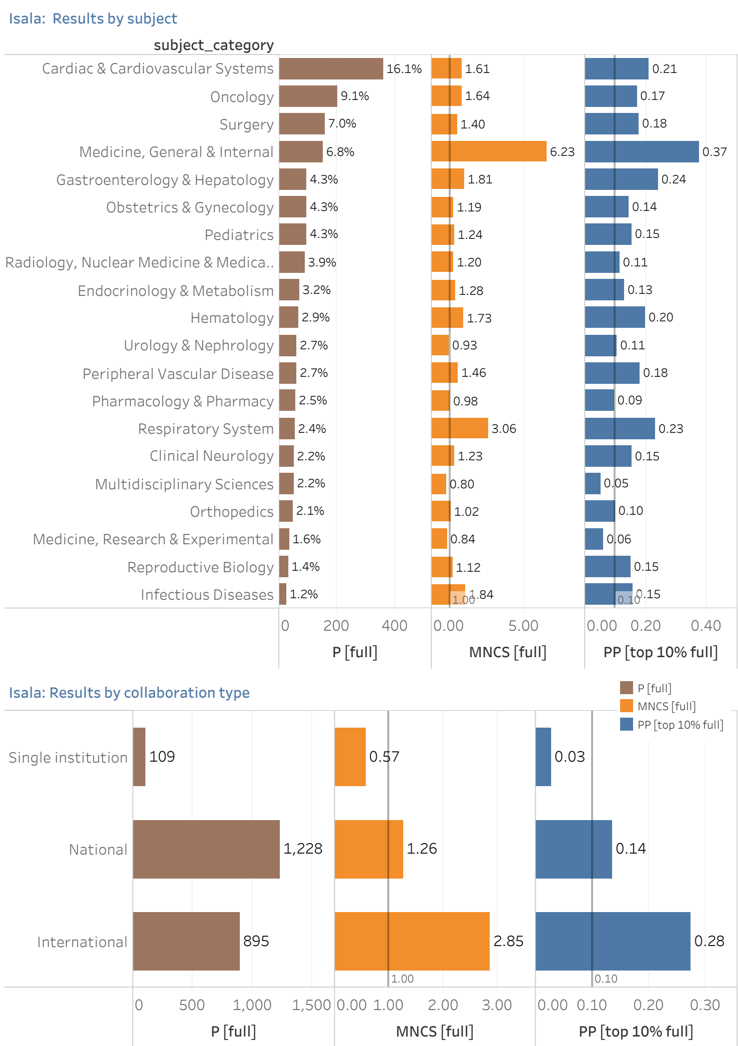
Interactive VOSviewer network at https://tinyurl.com/2ayvxdej

5.11 Isala Zwolle (ISAL)

Table 5.11.1: Stats Isala Zwolle

Indicator	2013-2017	2018-2022	Total
P [full]	893	1,339	2,232
PP [OA]	0.58	0.83	0.73
PP [top 10% full]	0.16	0.21	0.19
MNCS [full]	1.60	2.04	1.86
MNJS [full]	1.61	1.89	1.78

Figure 5.11.1: Research and collaboration profile Isala Zwolle



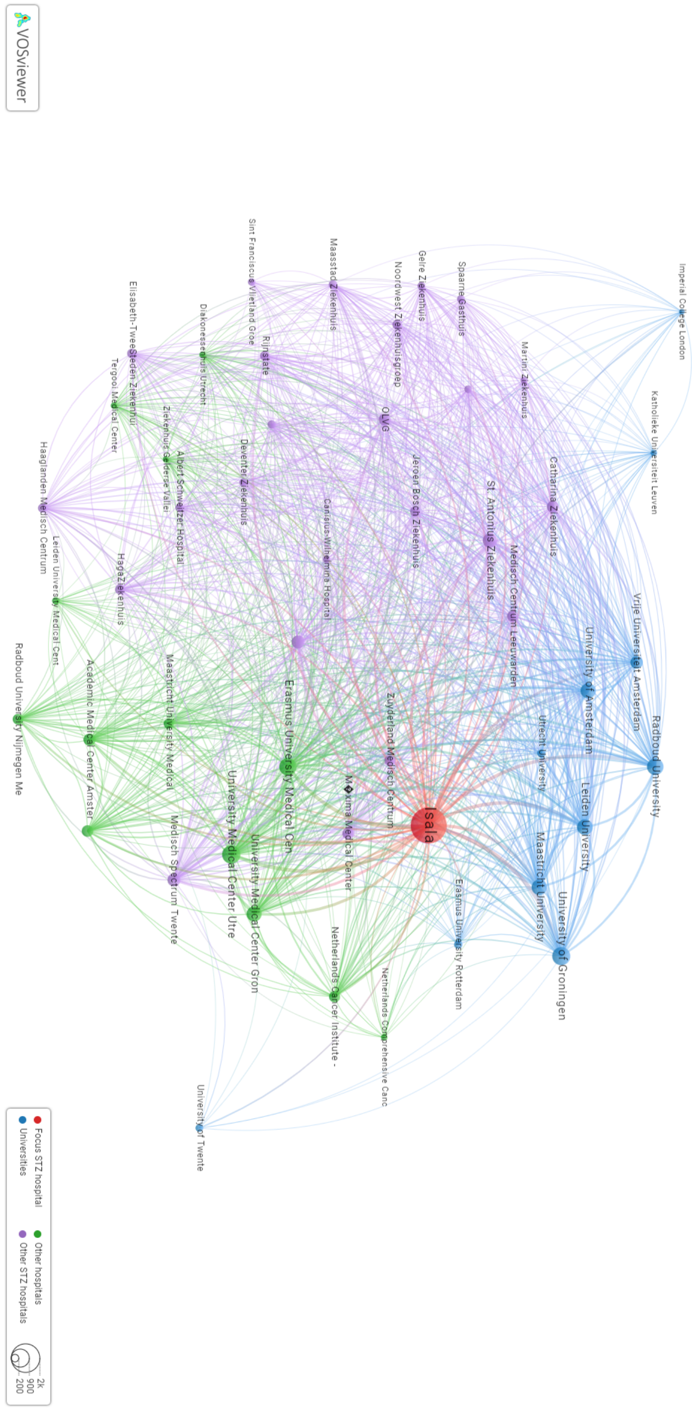


Figure 5.11.2: Co-author network Isala Zwolle with partners co-authoring in at least 2% of the output

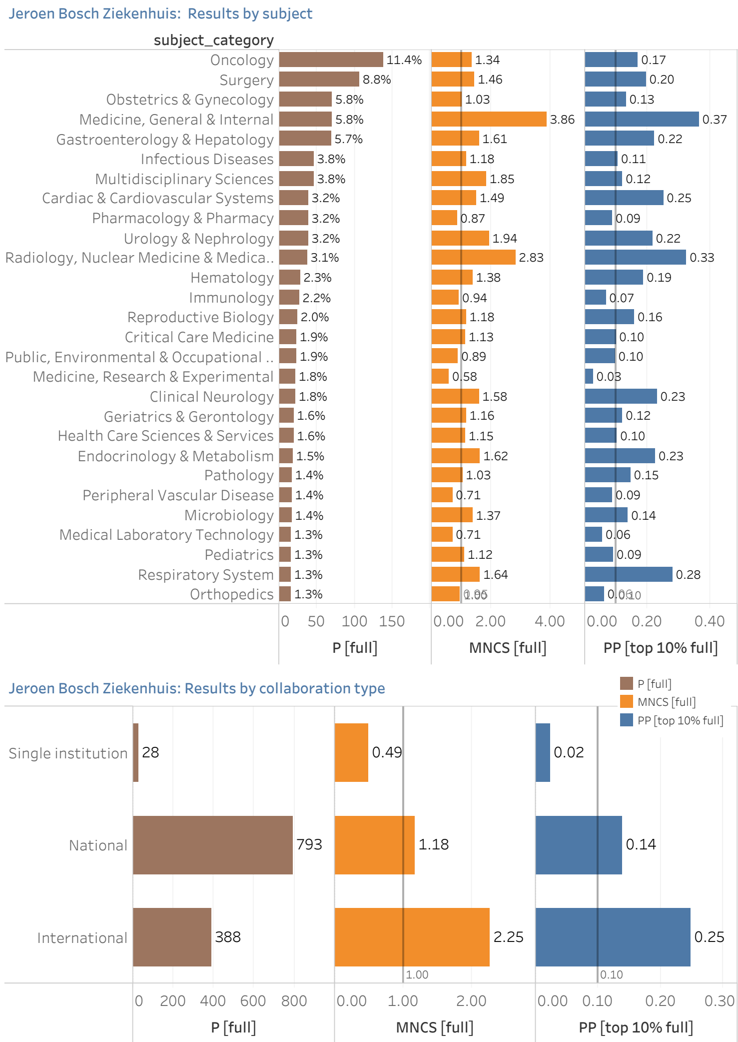
Interactive VOSviewer network at https://tinyurl.com/2dgthy2a

5.12 Jeroen Bosch Ziekenhuis (JBZ)

Table 5.12.1: Stats Jeroen Bosch Ziekenhuis

Indicator	2013-2017	2018-2022	Total
P [full]	453	756	1,209
PP [OA]	0.59	0.83	0.74
PP [top 10% full]	0.17	0.17	0.17
MNCS [full]	1.61	1.45	1.51
MNJS [full]	1.44	1.54	1.50

Figure 5.12.1: Research and collaboration profile Jeroen Bosch Ziekenhuis



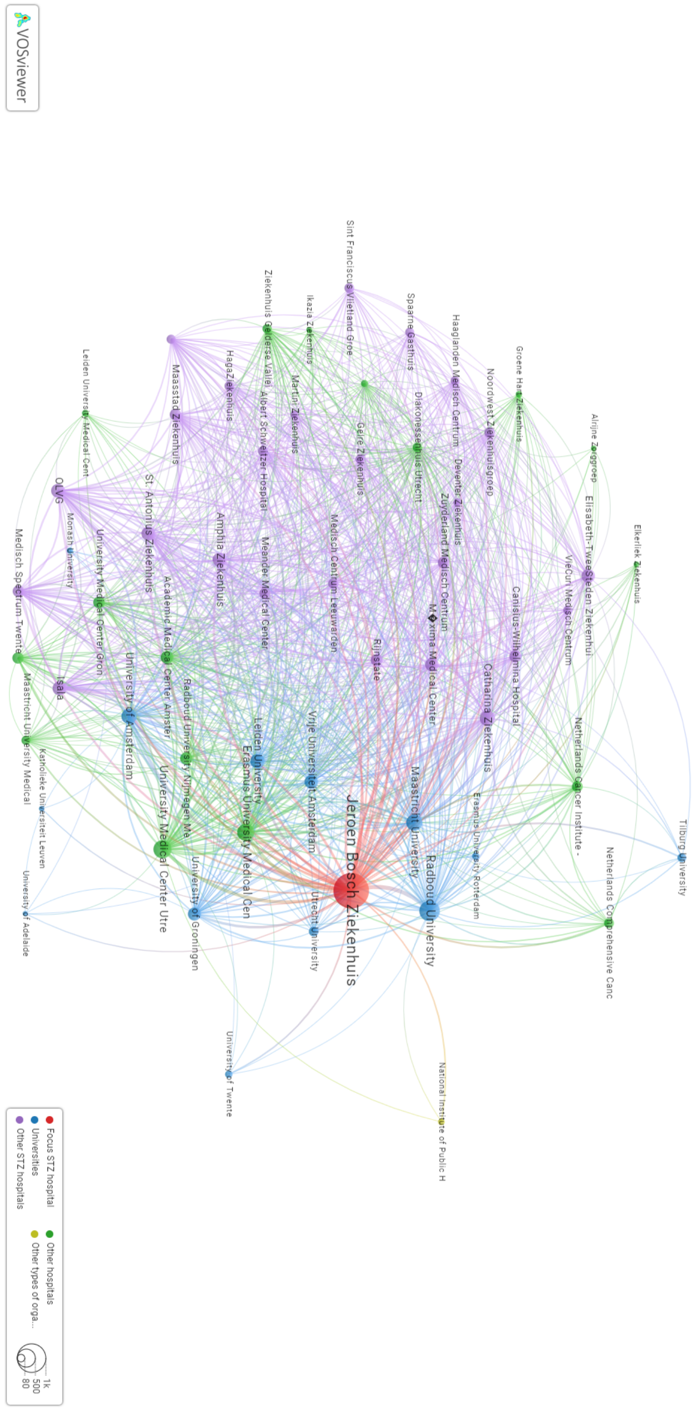


Figure 5.12.2: Co-author network Jeroen Bosch Ziekenhuis with partners co-authoring in at least 2% of the output

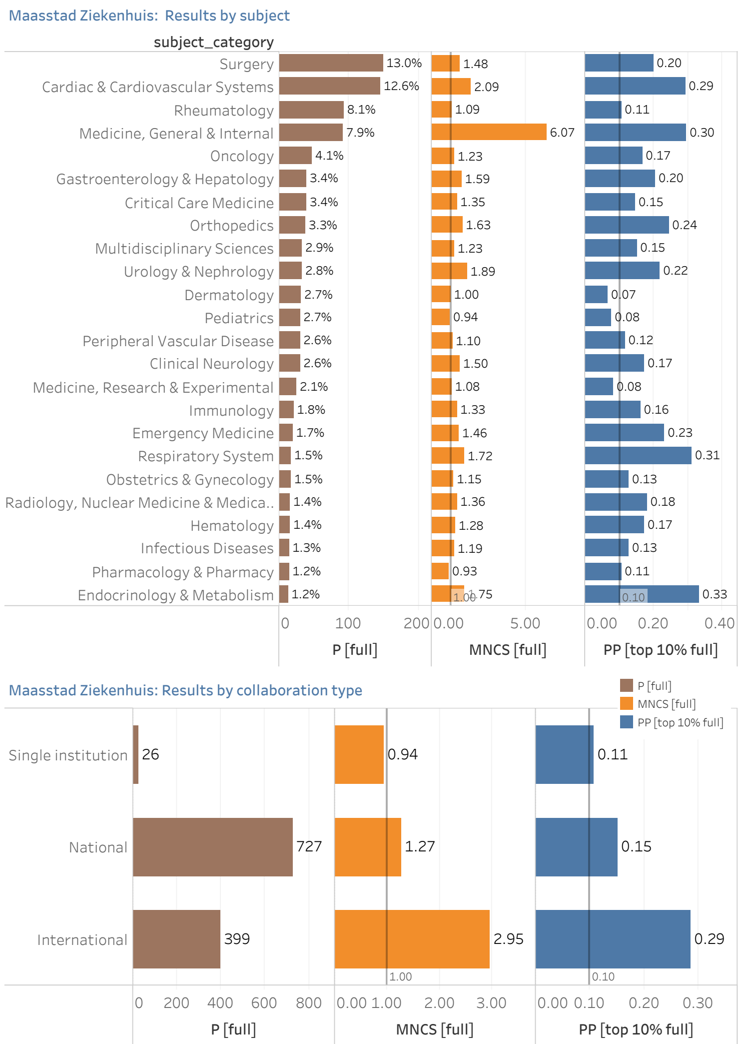
Interactive VOSviewer network at https://tinyurl.com/254uem94

5.13 Maasstad Ziekenhuis (MAAS)

Table 5.13.1: Stats Maasstad Ziekenhuis

Indicator	2013-2017	2018-2022	Total
P [full]	406	746	1,152
PP [OA]	0.54	0.82	0.72
PP [top 10% full]	0.19	0.20	0.20
MNCS [full]	1.80	1.87	1.85
MNJS [full]	1.69	2.08	1.94

Figure 5.13.1: Research and collaboration profile Maasstad Ziekenhuis



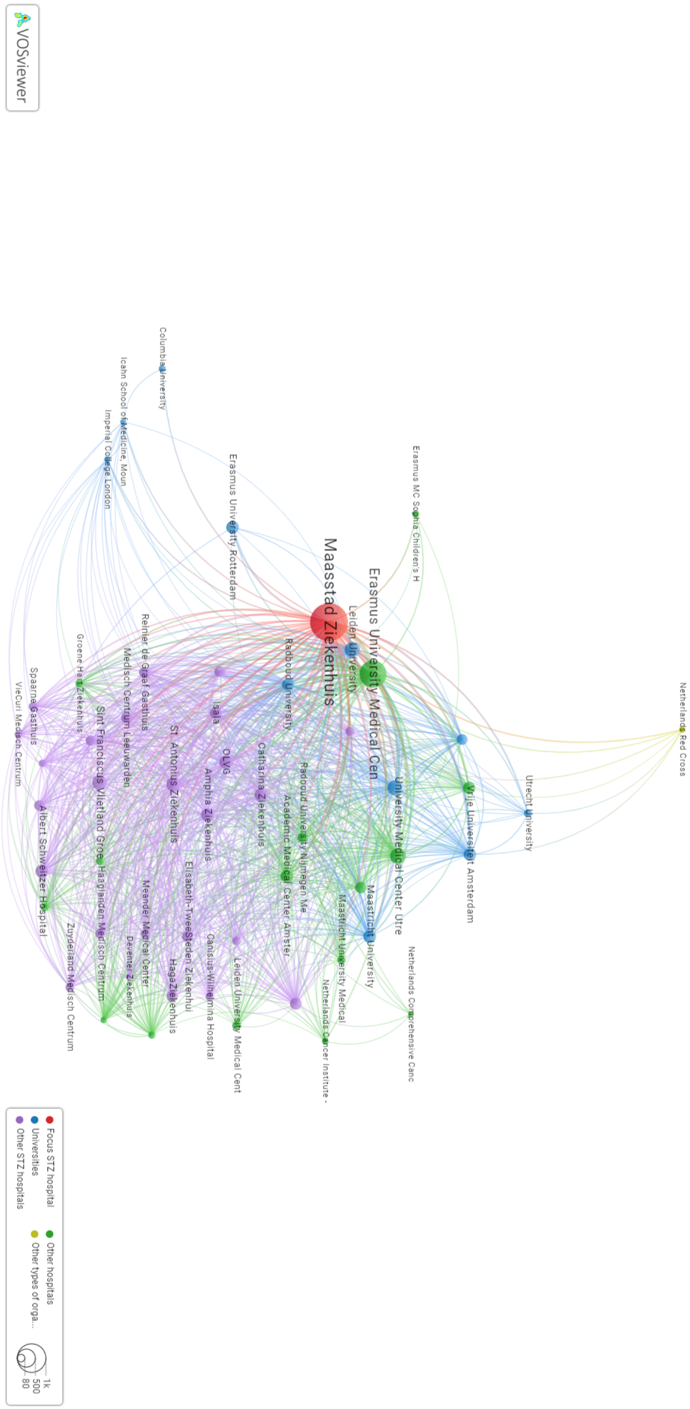


Figure 5.13.2: Co-author network Maasstad Ziekenhuis with partners co-authoring in at least 2% of the output

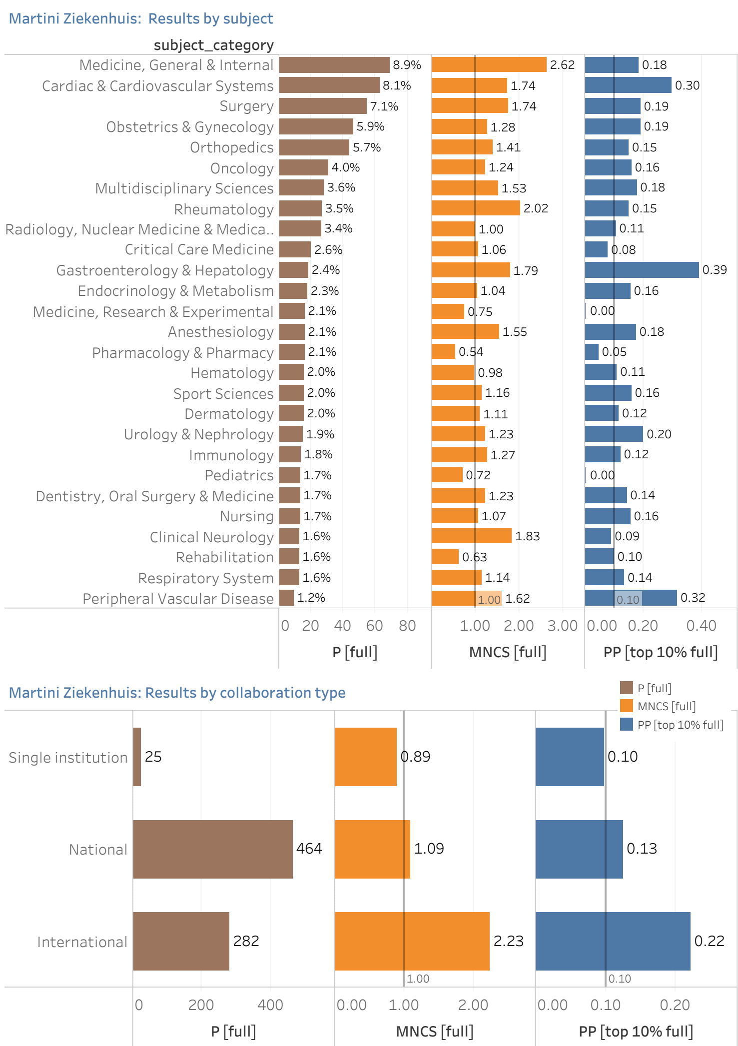
Interactive VOSviewer network at https://tinyurl.com/2dbp9ow6

5.14 **Martini Ziekenhuis (MART)**

Table 5.14.1: Stats Martini Ziekenhuis

Indicator	2013-2017	2018-2022	Total
P [full]	302	469	771
PP [OA]	0.57	0.88	0.76
PP [top 10% full]	0.13	0.18	0.16
MNCS [full]	1.34	1.61	1.50
MNJS [full]	1.42	1.60	1.53

Figure 5.14.1: Research and collaboration profile Martini Ziekenhuis



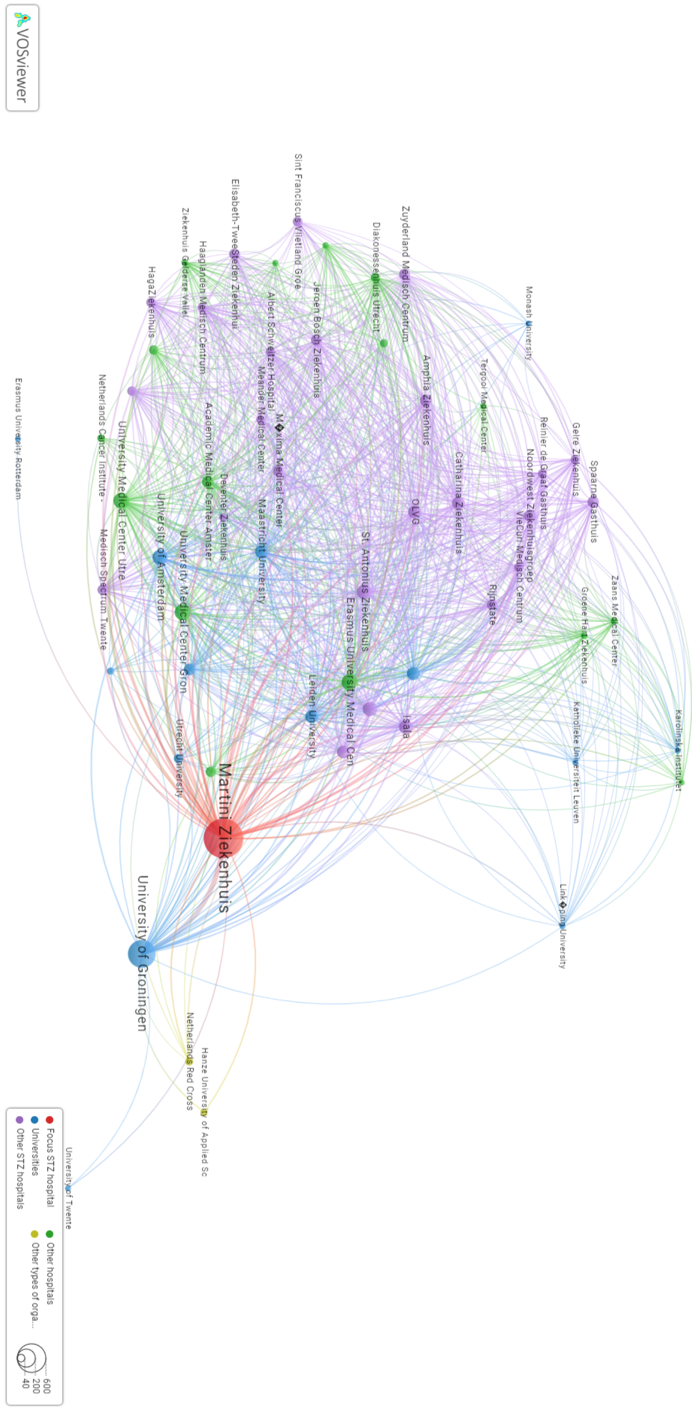


Figure 5.14.2: Co-author network Martini Ziekenhuis with partners co-authoring in at least 2% of the output

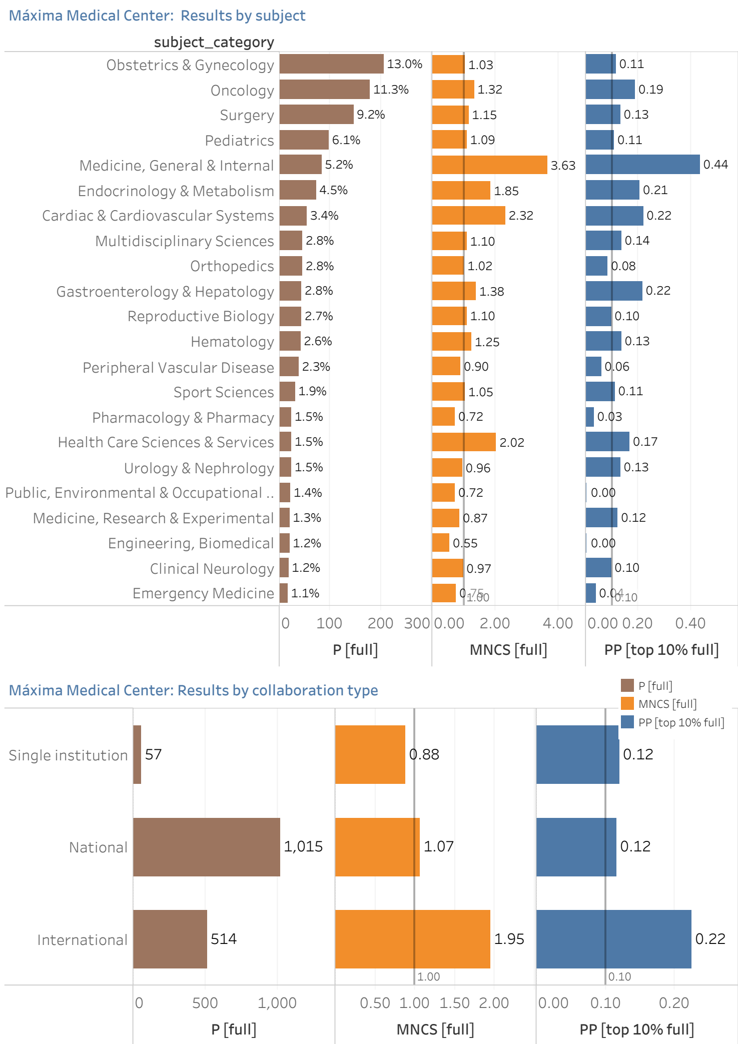
Interactive VOSviewer network at https://tinyurl.com/25tzxcm2

5.15 Maxima Medisch Centrum (MMC)

Table 5.15.1: Stats Maxima Medisch Centrum

Indicator	2013-2017	2018-2022	Total
P [full]	597	989	1,586
PP [OA]	0.57	0.79	0.71
PP [top 10% full]	0.15	0.15	0.15
MNCS [full]	1.31	1.37	1.35
MNJS [full]	1.43	1.38	1.40

Figure 5.15.1: Research and collaboration profile Maxima Medisch Centrum



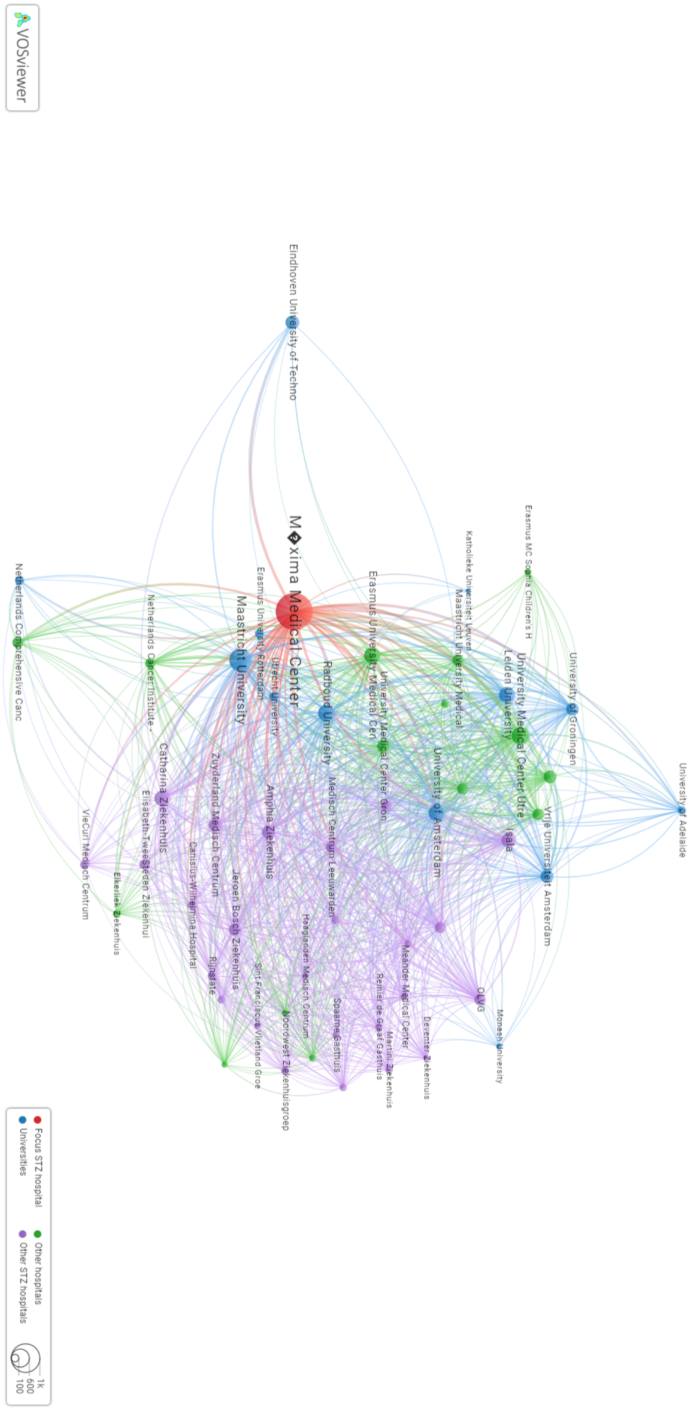


Figure 5.15.2: Co-author network Maxima Medisch Centrum with partners co-authoring in at least 2% of the output

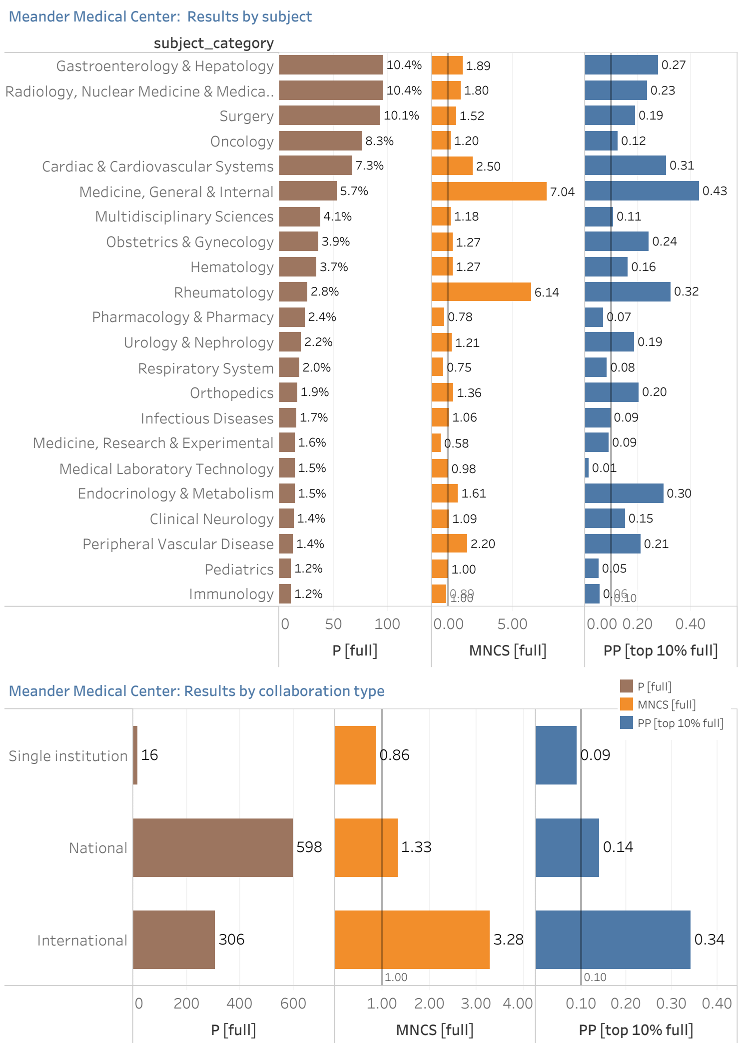
Interactive VOSviewer network at https://tinyurl.com/29d7tp23

5.16 Meander Medisch Centrum (MEAN)

Table 5.16.1: Stats Meander Medisch Centrum

Indicator	2013-2017	2018-2022	Total
P [full]	398	522	920
PP [OA]	0.55	0.80	0.69
PP [top 10% full]	0.19	0.22	0.21
MNCS [full]	2.16	1.83	1.97
MNJS [full]	1.87	1.79	1.83

Figure 5.16.1: Research and collaboration profile Meander Medisch Centrum



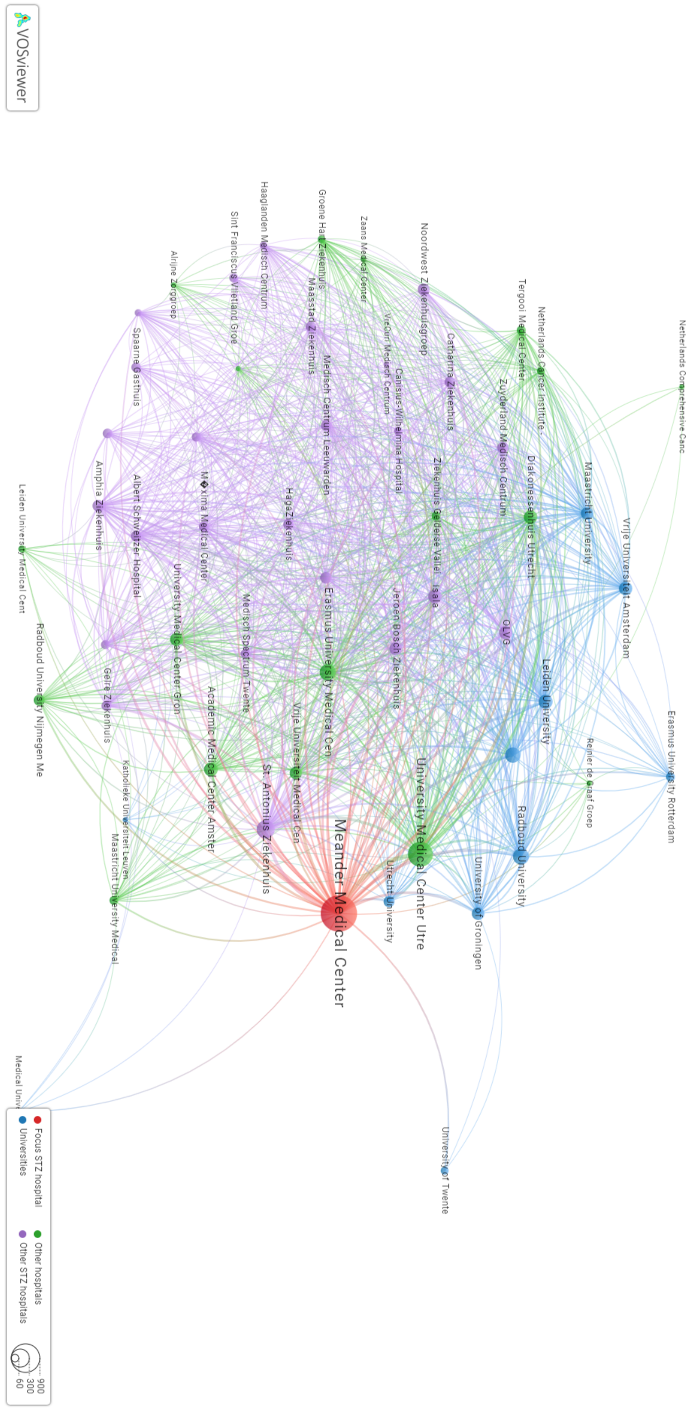


Figure 5.16.2: Co-author network Meander Medisch Centrum with partners co-authoring in at least 2% of the output

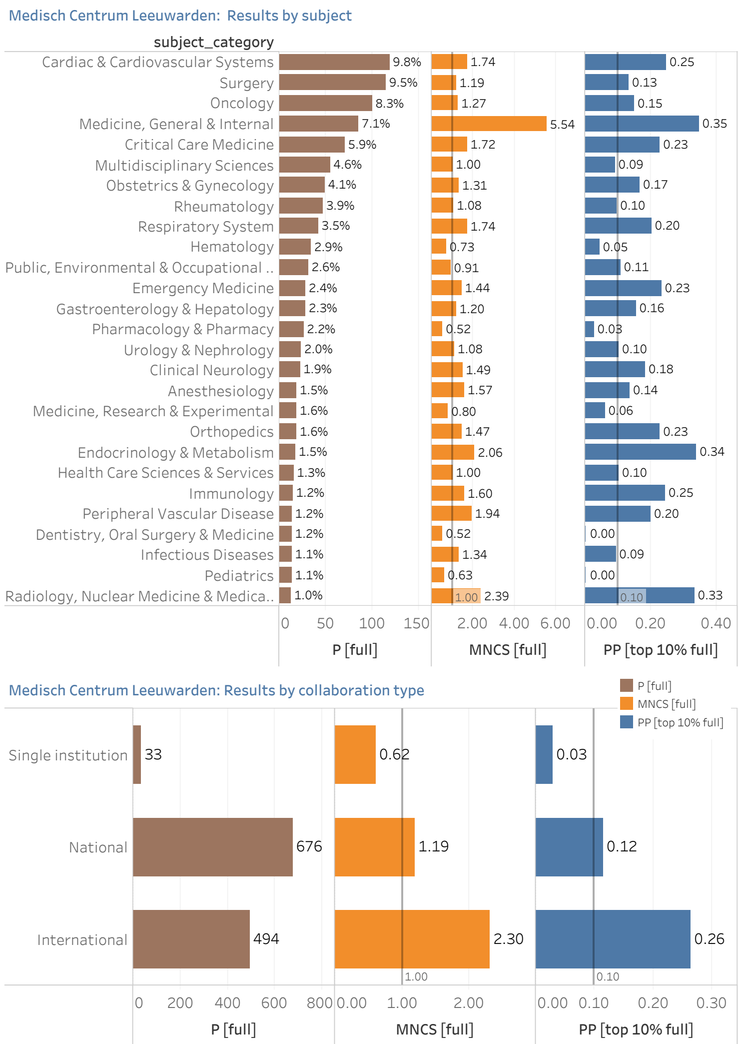
Interactive VOSviewer network at https://tinyurl.com/28obpf7u

5.17 Medisch Centrum Leeuwarden (MCL)

Table 5.17.1: Stats Medisch Centrum Leeuwarden

Indicator	2013-2017	2018-2022	Total
P [full]	455	748	1,203
PP [OA]	0.60	0.87	0.77
PP [top 10% full]	0.18	0.17	0.17
MNCS [full]	1.79	1.53	1.63
MNJS [full]	1.61	1.61	1.61

Figure 5.17.1: Research and collaboration profile Medisch Centrum Leeuwarden



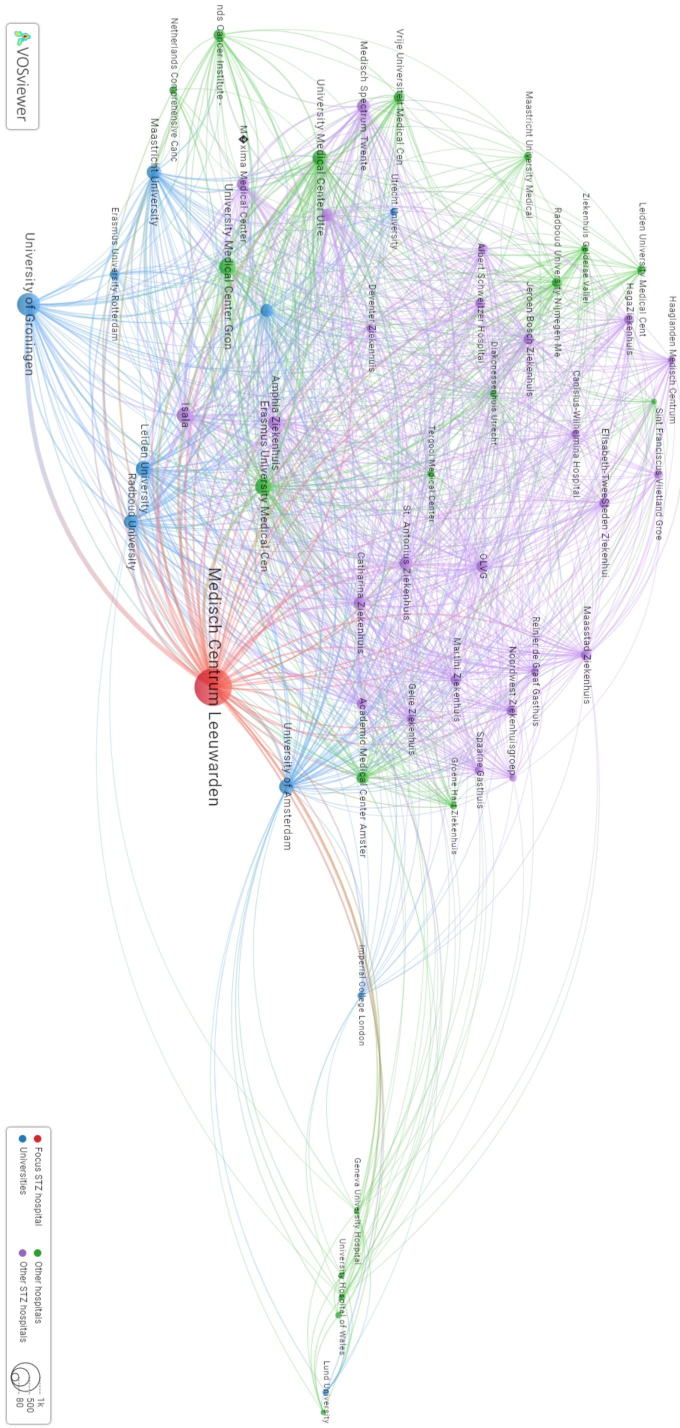


Figure 5.17.2: Co-author network Medisch Centrum Leeuwarden with partners co-authoring in at least 2% of the output

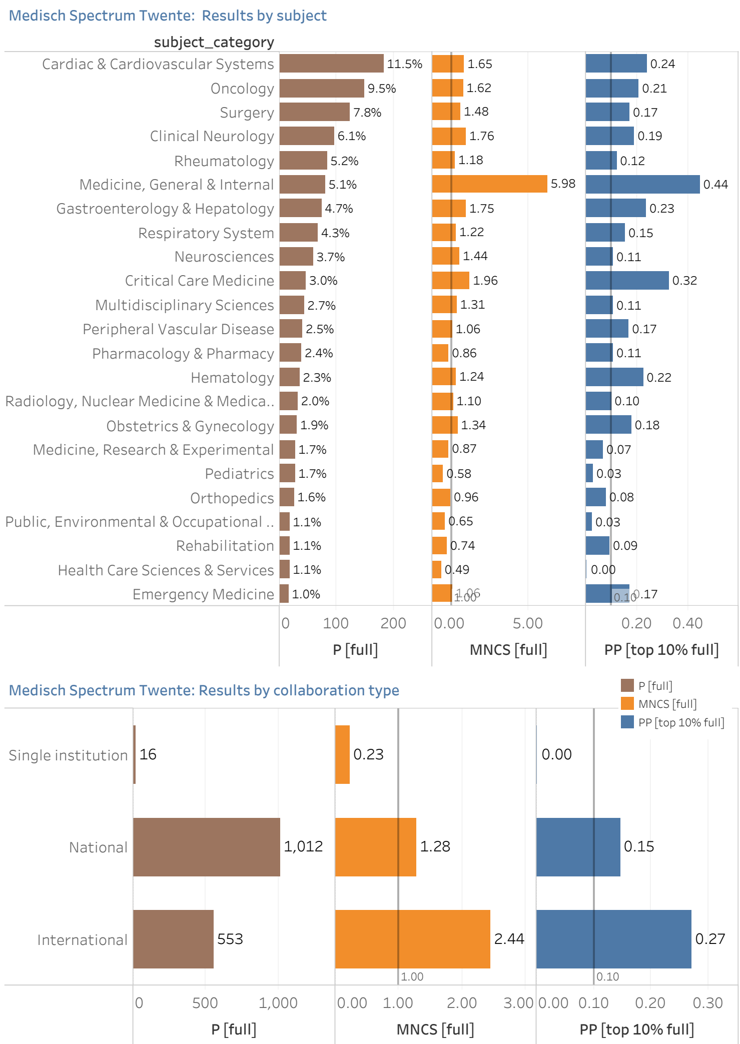
Interactive VOSviewer network at https://tinyurl.com/28zosmpr

5.18 Medisch Spectrum Twente (MST)

Table 5.18.1: Stats Medisch Spectrum Twente

Indicator	2013-2017	2018-2022	Total
P [full]	691	890	1,581
PP [OA]	0.74	0.89	0.82
PP [top 10% full]	0.19	0.19	0.19
MNCS [full]	1.70	1.65	1.67
MNJS [full]	1.56	1.80	1.70

Figure 5.18.1: Research and collaboration profile Medisch Spectrum Twente



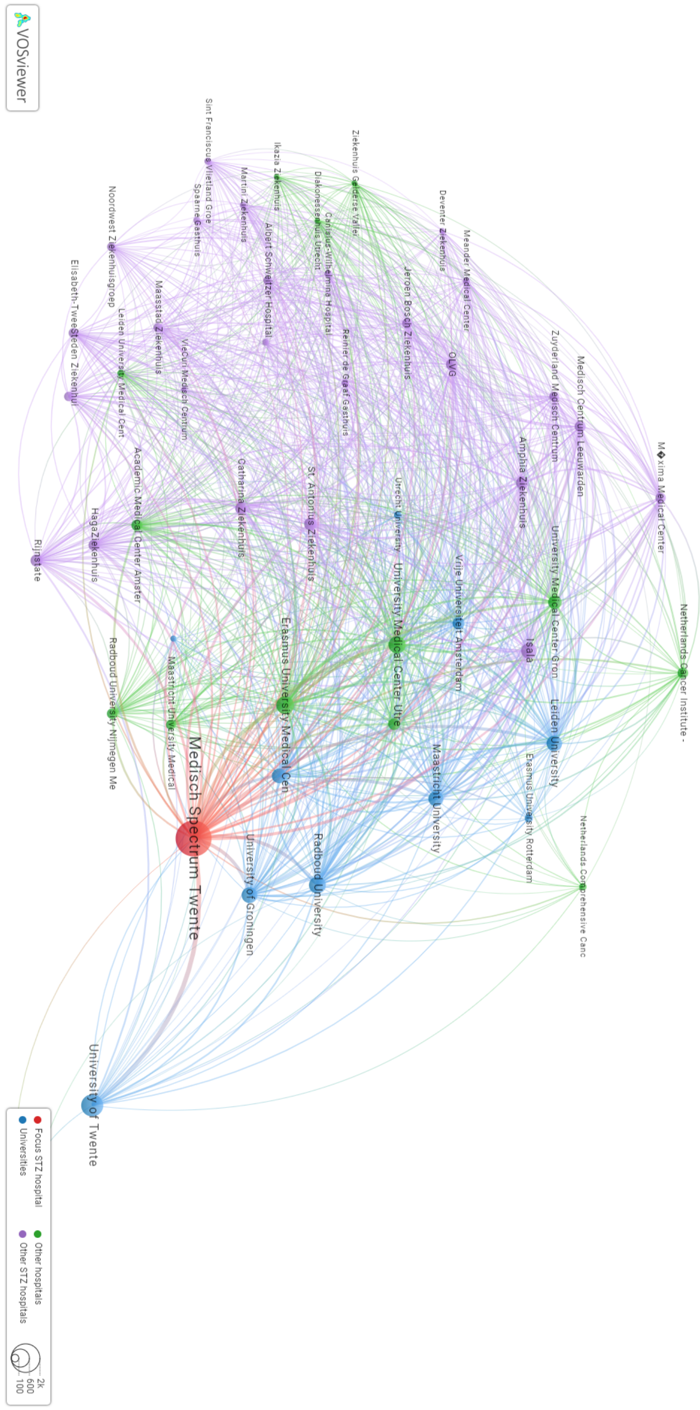


Figure 5.18.2: Co-author network Medisch Spectrum Twente with partners co-authoring in at least 2% of the output

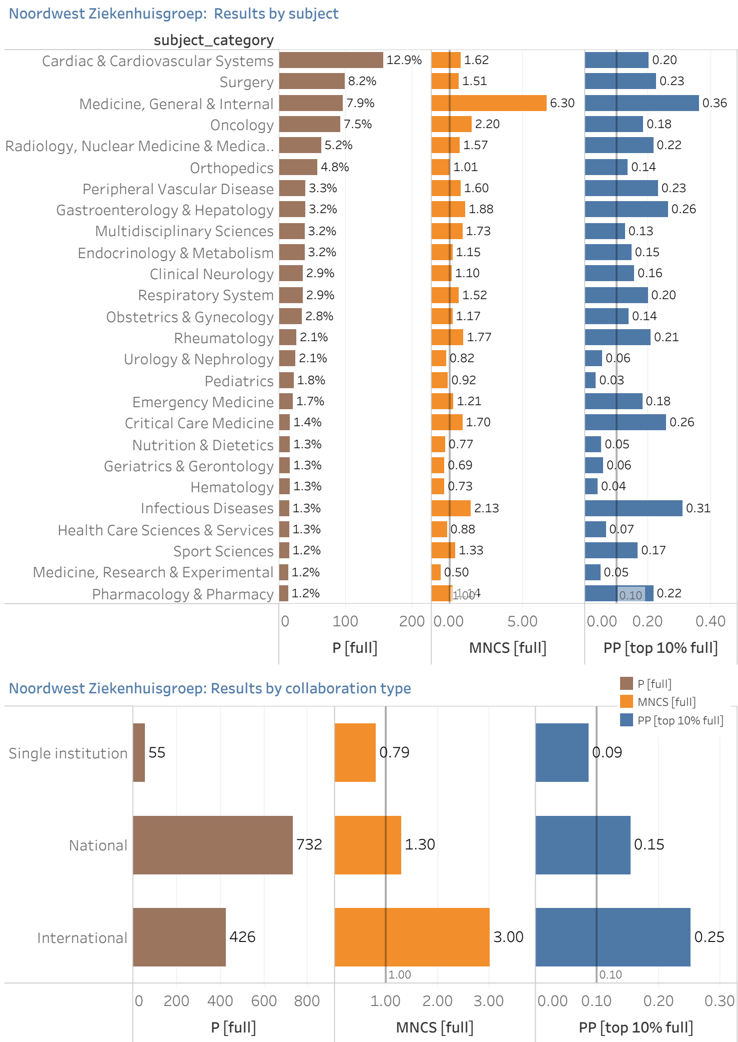
Interactive VOSviewer network at https://tinyurl.com/2dkh7vkc

5.19 Noordwest Ziekenhuisgroep (NWZ)

Table 5.19.1: Stats Noordwest Ziekenhuisgroep

Indicator	2013-2017	2018-2022	Total
P [full]	511	702	1,213
PP [OA]	0.52	0.78	0.67
PP [top 10% full]	0.18	0.19	0.19
MNCS [full]	2.03	1.76	1.87
MNJS [full]	1.91	1.77	1.83

Figure 5.19.1: Research and collaboration profile Noordwest Ziekenhuisgroep



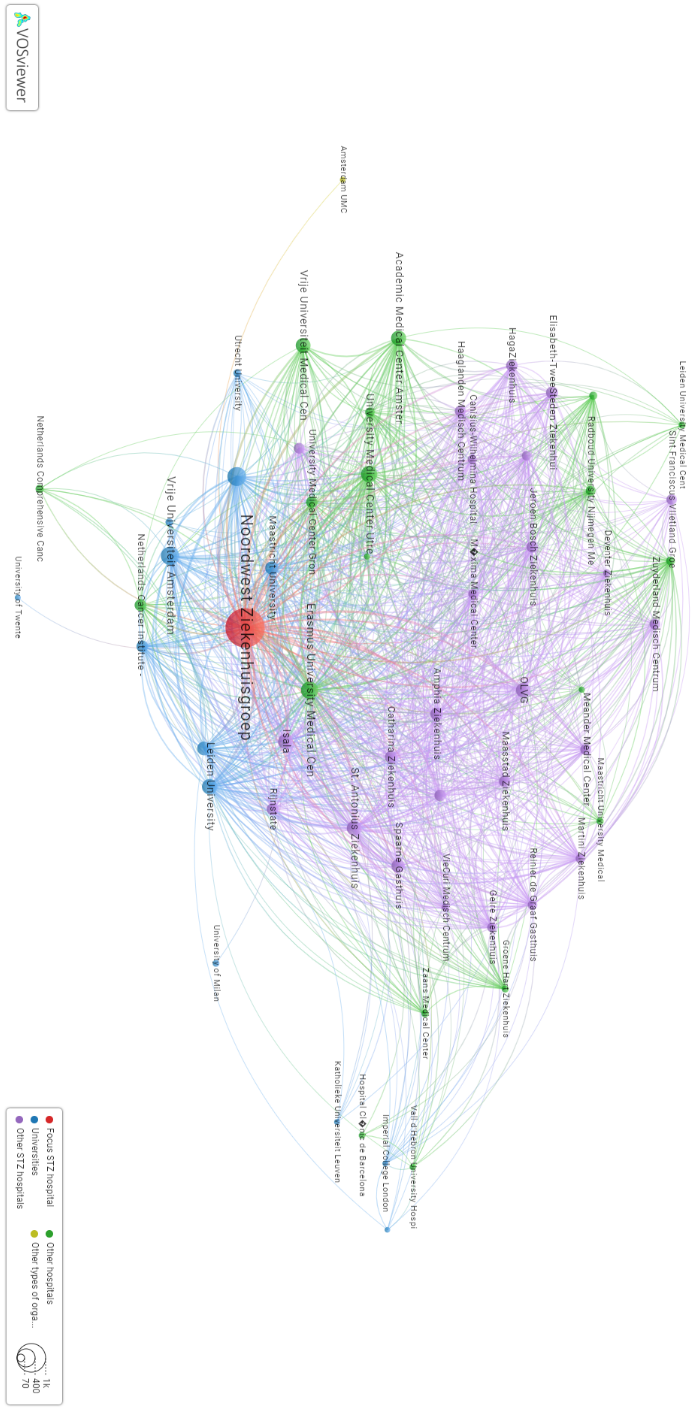


Figure 5.19.2: Co-author network Noordwest Ziekenhuisgroep with partners co-authoring in at least 2% of the output

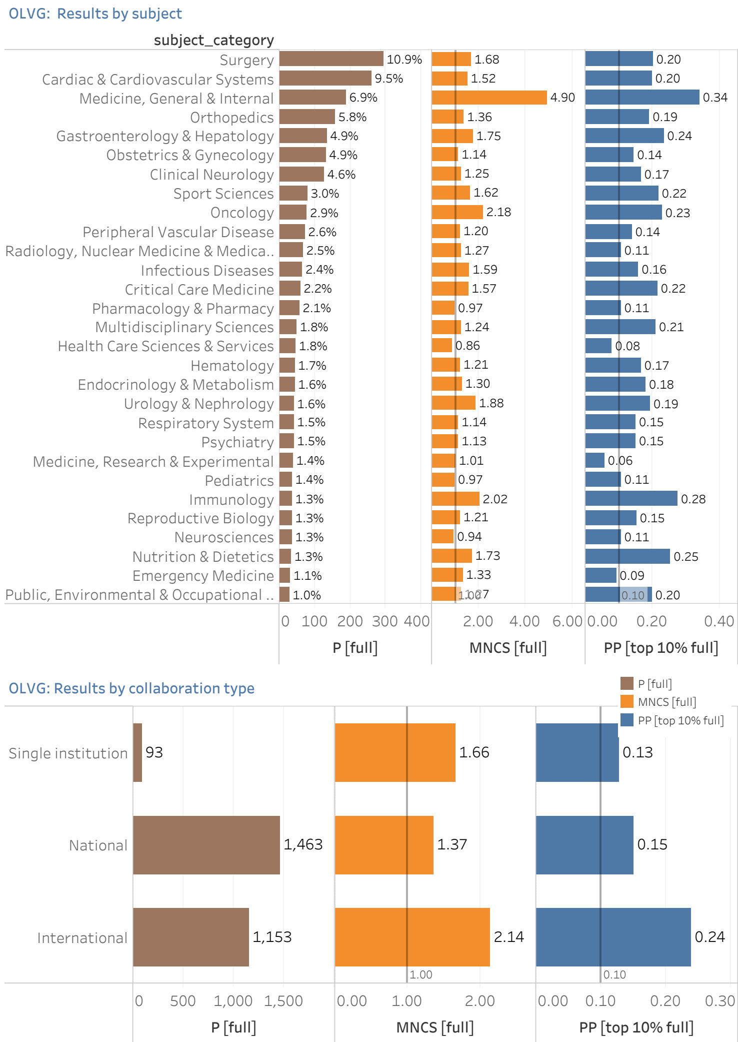
Interactive VOSviewer network at https://tinyurl.com/26zezwo8

5.20 **OLVG (OLVG)**

Table 5.20.1: Stats OLVG

Indicator	2013-2017	2018-2022	Total
P [full]	1,118	1,591	2,709
PP [OA]	0.52	0.77	0.66
PP [top 10% full]	0.19	0.19	0.19
MNCS [full]	1.85	1.61	1.71
MNJS [full]	1.70	1.57	1.62

Figure 5.20.1: Research and collaboration profile OLVG



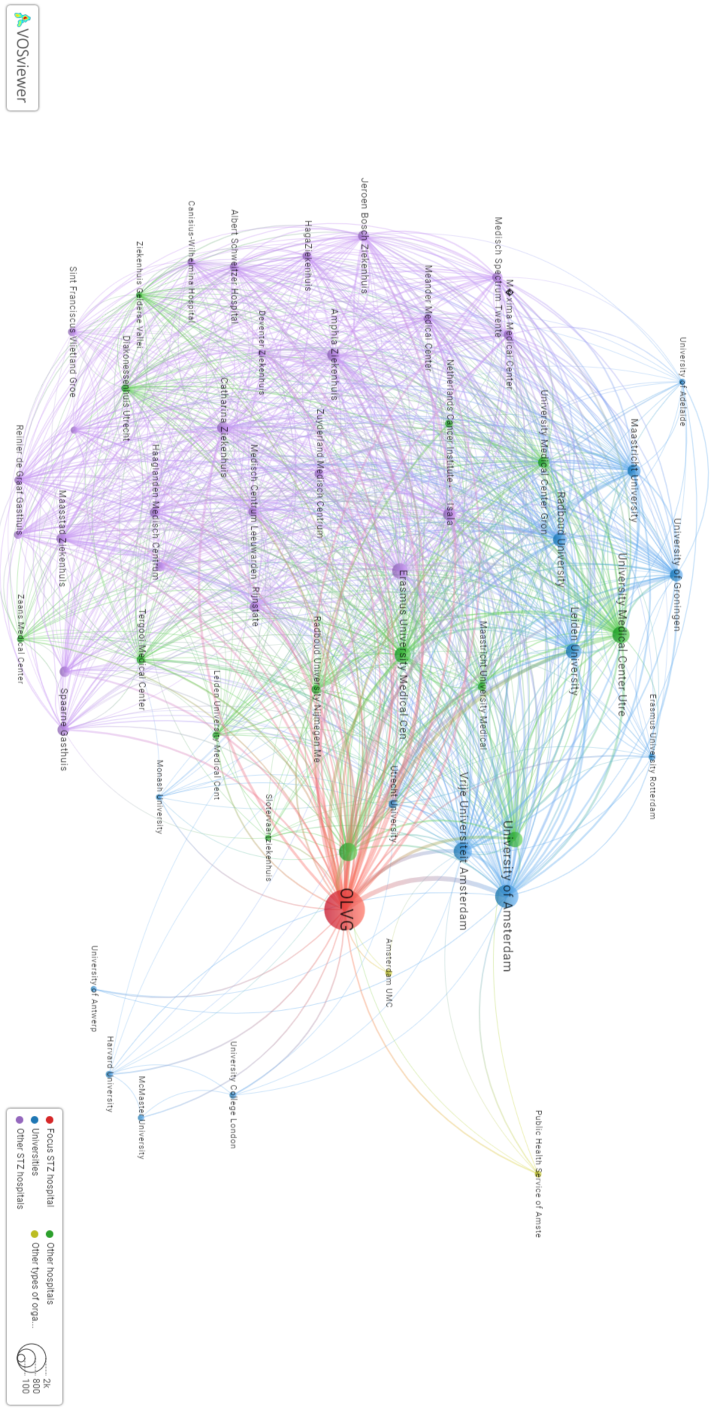


Figure 5.20.2: Co-author network OLVG with partners co-authoring in at least 2% of the output

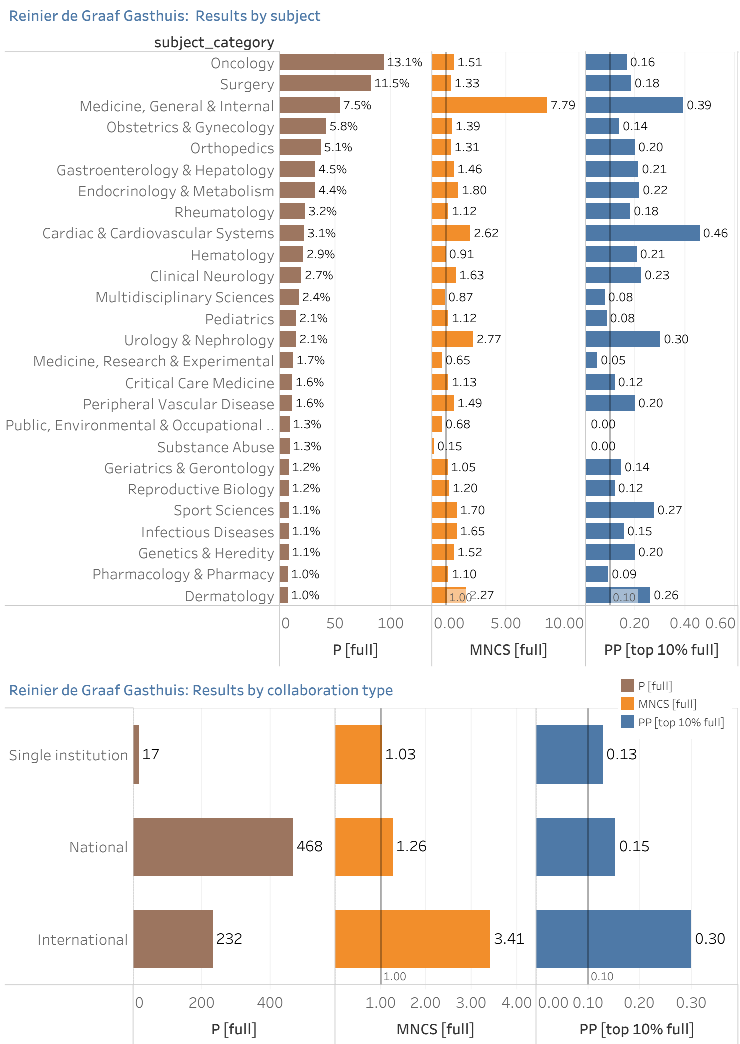
Interactive VOSviewer network at https://tinyurl.com/2ysr2c2g

5.21 Reinier de Graaf Ziekenhuis (RDGG)

Table 5.21.1: Stats Reinier de Graaf Ziekenhuis

Indicator	2013-2017	2018-2022	Total
P [full]	274	443	717
PP [OA]	0.61	0.81	0.73
PP [top 10% full]	0.21	0.20	0.20
MNCS [full]	2.43	1.66	1.95
MNJS [full]	2.16	1.73	1.90

Figure 5.21.1: Research and collaboration profile Reinier de Graaf Ziekenhuis



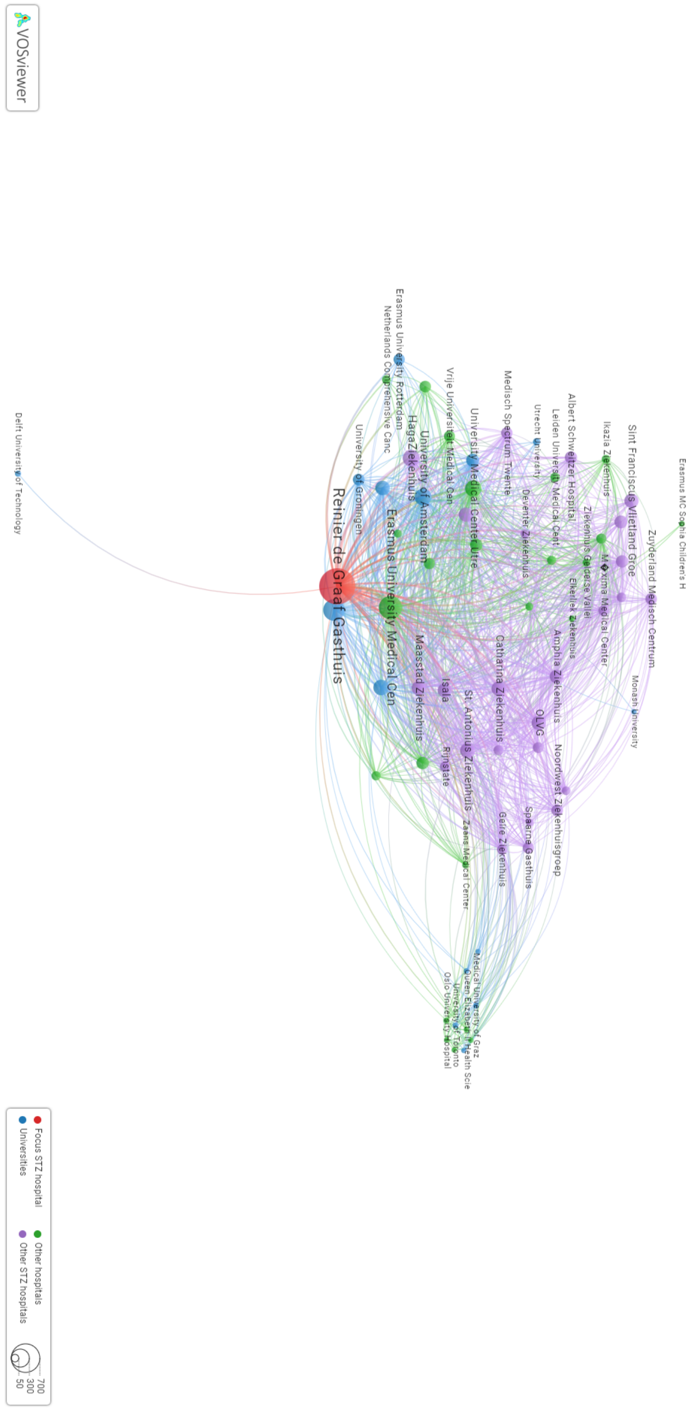


Figure 5.21.2: Co-author network Reinier de Graaf Ziekenhuis with partners co-authoring in at least 2% of the output

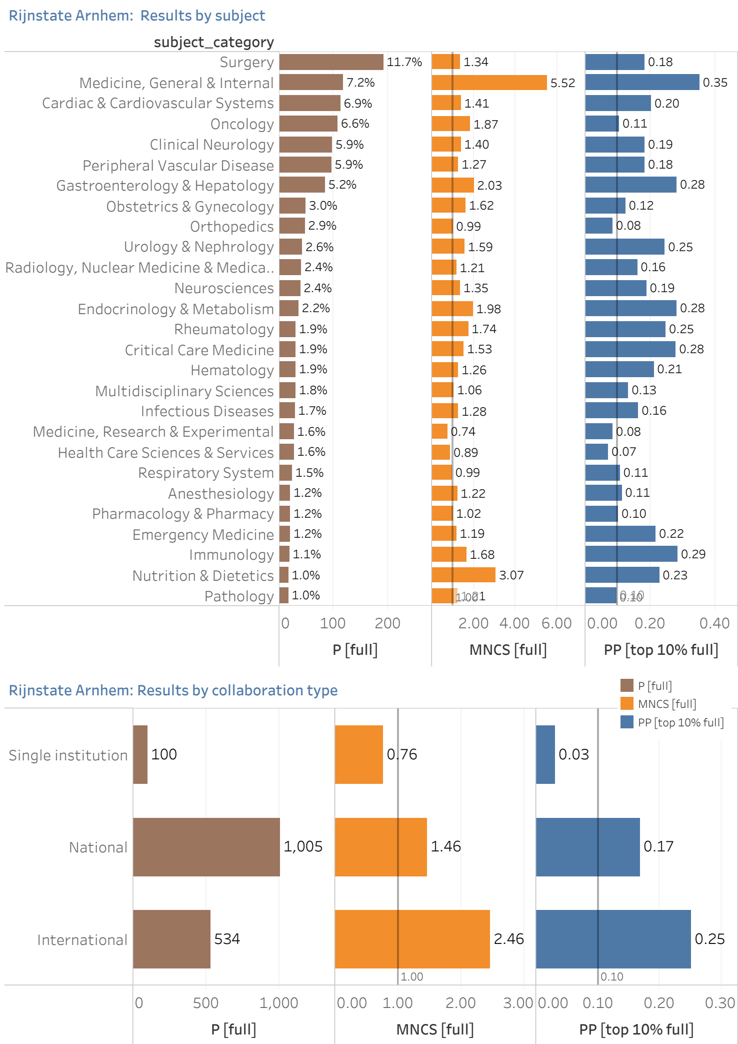
Interactive VOSviewer network at https://tinyurl.com/2786j6mk

5.22 Rijnstate Arnhem (RIJN)

Table 5.22.1: Stats Rijnstate Arnhem

Indicator	2013-2017	2018-2022	Total
P [full]	640	999	1,639
PP [OA]	0.55	0.80	0.70
PP [top 10% full]	0.20	0.18	0.19
MNCS [full]	1.85	1.68	1.75
MNJS [full]	1.74	1.73	1.73

Figure 5.22.1: Research and collaboration profile Rijnstate Arnhem



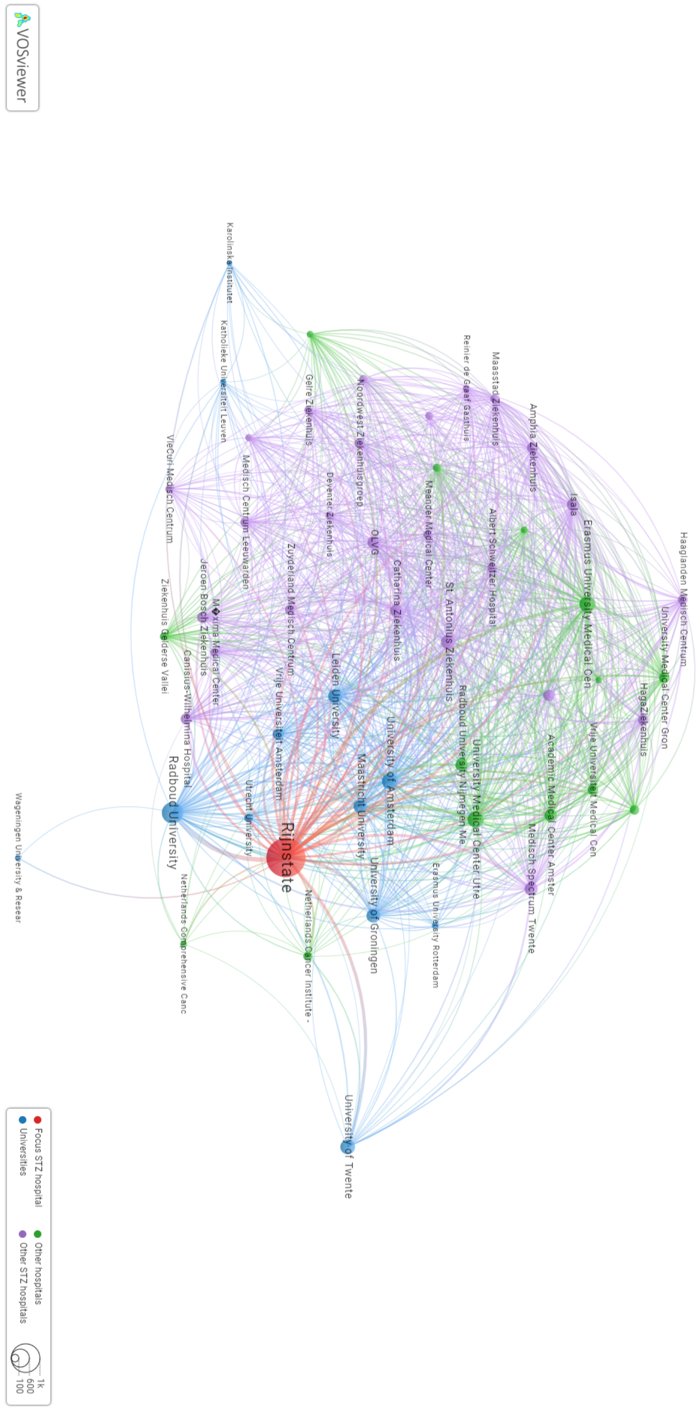


Figure 5.22.2: Co-author network Rijnstate Arnhem with partners co-authoring in at least 2% of the output

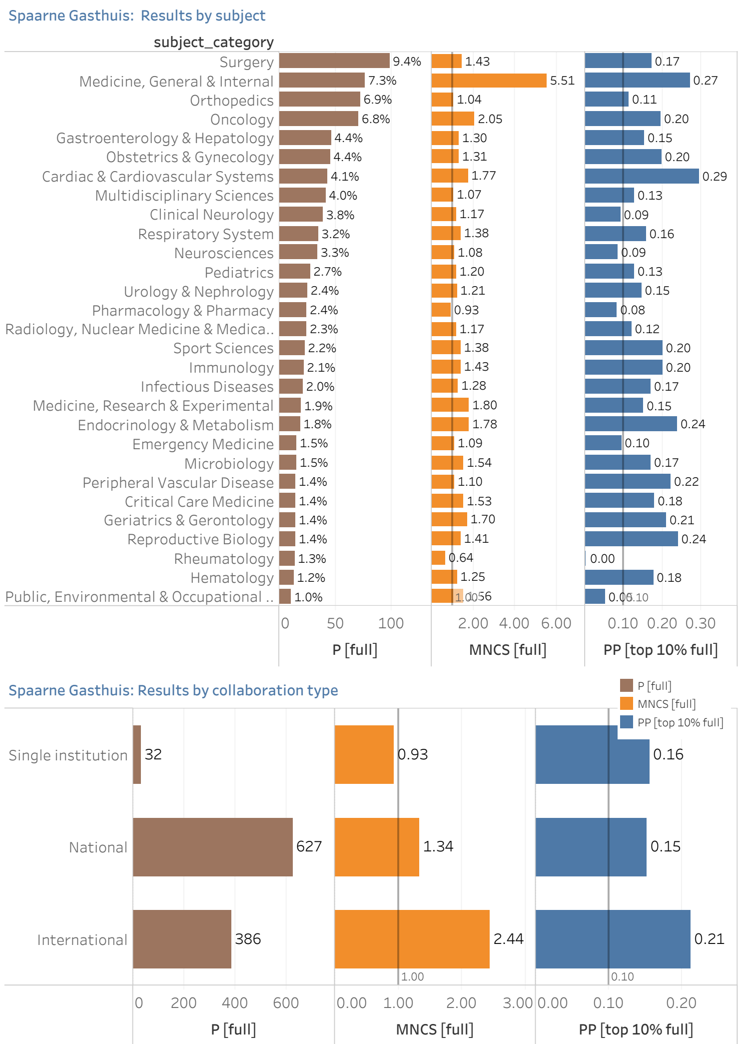
Interactive VOSviewer network at https://tinyurl.com/2yyx6385

5.23 Spaarne Gasthuis (SG)

Table 5.23.1: Stats Spaarne Gasthuis

Indicator	2013-2017	2018-2022	Total
P [full]	446	599	1,045
PP [OA]	0.54	0.77	0.67
PP [top 10% full]	0.19	0.17	0.17
MNCS [full]	1.78	1.70	1.74
MNJS [full]	1.84	1.82	1.83

Figure 5.23.1: Research and collaboration profile Spaarne Gasthuis



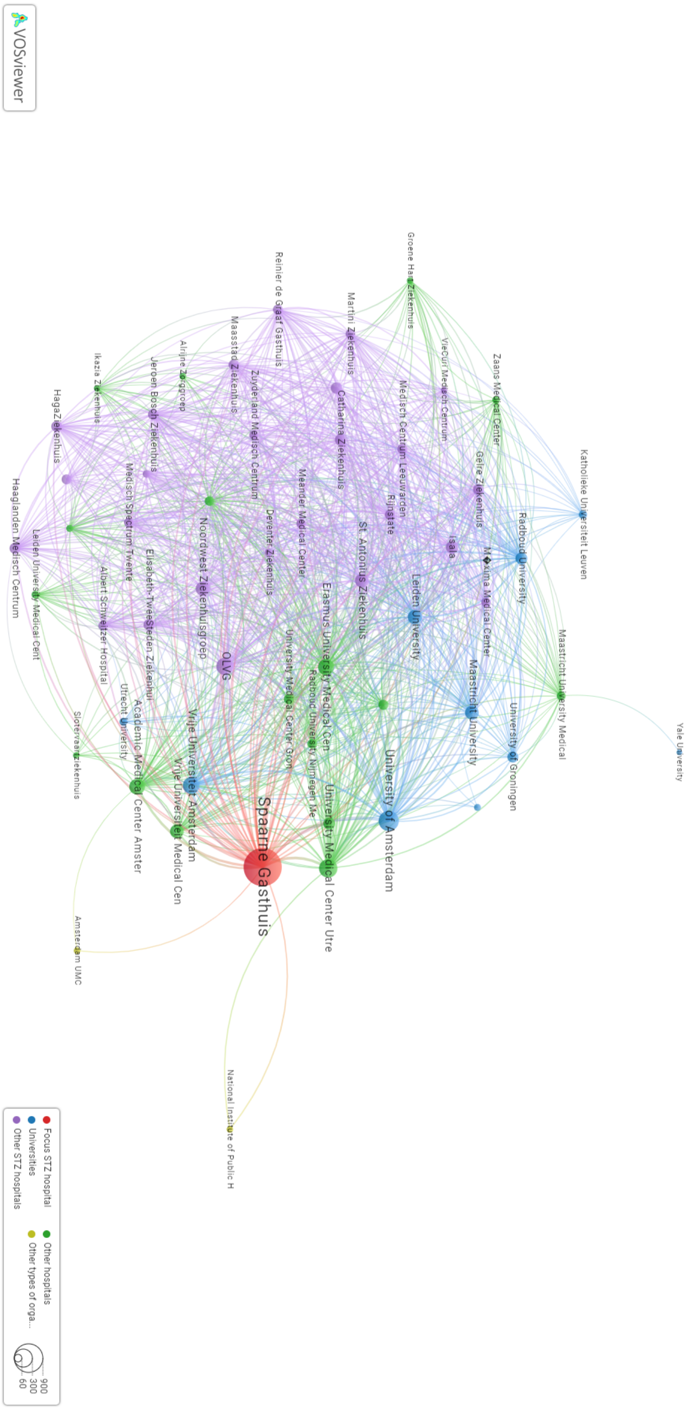


Figure 5.23.2: Co-author network Spaarne Gasthuis with partners co-authoring in at least 2% of the output

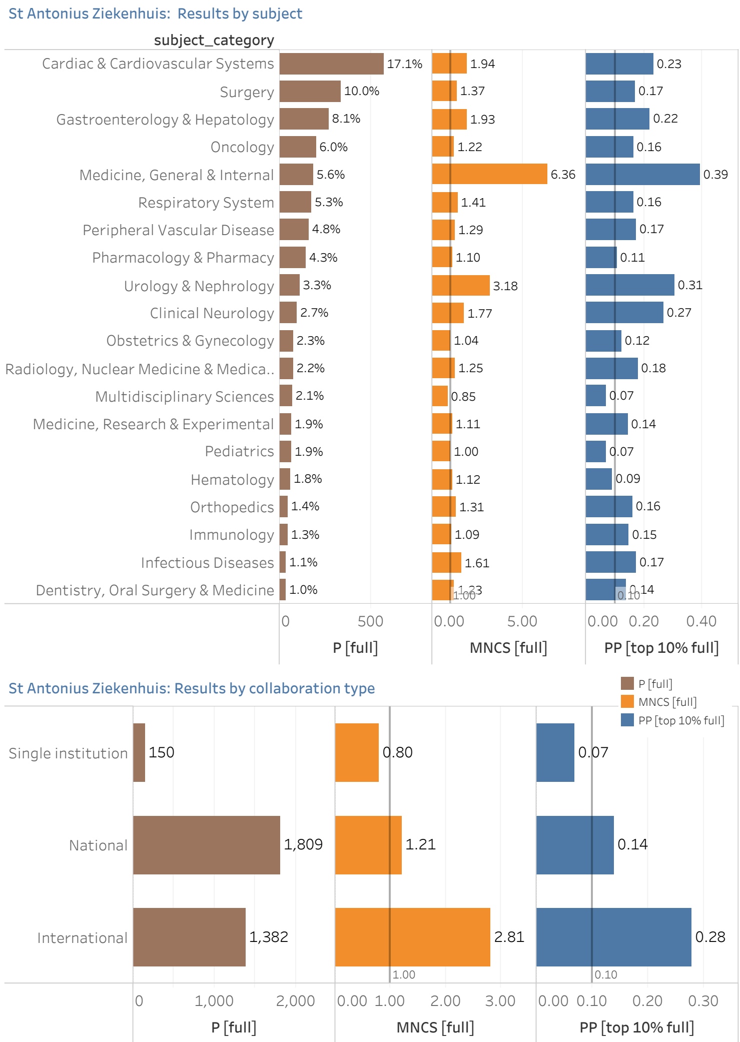
Interactive VOSviewer network at https://tinyurl.com/2bjngq3m

5.24 St. Antonius Ziekenhuis (ANTO)

Table 5.24.1: Stats St. Antonius Ziekenhuis

Indicator	2013-2017	2018-2022	Total
P [full]	1,373	1,968	3,341
PP [OA]	0.55	0.77	0.68
PP [top 10% full]	0.20	0.19	0.19
MNCS [full]	1.86	1.85	1.85
MNJS [full]	1.67	1.69	1.68

Figure 5.24.1: Research and collaboration profile St. Antonius Ziekenhuis



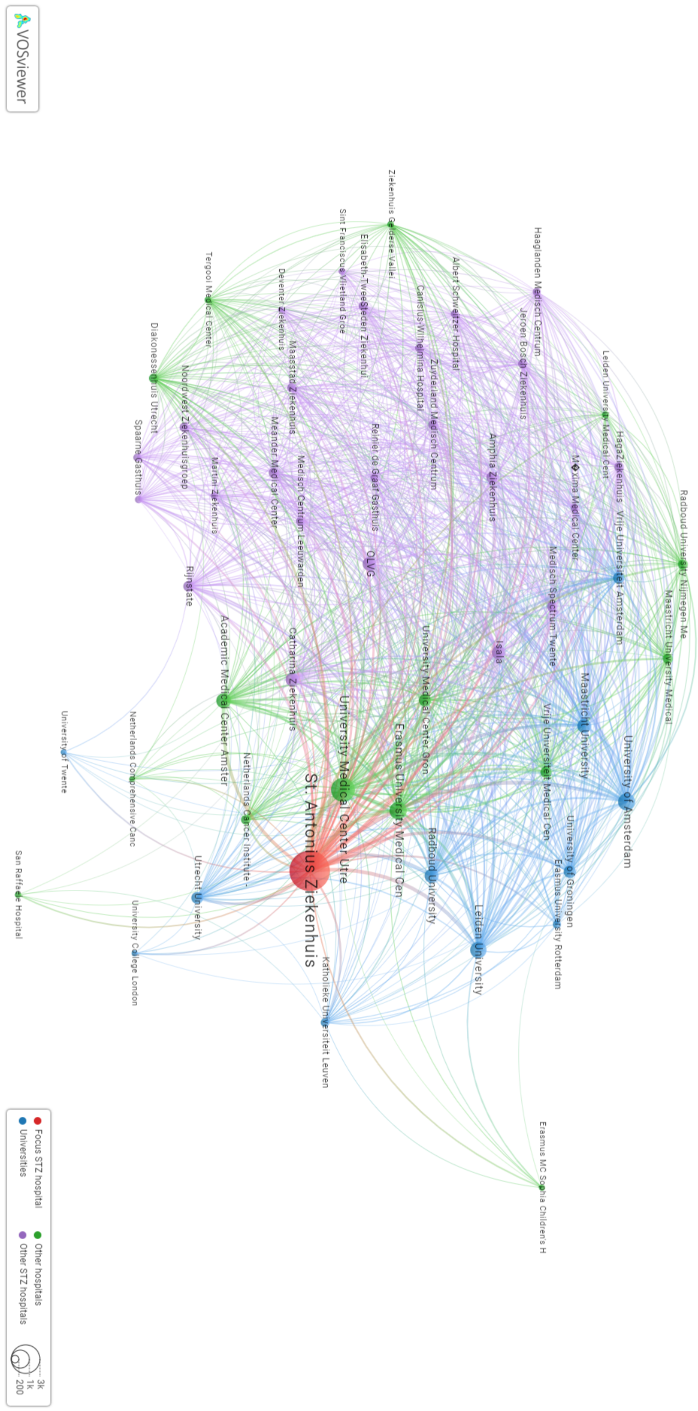


Figure 5.24.2: Co-author network St. Antonius Ziekenhuis with partners co-authoring in at least 2% of the output

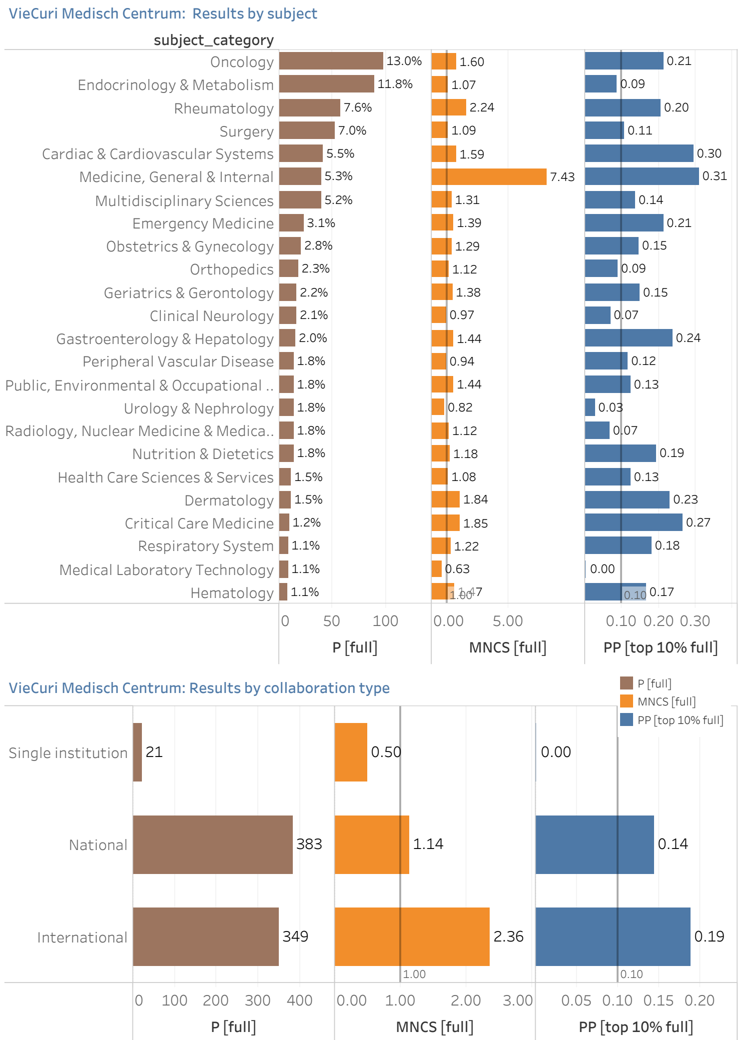
Interactive VOSviewer network at https://tinyurl.com/22znpqrv

5.25 **VieCuri Medisch Centrum (VIEC)**

Table 5.25.1: Stats VieCuri Medisch Centrum

Indicator	2013-2017	2018-2022	Total
P [full]	303	450	753
PP [OA]	0.65	0.83	0.76
PP [top 10% full]	0.15	0.17	0.16
MNCS [full]	1.92	1.53	1.69
MNJS [full]	1.83	1.61	1.70

Figure 5.25.1: Research and collaboration profile VieCuri Medisch Centrum



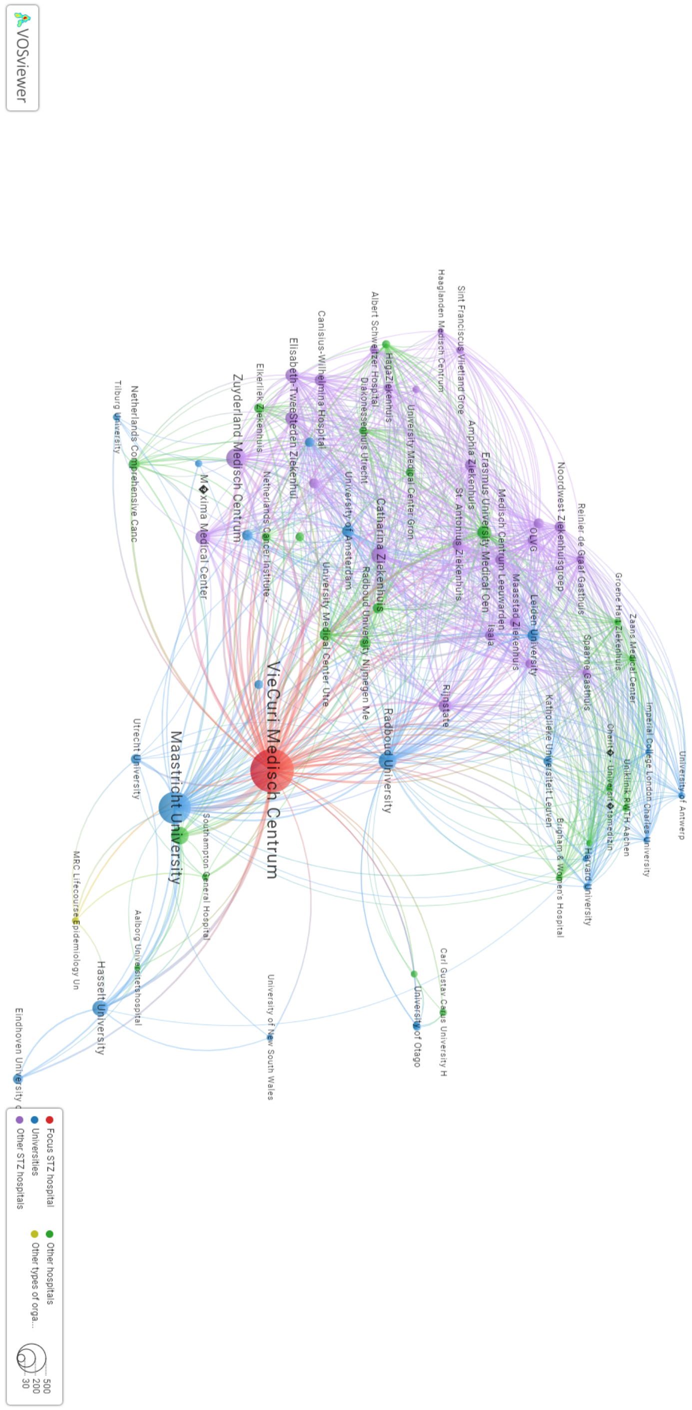


Figure 5.25.2: Co-author network VieCuri Medisch Centrum with partners co-authoring in at least 2% of the output

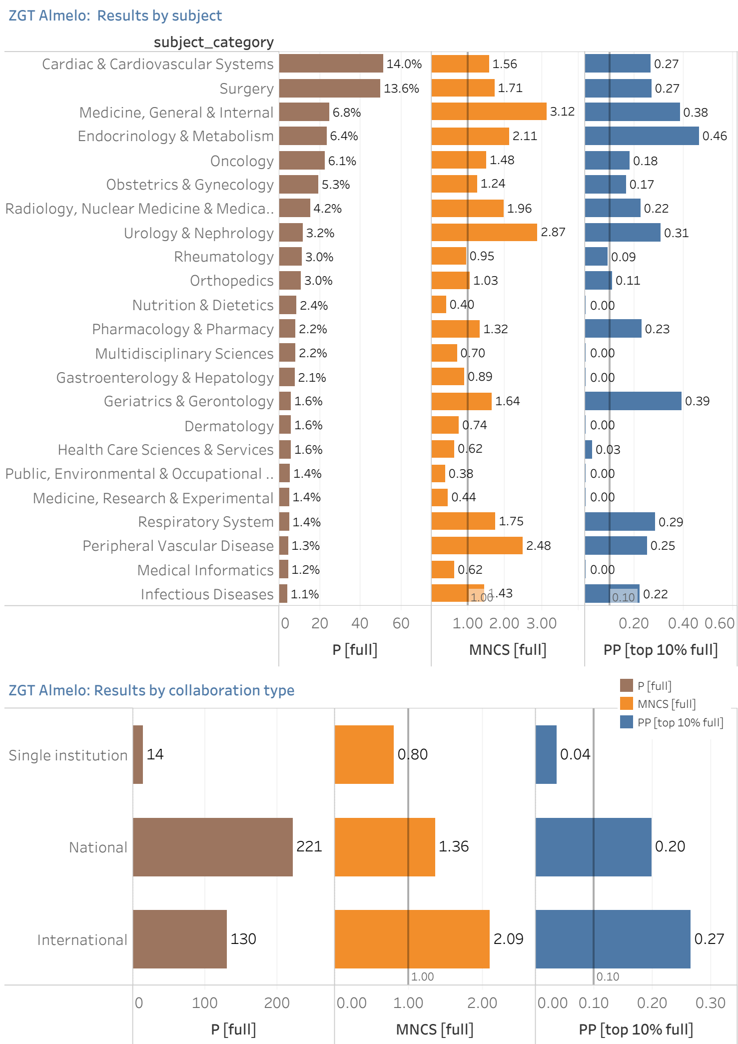
Interactive VOSviewer network at https://tinyurl.com/27ezfc8e

5.26 Ziekenhuis Groep Twente (ZGT)

Table 5.26.1: Stats Ziekenhuis Groep Twente

Indicator	2013-2017	2018-2022	Total
P [full]	138	227	365
PP [OA]	0.61	0.83	0.75
PP [top 10% full]	0.09	0.19	0.15
MNCS [full]	1.54	1.64	1.60
MNJS [full]	1.42	1.60	1.54

Figure 5.26.1: Research and collaboration profile Ziekenhuis Groep Twente



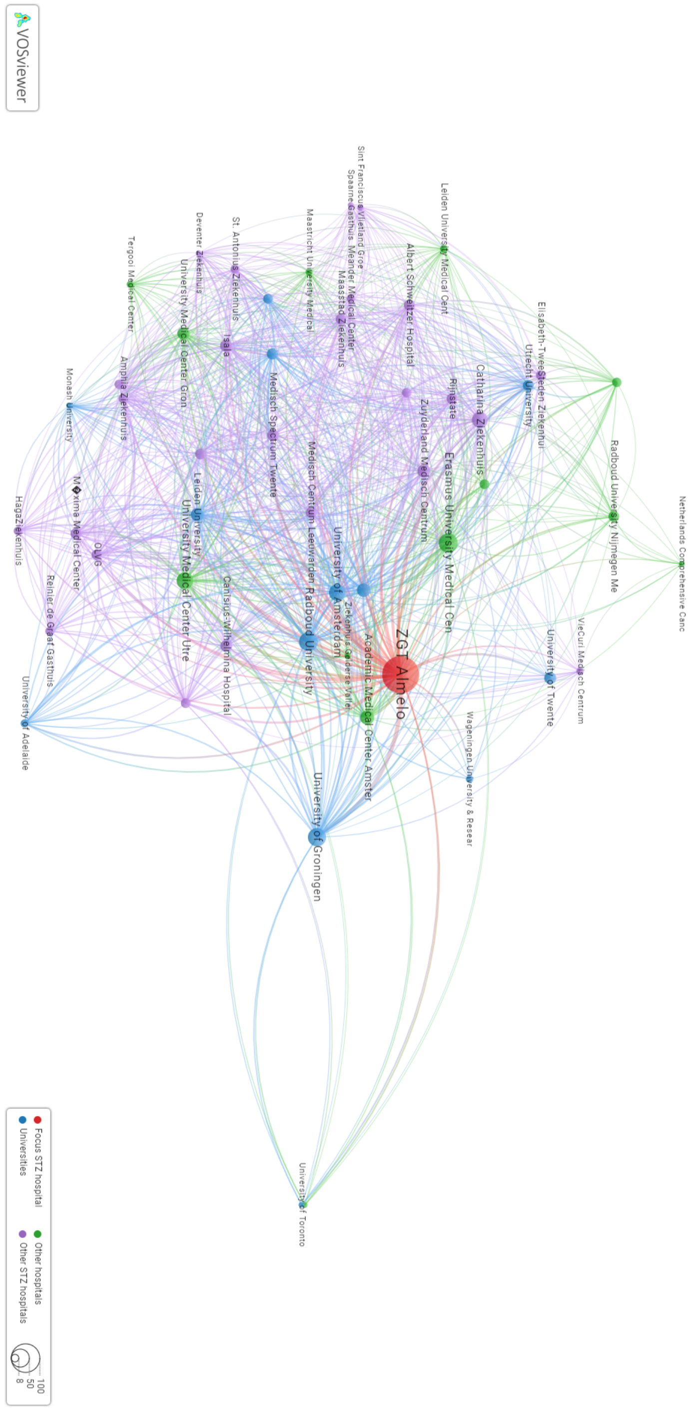


Figure 5.26.2: Co-author network Ziekenhuis Groep Twente with partners co-authoring in at least 2% of the output

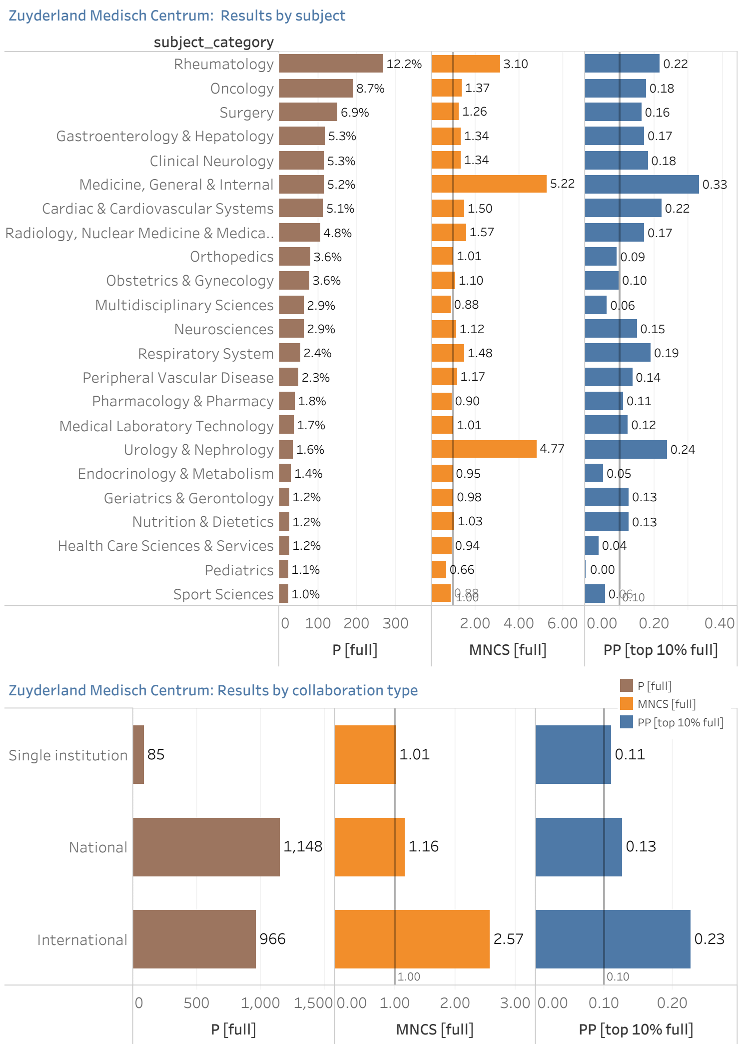
Interactive VOSviewer network at https://tinyurl.com/22ra7dr2

5.27 **Zuyderland Medisch Centrum (ZUYD)**

Table 5.27.1: Stats Zuyderland Medisch Centrum

Indicator	2013-2017	2018-2022	Total
P [full]	866	1,333	2,199
PP [OA]	0.58	0.80	0.71
PP [top 10% full]	0.17	0.17	0.17
MNCS [full]	2.04	1.60	1.77
MNJS [full]	1.69	1.50	1.58

Figure 5.27.1: Research and collaboration profile Zuyderland Medisch Centrum



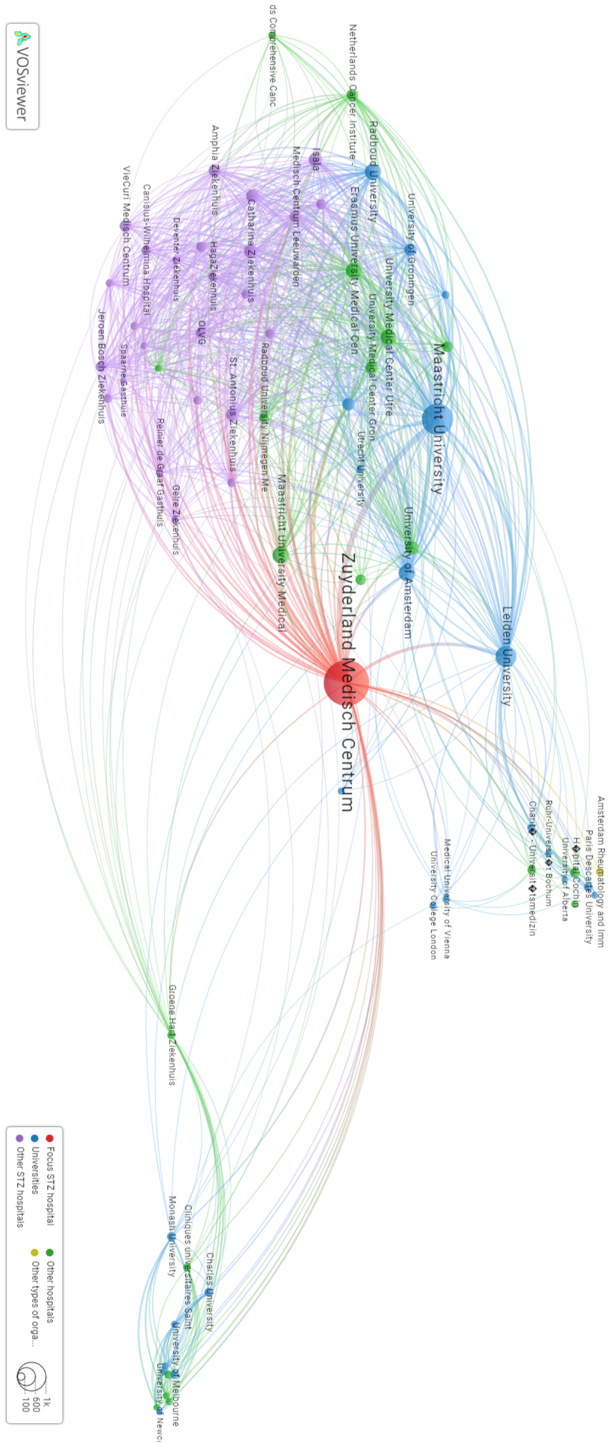


Figure 5.27.2: Co-author network Zuyderland Medisch Centrum with partners co-authoring in at least 2% of the output

Interactive VOSviewer network at https://tinyurl.com/2a8xv8kb

References

Javier Ruiz-Castillo and Ludo Waltman. Field-normalized citation impact indicators using algorithmically constructed classification systems of science. *Journal of Informetrics*, 9(1):102–117, January 2015. ISSN 17511577. doi: 10.1016/j.joi.2014.11.010. URL https://linkinghub.elsevier.com/retrieve/pii/S1751157714001126.

Ludo Waltman and Nees Jan van Eck. A new methodology for constructing a publication-level classification system of science. *Journal of the American Society for Information Science and Technology*, 63(12):2378–2392, December 2012. ISSN 15322882. doi: 10.1002/asi.22748. URL http://doi.wiley.com/10.1002/asi.22748.

Ludo Waltman, Clara Calero-Medina, Joost Kosten, Ed C. M. Noyons, Robert J. W. Tijssen, Nees Jan van Eck, Thed N. van Leeuwen, Anthony F. J. van Raan, Martijn S. Visser, and Paul Wouters. The Leiden ranking 2011/2012: Data collection, indicators, and interpretation. *Journal of the American Society for Information Science and Technology*, 63(12):2419–2432, December 2012. ISSN 1532-2890. doi: 10.1002/asi.22708. URL https://onlinelibrary.wiley.com/doi/abs/10.1002/asi.22708.

Annexes

A Methodology in more detail

In this annex we provide more detail about the methodology developed at CWTS and applied in this study.

A.1 Database Structure

At CWTS, we calculate bibliometric indicators based on an in-house version of the Web of Science (WoS) online database, which will be referred to as the CI-system. The WoS is a bibliographic database that covers publications of about 12,000 journals and each of these journals is assigned to one or more Journal Subject Categories (JSC). Each publication in the CI-system has a document type. The most frequently occurring document types are 'articles', 'reviews', 'proceeding papers', 'corrections', 'editorial material', 'letters', 'meeting abstracts' and 'news items'. In this report, we only consider document types 'articles', 'reviews' and 'proceedings papers'. In limiting the analysis to these three types of publications, we consider that these documents reflect most of the original scientific output in a field.

The CI-system is an improved and enhanced version of the WoS database versions of the Science Citation Index (SCI), Social Science Citation Index (SSCI), and Arts & Humanities Citation Index (A&HCI). The CI-system implements a publication-based field classification which clusters publications into research areas based solely on citation relations (Waltman and van Eck, 2012) (more detail in Annex B). One important advantage of this publication-level classification system is that it allows for a taxonomy of science that is more detailed and better matches the current structure of scientific research. This not only reduces classification bias but is also essential for calculating field-normalised indicators (Ruiz-Castillo and Waltman, 2015).

Moreover, in this study we include citation data up to 2023. Please note that publications require at least one full year to receive citations in order to make robust calculations of citation impact indicators. For this reason, we will work with publication output up to and including 2022, counting citations up to and including 2023. For each publication (and its benchmark publications), we consider 4 years of citations since the year of publication. For a publication from 2018, for instance , we count citations in the years 2018-2022.

A.2 Citation Window, Counting Method and Field Normalisation

Citation window

Several indicators are available for measuring the average scientific impact of the publications of a research unit. These indicators are all based on the idea of counting the number of times the publications of a unit have been cited. Citations can be counted using either a fixed-length citation window or a variable-length citation window. In the case of a fixed-length citation window, only citations received within a fixed time period (e.g. four years fixed window) are counted. The main advantage of a fixed-length citation window is that it is possible to meaningfully analyse the trend patterns of the non-normalised impact indicators, setting the same criteria for all publications included. A variable-length window, on the other hand, uses all the citations that are available in the database until a fixed point in time, which not only yields higher citation counts (depending on the window length), but also more robust impact measurements. When using a variable-length citation window, impact indicators such as the average impact (MCS) and the total impact score (TCS) may systematically present a decreasing pattern.

In this study, we use a fixed-length window of 4 year (if available) for the overall period of the analysis (2013-2022). The most recent year for receiving citations is 2023.

Self-citations

In the calculation of advanced citation impact indicators, we disregard self-citations. A citation is considered a self-citation if the cited publication and the citing publication have at least one author (i.e. last name and initials) in common. The main reason for excluding self-citations is that they often have a different purpose from ordinary citations. Specifically, self-citations may indicate how different publications of a researcher build on one another, or they may serve as a mechanism for self-promotion rather than for indicating relevant related work. Self-promotion can in turn be used to manipulate the impact of a publication in terms of the number of citations received. Excluding self-citations from the analysis effectively reduces the sensitivity of impact indicators to potential manipulation. In doing so, impact indicators can be interpreted as the impact of researchers' work on other members of the scientific community rather than on his or her own work.

Field Normalisation

There can be quite large differences in citation practices in different scientific fields. Field normalisation is about correcting for differences in citation practices between different scientific fields. The goal of field normalisation is to develop citation-based indicators that allow for valid between-field (and year) comparisons.

In this report, we will use our in-house publication-based classification system of science to define the scientific fields that are used in this normalisation process. This system has three major advantages compared to the conventional journal-based classification systems of science: Web of Science Journal Subject Categories:

- Proper granularity in terms of fields.

- Fields are defined at the level of publications citing each other, not on allocating complete journals to field(s) where inaccuracies are introduced.

- Publications from journals like Nature, Science, PLoS ONE (multidisciplinary journals) are allocated to the field they actually belong to and not to the artificial journal field 'Multidisciplinary Sciences'.

The reasons to use this publication-based classification are furthered explained in Annex B.

Counting method

Counting methods are about the way in which co-authored publications are handled. For instance, if a publication is co-authored by researchers from two countries, should the publication be counted as a full publication for each country or should it be counted as half a publication for each of them? In this study, we use both full and fractional counting. Full counting means that if a publication is co-authored by multiple organisations, that publication counts multiple times, once for every organisation, regardless of the weight of their contribution. In this report, we use mainly the full counted publications for output and fractionalised (by number of institutions/ organisations involved) for impact measures.

B Publication level classification

The CWTS citation database is a bibliometric version of Web of Science (WoS). One of the special features of this database is the publication-based classification. This classification is an alternative to the WoS journal classification, the WoS subject categories. The reason to have this publication-based classification are the problems we encounter using the journal classification for particular purposes. We discern the following as the most prominent ones.

B.1 Journal scope (including multi-disciplinary journals)

A journal classification introduces sets of journals to represents a class, in this case a subject category. This implies that journals have a similar scope. They do not need to be comparable with regard to volume (number of articles per year) but they should represent a similar specialisation. This is not the case, of course. Journals represent a very broad spectrum. There are very specialist journals (e.g., Scientometrics) and very general ones (e.g., Nature or Science but also British Medical Journal). The classification scheme can therefore not be very specialised. In WoS, a subject category Multi-disciplinary hosts the very general ones so that a bibliometric analysis of, for instance, the Social Sciences or Nanotechnology, using this classification, will not take papers in Nature into consideration.

B.2 Granularity of the WoS subject categories

The WoS journal classification scheme contains 255 elements. As such it is a stable system. In many cases however, it appears that these 255 subject categories are insufficient to be used for proper field analyses. The problem is that the granularity of the system looks somewhat arbitrary. 'Biochemistry & Molecular Biology' on the one hand and 'Ornithology' on the other, for instance, represent rather different aggregates of research. This is illustrated by the number of journals in each of them. Where the 'Biochemistry & Molecular Biology' category contains almost 500 journals, 'Ornithology' has only 27. We acknowledge that there is no perfect granularity, but we argue that in the WoS subject categories the differences are really too big. A classification based on more objective grounds does not solve this problem but is at least transparent.

B.3 Multiple assignment of journals to categories

In journal classifications from multi-disciplinary databases, journals are assigned to more than one category. Journals often have broader scopes than the categories allow. Also here there are large differences between categories. In the example we used before, 'Biochemistry & Molecular Biology,' journals are on average assigned to almost 2 categories. This means that (on average) each journal in this category is also assigned to one other category. For the more specialist category of 'Ornithology', the average is 1. This means that in this category all journals are assigned to this category only. If publications in journals with a multiple assignment would always cover the categories at stake, this should not necessarily be a problem. However, it mostly means that such journals structurally contain publications from the different categories. Therefore, publications may be assigned to two categories although they belong to just one of them.

B.4 The CWTS publication-based classification scheme

CWTS has developed an advanced alternative for the Web of Science journal classification. It counters three major issues:

1. Journal scope (including multi-disciplinary journals)
2. Granularity of the WoS subject categories
3. Multiple assignment of journals to categories

The CWTS publication-based classification is developed as described in Waltman and van Eck (2012). Since the first version there have been yearly updates of the system. The main characteristics of the classification are as follows.

Publication to publication citation clustering

Clusters of publications are created on the basis of citations from one publication to another. Tens of millions of publications have been processed. The clusters contain publications from multiple years (2000–2023). Each publication is assigned to one cluster only at each level. A cluster is considered, and in many cases validated as, representative for disciplines, research areas, fields or sub-fields. For each cluster, we can calculate growth indices pointing at changing research focus over time.

Multi-level clustering

The classification scheme has at present three different levels. The clusters are hierarchically organised. Currently we discern the following levels.

1. A top level of 25 clusters (fields)
2. A second level of around 800 clusters (sub-fields)
3. A third level of more than 4,000 clusters (research areas or micro-fields)

A common way of visualising the landscape of science by the publication clusters is a 2-dimensional map. In such a landscape (see B.4.1), we position publication clusters in relation to each other on the basis of citation traffic. The denser the traffic between two clusters, the closer they are. The two dimensions do not represent anything. The only thing that matters is the distance. Furthermore, the size of a cluster represents the relative volume (number of publications included), while the color coding adds a main clustering labeled by main disciplines.

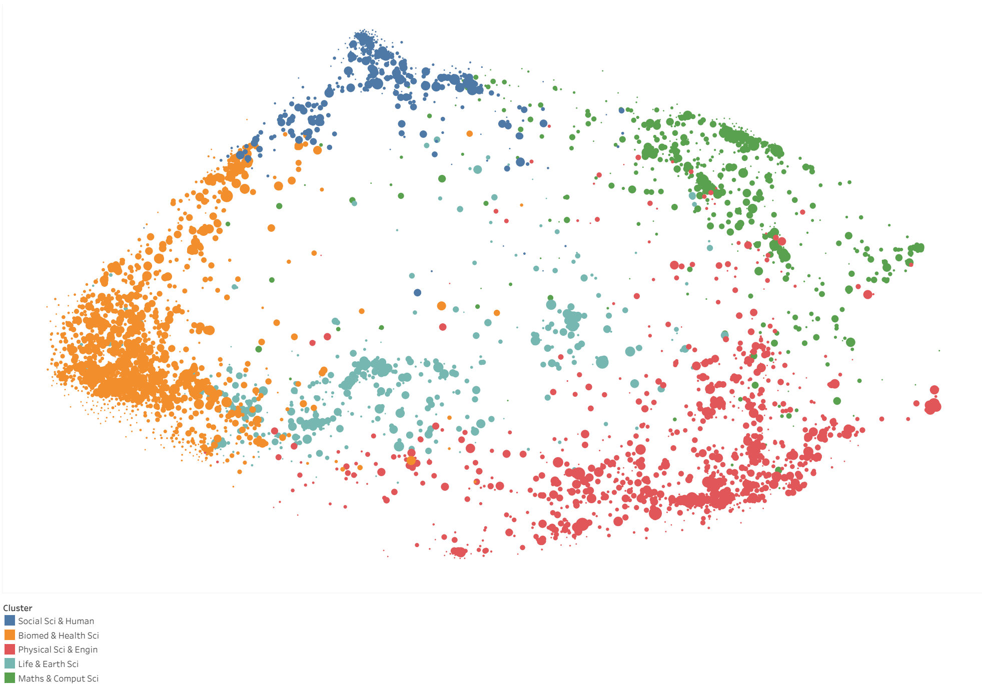


Figure B.4.1: Landscape of all science (WoS publications). Circles represent (over 4,000) publication clusters. Position is defined by citation traffic between clusters. Size indicates relative volume. Color reflects 5 main disciplines