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Original Article

Research and collaboration overview of Institut Pasteur International Network: a bibliometric approach toward research funding decisions

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Abstract

Background: Institut Pasteur International Network (IPIN), which includes 32 research institutes around the world, is a network of research and expertise to fight against infectious diseases. A scientometric approach was applied to describe research and collaboration activities of IPIN.

Methods: Publications were identified using a manual search of IPIN member addresses in Science Citation Index Expanded (SCIE) between 2006 and 2011. Total publications were then subcategorized by geographic regions. Several scientometric indicators and the H-index were employed to estimate the scientific production of each IPIN member. Subject and geographical overlay maps were also applied to visualize the network activities of the IPIN members.

Results: A total number of 12667 publications originated from IPIN members. Each author produced an average number of 2.18 papers and each publication received an average of 13.40 citations. European Pasteur Institutes had the largest amount of publications, authored papers, and H-index values. Biochemistry and molecular biology, microbiology, immunology and infectious diseases were the most important research topics, respectively. Geographic mapping of IPIN publications showed wide international collaboration among IPIN members around the world.

Conclusion: IPIN has strong ties with national and international authorities and organizations to investigate the current and future health issues. It is recommended to use scientometric and collaboration indicators as measures of research performance in IPIN future policies and investment decisions.

Keywords: International Cooperation, Scientometrics, Institut Pasteur, Organizational Policy

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Background

During the last few years, significant advances in controlling and preventing infectious diseases have resulted in notable developments on health promotion worldwide (e.g. new vaccines against chicken pox, meningitis, human papilloma virus, and rotavirus infectious and the imminent eradication of polio) (1–4). Due to the increased routine vaccination in immunization programs worldwide, childhood mortality has reduced with an estimated 7.50 million lives saved over the last ten years (5).

However, global emerging infectious diseases, outbreaks and old diseases rebound are increasingly threatening the public health around the world. Three of the top ten causes of death, or approximately 24% of all deaths made infectious diseases one of the most leading causes of mortality in low- and middle-income countries (6), where the most recent advances are often unavailable to the populations most in need (7).

There is a public interest concerning emerging infectious diseases requesting a global response of integrated control via the global work and collaboration in fighting against infectious diseases especially in countries where they emerge. Several global efforts have been made to prevent and control infectious diseases through capacity building, improvement of infrastructures and research collaboration (8,9). Institut Pasteur International Network already known as IPIN, since 1888, has been established to fight against infectious diseases by working directly in regions where the local disease management needed support. Now with 32 members around the world, IPIN provides a unique capacity for research and public health network collaboration to prevent and treat infectious diseases and promote the public health (10–13).

In recent years, bibliometrics have provided us numerous tools in research performance assessment of academic and research institutions as well as individual researchers. A great body of literature referred to bibliometric indicators as one of the most common tools of measuring research performance (4,14–19). Considering the impact IPIN research activities have on the global control and prevention of infectious diseases, promoting research policies and assessing their research performance would be of great value. Therefore, this study was undertaken to reach an overview of IPIN research and collaboration activities by describing the production of scientific articles, defining the main subject areas, and comparing the collaboration and scientific production of IPIN members using a bibliometric

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approach. These findings can assist IPIN administrators and stakeholders in allocating funds, benchmarking and accomplishing their missions.

Methods

Scientometric analysis

This study was designed based on Science Citation Index Expanded (SCIE) members' scientific publications in scholarly journals. An SCIE search was performed in June 2012. Filters were used to include IPIN members' relevant publications using organization enhanced panel. Articles published between 2006 and 2011 were obtained by scanning their address field (with at least one author affiliated to an IPIN member), under the heading "Pasteur". This review resulted in publications originating from the IPIN members, and then each article was subcategorized by geographic regions (based on World Health Organization (WHO) regions). Absolute Number of Articles (ANA), Total Number of Citations (TNC), Citation to any Papers (CP), Average number of Authors per Papers (AAP), Average number of Papers to Author (APA), and the H-index were used to estimate the scientific production of each IPIN member. A comparison of IPIN members was presented based on the above-mentioned indicators. IPIN includes institutions from five continents. However, in this study, all IPIN members were sub–classified into geographical regions based on WHO classification to increase the efficacy of IPIN ranking and to better describe the position of each Institute in the region.

International collaboration

The publications of IPIN were separately retrieved according to the name of the institute and research areas. Data were analyzed using ISI.exe (20,21) in the first step and Cities1.exe (21) afterwards. The retrieved addresses of the Pasteur Institutes and other collaborating organizations were extracted using GPS visualizer (22) and as a result, the precise addresses of the cities and institutes were identified (21). Using Pajek software (23), the output of this file was then demonstrated in the form of a figure representing special fields with the most frequently studied topics among IPIN members. In addition, Google Maps and its facilities were applied to reflect the geographic mapping of the collaborative scientific networks according to their dominant fields of activity. VOSviewer was also used to visualize the network map of IPIN international collaboration (24).

Webometric analysis

In order to compare the webometric indicators of the network members in 2012, the activity and impact indicators of the web were applied (25). To reach this goal, the status of the Pasteur Institutes websites were assessed via link analysis according to the standard criteria of webometrics, Impact (backlinks and referring domains), Size of website and the number of rich files (the number of documents which are indexed with the website address of the Pasteur Institutes in Google Scholar and SCImago SIR) (26). In this study, the Pasteur Institutes were compared according to the activity, impact indicator, and the main webometric indicators (a combination of activity and impact indicators). According to the methodology of the world webometric ranking, the composite indicator was built for any institute based on impact (50%) and activity (50%). Table 1 provides more details on the weighting criteria and composites of webometric indicators.

Statistical Tests

All tests were conducted using SPSS 16 (SPSS Inc., Chicago, IL, USA). Pearson correlation analysis and one-way analysis of variance (ANOVA) test were used for further analysis. P-value less than 0.05 was considered statistically significant.

Results

In this study, the research and network activities of 32 research institute belonging to IPIN were compared. Europe had the largest number of Pasteur Institutes (eight members) in IPIN. Having the Institut Pasteur of Paris as the oldest one (founded in 1887), the Institut Pasteur of Laos (founded in 2007), Uruguay and China (both founded in 2004), and South Korea (founded in 2003) were regarded as the most recent established institute. The eastern Mediterranean Pasteur Institutes (with the mean age of 105 years) were the oldest, while the South-east Asian and western Pacific members (with the mean age of 33 years) were the youngest in IPIN (P= 0.004).

IPIN publication patterns

A total number of 12667 publications, originated from IPIN members, were identified between 2006 and 2011. The number of contributing authors was 5820. Each author produced the average number of 2.18 papers. Also, they received an average of 13.4 citations in SCIE. Top TNC and H-indexes belonged to the Pasteur Institutes of Paris and Lille, while the top rank

Table 1. The indicators and weighting rate in ranking the universities and research organizations around the word, using webometric indicators

	Indicator	Meaning	Source	Weight
Impact	Visibility Backlinks	Number of external inlinks (backlinks)	Majestic SEO	BL*RD 50%
	Visibility Referred Domains	Number of Domains Originating the backlinks		
Activity	Size	Number of webpages excluding rich files	Google	10%
	Rich files	Number of documents (pdf, doc, docx, ppt, pptx, ps, eps)		10%
	Scholar	Number of papers Google Scholar (2007–2011)	Google Scholar	30%
		Number of papers SCImago (2003–2010)	SCImago IR	

Available from: http://www.webometrics.info/methodology.html

in APA belonged to the Pasteur Institute of Iran and South Korea. The H-index of the Institut Pasteur of Paris—as the scientific pioneer of this network—was 111 and the authors of this institute had published 6199 articles over the study period (Table 2).

During this period, the largest number of scientometric indicators belonged to the European Pasteur Institutes, followed by eastern Mediterranean members. The European Pasteur Institutes had the largest amount of publications (9126), authored papers (4079) and achieved high H-index values (39.13) (Table 3). Pearson correlation analysis revealed no statistically significant relationship among age, H-index and CP. However, the same analysis showed a significant correlation among the number of authors in IPIN and ANA (P=0.0001), citations (P=0.0001), and H-index (P=0.014).

Biochemistry and molecular biology (15.76%), microbiology (14.64%), immunology (14.42%), and infectious diseases (11.36) were the main subject areas of IPIN's interest. Figure 1 indicates the IPIN scientific production according to Web of Science Subject Categories. With that in mind, all IPIN productions have been clustered in 19 categories, in which biomedical sciences, infectious diseases, material sciences and clinical medicine are the most distinctive categories. Hot points are referred to the most productive subject categories.

International collaboration

IPIN members have collaborated with 726 non-pasteurian institutes around the world. The European IPIN members had the largest amount of collaboration among IPIN members (Figure 2 and Figure 3). The overall collaboration followed a similar pattern in main subject areas. Biochemistry and immunology collaboration patterns were more similar in international connections among European and American institutions; however, collaboration among Asian and European countries were more significant in microbiology. Infectious diseases revealed broader and wider connections across the globe rather than others. It seemed that European institutions received more connections and were major parts of international collaboration among different subject categories. However, these connections were more distinct between American and European institutions. Figure 3 indicates the overall collaboration of IPIN members according to their number of co-authorship links.

Webometric analysis

All IPIN members had an independent website, except Laos. Amongst the rest of the Pasteur Institutes, the highest impact indicators belonged to the Pasteur Institutes of Paris, Lille, and Iran, while the highest activity indicators belonged to the Pasteur Institutes of Paris, South Korea and Belgium. The highest ranking according to the total score of webometric indicators was given to the Institut Pasteur of Paris, Lille and Iran (Table 2). Pearson correlation analysis showed a positive significant relationship among the Pasteur Institutes around the world regarding activity and impact indicators (P= 0.05, r= 0.44). Moreover, Pearson correlation analysis also showed a positive significant relationship between the total score of webometrics and the indicators including the total number of articles (P= 0.01, r= 0.57), the number of citations (P= 0.01, r= 0.55), and the H-Index (P= 0.01, r= 0.63).

Comparing the webometric indicators among different geographic areas revealed that the European Pasteur Institutes were the pioneer in their activities and impact indicators in websites, followed by the Asian Pasteur Institutes. The lowest level of these indicators belonged to the African Pasteur Institutes (Table 3). However, no statistically significant differences was observed among geographical regions.

Discussion

This study demonstrated the unique role of IPIN European members in research and network activities according to scientometric and webometric indicators. Major themes of this work is represented and highlighted with a conclusion in the following sections.

IPIN's publication patterns

The findings of this study indicated that the European members especially Paris, Lille, and Greece were the most considerable institutes which have been demonstrated to be an important production source of scientific publication, because of their developments in basic and applied research (4).

African members obtained lower ranks in IPIN research activities that might be due to their shortcomings, language and the lower quantity and quality of their articles (27,28). In terms of rank, the European Pasteur Institutes were placed in the first rank, followed by the Pasteur Institutes of Vietnam, Iran, Tunisia and South Korea.

Although in this study the highest scientometric indicators belonged to the European members, the average number of these indicators was not significantly different between European and non-European Institutes. This fact can be simply explained by the lower rank of the Pasteur Institutes in Eastern Europe (Bulgaria, Russia, and Romania) compared to those in the central and Western Europe (France (Lille), Greece, Italy, and Belgium).

Interestingly, there were notable similarities between the findings of the previous studies and our findings considering the number of affiliated authors as a major determinant of the scientific output indicators regardless of history (29). Eastern Mediterranean region is one of the most leading sites of IPIN in terms of research activities, placed after European members in higher ranks of studied indicators. It seems that Iran, Tunis, and Morocco have a remarkable place among IPIN non-European members. These institutions are considered as the old members of the network. Among these, Iran is the only institute located in Asia according to the Iranian Ministry of Health's annual reports. Pasteur Institute of Iran is one of the most productive research institutes in the country. It is the only research institution in the country which is ranked among universities (30). With that in mind, Pasteur Institute of Iran is one of the most influential and productive institutions in national and regional perspectives.

Institut Pasteur of Paris was the most considerable member in IPIN for its international achievements and scientometric indicators possibly due to its larger number of authors.

IPIN's international collaboration

Geographical mapping of IPIN scientific collaboration in major research areas signified a rather similar trend of collaboration among the members. Despite the differences in IPIN research and network activities, collaboration were typically formed between the European members based on their relative

Table 2. Description of Pasteur Institutes and their ranking according to the Scientometrics and Webometrics in SCIE

	Region	Country	Established year	Number of authors	Number of papers	Number of citations	Citation per paper	H-Index	Paper per author	Scientometrics Rank by				Webometric Rank by				Website address
										Total papers	Total citations	Citation per paper	H-Index	Paper per Author	Impact	Activity	Total indicators	
1	Europe	France (Paris)	1887	2535	6199	97876	15.8	111	2.45	1	1	5	1	6	1	1	1	www.pasteur.fr
2		France (Lille)	1894	572	1511	35071	23.2	76	2.64	2	2	1	2	4	2	6	2	www.pasteur-lille.fr
3		Greece	1919	256	517	7618	14.7	40	2.02	5	3	6	3	9	7	20	7	www.pasteur.gr
4		Italy	1956	470	611	6610	10.8	36	1.30	4	5	13	5	23	19	19	19	www.istitutopasteur.it
5		Belgium	1897	36	62	1435	23.1	21	1.72	19	11	2	10	12	4	3	4	www.wiv-isp.be
6		Bulgaria	1947	97	136	486	3.4	11	1.40	11	23	29	24	19	25	8	24	www.microbio.bas.bg
7		Russia	1923	17	43	287	6.7	11	2.53	27	26	21	23	5	29	28	29	www. pasteurorg.ru
8		Romania	1921	96	47	217	4.6	7	0.49	23	28	26	28	30	6	15	6	www.cantacuzino.ro
9	South-east Asia and Western Pacific	Cambodia	1995	104	193	1898	9.8	24	1.86	8	9	14	7	11	10	13	10	www.pasteur-kh.org
10		South Korea	2003	25	122	2060	16.9	22	4.88	12	8	4	9	2	15	2	15	www.ip-korea.org
11		Hong Kong	1999	26	83	1193	14.4	19	3.19	17	12	8	11	3	28	17	27	www.hkupasteur.hku.hk
12		New Caledonia	1955	39	52	348	6.7	10	1.33	22	25	20	26	20	16	18	16	www.institutpasteur.nc
13		China	2004	115	110	591	5.4	12	0.96	14	20	25	21	27	27	10	25	www.shanghaipasteur.cas.cn
14		Vietnam*	1891	245	367	6617	18.0	36	1.50	7	4	3	4	17	5	12	5	www.pasteur-hcm.org.vn
15		Laos	2007	7	4	1	0.25	1	0.57	30	30	30	30	29	-	-	-	No website found
16	Eastern Mediterranean	Iran	1920	124	1149	4419	3.8	26	9.27	3	6	27	6	1	3	4	3	www.pasteur.ac.ir
17		Morocco	1910	59	92	1015	11.0	16	1.56	16	14	12	15	16	12	29	12	www.pasteur.ma
18		Tunisia	1893	325	423	2978	7.0	24	1.30	6	7	19	8	22	20	11	20	www.pasteur.tn
19	Africa	Algeria	1894	56	45	657	14.6	12	0.80	25	18	7	19	28	18	21	18	www.pasteur.dz
20		Cameroun	1959	56	95	601	6.3	13	1.70	15	19	22	18	14	21	23	21	www.pasteur-yaounde.org
21		Central African Republic	1961	43	62	521	8.4	12	1.44	20	22	16	20	18	23	27	28	www.pasteur-bangui.org
22		Cote Ivoire	1972	34	37	135	3.6	6	1.09	29	29	28	29	25	11	24	11	www.Abc.ci
23		Madagascar	1898	129	148	1086	7.3	15	1.15	10	13	18	16	24	9	9	9	www.pasteur.mg
24		Nigeria	1978	25	39	237	6.1	8	1.56	28	27	24	27	15	22	25	22	www.cermes.net
25		Senegal	1923	93	190	1520	8.0	19	2.04	9	10	17	12	8	14	22	14	www.pasteur.sn
26	America	Canada	1938	72	75	1003	13.4	18	1.04	18	15	9	13	26	24	7	23	www.iaf.inrs.ca
27		Guadeloupe	1948	20	44	404	9.2	11	2.20	26	24	15	22	7	17	26	17	www.pasteur-guadeloupe.fr
28		Guyane	1940	31	61	720	11.8	17	1.97	21	16	11	14	10	13	14	13	www.pasteur-cayenne.fr
29		Uruguay	2004	86	112	699	6.2	15	1.30	13	17	23	17	21	8	5	8	www.pasteur.edu.uy
30		Brazil	1900	27	46	548	11.9	10	1.70	24	21	10	25	13	26	16	26	www.pasteur.saude.sp.gov.br
All Pasteur Institutes			1887	5820	12667	169260	13.4	-	-	-	-	-	-	-	-	-	-	-

*Numbers reported as Logarithmic values

Table 3. A comparison of the international network of the Pasteur Institutes according to scientometric and webometric indicators considering WHO geographical regions

Indicator Continent (Number of institutes)	Total papers	Total Citations	Total authors	Average Paper per author	Average Citation per paper	Average H-Index	Average Web Impact*	Average Web Activity*	Total average of Webometric Indicators*
Europe (8)	9126	149600	4079	2.24	16.39	39.13	7.73	3.10	7.70
Americas (5)	338	3374	236	1.43	9.98	14.20	4.60	2.40	4.60
Africa (7)	616	4757	436	1.41	7.72	12.14	4.30	1.70	4.30
Eastern Mediterranean (3)	1664	8412	508	3.28	5.06	22.00	6.09	2.91	6.90
South-east Asia and Western Pacific (7)	931	12708	561	1.66	13.65	17.71	4.90	2.70	4.90

*Numbers reported as Logarithmic values.

geographical proximity. This could be due to many factors. For example, researchers may be more interested in forming scientific collaboration with their colleagues from nearby countries, because they may encounter each other at regional conferences more often. Besides it may be easier to collaborate with researchers sharing the same language or culture (31). European Union's policies in improving the scientific collaboration among European members may be another reason (32).

It seems that Europe, northern America, South-east Asia and western Pacific are to some extent the most collaborative regions in the world. All Pasteur institutes around the world are more likely to collaborate with European members specially Institut Pasteur of Paris as a core element in the network, forming a centralized network. Preliminary studies have indicated several reasons for international collaboration among different countries. In this regard, sharing knowledge and transmitting information, access to resources and equipment, higher quality of the research, and sharing costs were identified as motivating factors (33,34). However, developments and the economic status of countries could make different patterns of collaboration across the world. Evidence showed that international collaboration of peripheral and developing countries is directed to attain knowledge and techniques from developed countries (33,35). Getting more citations and better prestige were mentioned as other encouraging reasons (33). Our findings revealed that except for infectious diseases, other subject domains indicated major connections between European, American, and Eastern Asian countries. Since countries located in South-east Asia are among developing and low-income countries, it could be understood that their connections were to get more knowledge and advanced equipment, as other developing countries. It was also noted that IPIN members revealed few connections within non-European members.

Thus, it is highly suggested that IPIN regional offices, play an important role in improving regional collaboration among nearby members, sustaining domestic capabilities and research expertise in the regions to foster regional reactions in the case of emergent conditions.

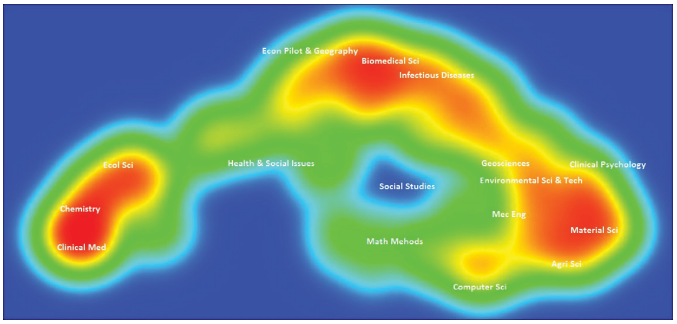

Figure 1. IPIN scientific production according to Web of Science subject categories using VOSviewer.

IPIN's citation patterns

Increasing scientific collaboration would lead to an increase in the scientific production and quality of publications. Therefore, citations to those articles would go up (32,36). That is why European institutions had the highest scientometric indicators besides the highest level of international collaboration.

As shown in Figure 1, the European Pasteur Institutes had significant collaboration with the developing IPIN members (particularly in Africa and Western Pacific). It could be simply explained by the need of African and Asian countries to the potential facilities and capabilities of the developed countries, and the policy of European countries in developing international collaboration. As the scientific and international collaboration of the European Union members with non-European countries was significantly increased in 2005 compared to 1997–1999 (37,38), the interest of some Asian countries to have more collaboration with Europeans have been mentioned by recent works. According to the National Science Foundation of America (NSF)'s report, international collaboration of Asian countries with non-Asian ones has annually increased by 11% over recent years, showing their inclination toward scientific collaboration with developed countries, particularly European ones (27). Increasing the scientific collaboration among countries is a progressive trend in science. Lack of expert human forces and resources, against the increasing need of conducting multidisciplinary and interdisciplinary research are the most important reasons (32,37,39).

Since IPIN members are united by the same Pasteurian culture, the same scientific rigor and the same values, it is expected to have closer scientific relationship with each other within the network. But this finding signified that IPIN members prefer to have close collaboration with European members, especially Paris, rather than having a wide range of connection through all IPIN members. Improving the scientific collaboration among IPIN members as well as non-Pasteurian institutes will improve the IPIN publications' impact. It also increases the quality of researches they conduct. More collaborative members of IPIN will receive much attention and impact from the scholar community, if IPIN administrations have a look on network

Figure 2. International collaboration patterns of IPIN papers in SCIE regarding the dominant research areas using Google Maps: The geographic maps belong to Biochemistry and Molecular Biology, and Microbiology, accordingly.

activities of their members as well as doing research.

IPIN is one of the most known research networks working on infectious diseases by producing vaccines, developing immunization programs, and having a broad impact on the public health promotion worldwide (12).

Conclusion

Having global collaboration, European Pasteur Institutes especially Institut Pasteur of Paris, Lille, and Greece were the most noticeable IPIN members. Eastern Mediterranean members including Pasteur Institutes of Iran, Tunis, and Morocco were after the European members. These members were considered as significant ones in the IPIN organization. Comparing Pasteur Institutes according to their highly valued parameters help the IPIN administrations modify their policies based on the best available evidence provided by scientometric indicators. Our findings recommended using scientometric and collaboration indicators as measures of research performance in IPIN future policies and investment decisions. Furthermore, establishing sub-regional networks and improving regional offices might serve better in the quality of regional collaboration among IPIN members and fulfilling the regional requirements as well.

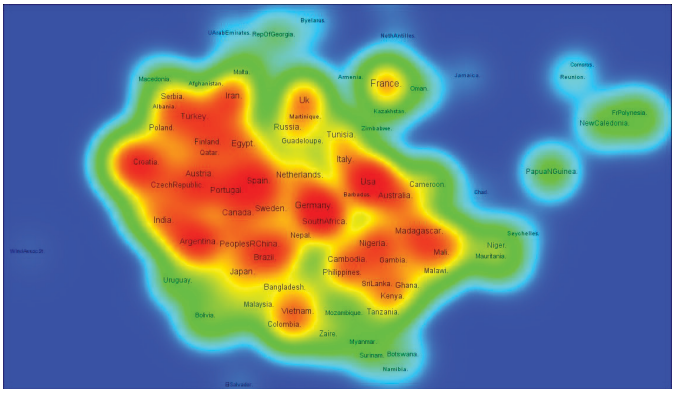

Figure 3. International collaboration of IPIN members based on the cosine-normalized network of co-authorship relations among 158 countries; VOSviewer was used for visualization

Ethical issues

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Competing interests

The authors declare that they have no competing interests.

Authors' contributions

EM and AB have made substantial contribution to the content of the manuscript in various sections: conception and design, acquisition of data, analysis and interpretation of data, drafting the manuscript and statistical analysis. EM has also participated in obtaining funds and critical revision of the manuscript for intellectual content.

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References

1. Chene G, Sterne JA, May M, Costagliola D, Ledergerber B, Phillips AN, *et al*. Prognostic importance of initial response in HIV-1 infected patients starting potent antiretroviral therapy: analysis of prospective studies. *Lancet* 2003; 362: 679–86.
2. Cartwright K. Pneumococcal disease in western Europe: burden of disease, antibiotic resistance and management. *Eur J Pediatr* 2002; 161: 188–95.
3. Velati C, Fomiatti L, Baruffi L, Romano L, Zanetti A. Impact of

nucleic acid amplification technology (NAT) in Italy in the three years following implementation (2001-2003). *Euro Surveill* 2005; 10: 12–4.
4. Durando P, Sticchi L, Sasso L, Gasparini R. Public health research literature on infectious diseases: coverage and gaps in Europe. *Eur J Public Health* 2007; 17: 19–23.
5. Center for Strategic and International Studies. Infectious Diseases: a presistent threat [internet]. 2013. [cited 2013 Mar 27]. Available from: http://www.smartglobalhealth.org/issues/entry/infectious-diseases
6. World Health Organization (WHO). The top 10 cuases of death: World Health Organization [internet]. 2008. [cited 2013 Mar 27]. Available from: http://who.int/mediacentre/factsheets/fs310/en/
7. Donald PR, van Helden PD. The global burden of tuberculosis--combating drug resistance in difficult times. *N Engl J Med* 2009; 360: 2393–5.
8. Richet HM, Mohammed J, McDonald LC, Jarvis WR. Building communication networks: international network for the study and prevention of emerging antimicrobial resistance. *Emerg Infect Dis* 2001; 7: 319.
9. Ahmed J, Bouloy M, Ergonul O, Fooks A, Paweska J, Chevalier V, *et al*. International network for capacity building for the control of emerging viral vector-borne zoonotic diseases: ARBO-ZOONET. *Euro Surveill* 2009; 14: 19160.
10. Moulin A. Patriarchal Science: The Network of the Overseas Pasteur Institutes. In: Petitjean P, Jami C, Moulin A, editors. *Science and Empires.* Netherlands: Springer; 1992. p. 307–22.
11. Maxime S. The Institut Pasteur: 120 years of research in microbiology. *Res Microbiol* 2008; 159: 5–14.
12. Institut Pasteur International Network. Institut Pasteur International Network /Missions. 2012. [cited 2013 14.12]; Available from: http://www.pasteur-international.org/ip/easysite/pasteur-international-en/institut-pasteur-international-network/missions.
13. Institut Pasteur International Network. *Institut Pasteur International Network: report 2010*. Paris: Institut Pasteur International Network; 2010.
14. Li LL, Ding G, Feng N, Wang MH, Ho YS. Global stem cell research trend: Bibliometric analysis as a tool for mapping of trends from 1991 to 2006. *Scientometrics* 2009; 80: 39–58.
15. Avital M, Collopy F. Assessing Research Performance: Implications for Selection and Motivation. *Sprouts: Working Papers on Information Systems* 2001; 1: 1–14.
16. Butler L. Using a balanced approach to bibliometrics: quantitative performance measures in the Australian Research Quality Framework. *Ethics Sci Environ Polit* 2008; 8: 83–92.
17. Geuna A, Martin BR. University research evaluation and funding: an international comparison. *Minerva* 2003; 41: 277–304.
18. Patel VM, Ashrafian H, Ahmed K, Arora S, Jiwan S, Nicholson JK, *et al*. How has healthcare research performance been assessed? A systematic review. *J R Soc Med* 2011; 104: 251–61.
19. Aksnes DW. Citations and their use as indicators in sceience policy. Studies of validity and applicability issues with a particular focus on highly cited papers [Thesis]. Netherlands: University of Twente; 2005.
20. Leydesdorff L. ISI.exe [internet]. 2008. [cited 2012 Aug 25]. Available from: http://www.leydesdorff.net/software/isi/index.htm
21. Leydesdorff l, Persson O. Mapping the Geography of Science: Distribution Patterns and Networks of Relations among Cities and Institutes. *JASIST* 2010; 61: 1622–34.
22. Schneider A. About GPS Visualizer [internet]. 2012. [cited 2012 Aug 25]. Available from: http://www.gpsvisualizer.com/about.html
23. Batagelj V, Mrvar A. Pajek - Program for Large Network Analysis [internet]. 2013. [cited 2013 Mar 27]. Available from: http://pajek.imfm.si/doku.php?id=pajek
24. Leydesdorff L, Wagner CS, Park HW, Adams J. International collaboration in science: The global map and the network. *El profesional de la información* 2013; 22: 87–95.
25. Ortega JL, Aguillo IF. Mapping world-class universities on the web. *Information Processing & Management* 2009; 45: 272–9.
26. Auguillo IF. Ranking web of universities methodology [internet]. 2012. [cited 2012 Aug 28]. Available from: http://www.webometrics.info/en/Methodology
27. National Science Fundation. Asia's Rising Science and Technology Strength: Comparative Indicators for Asia, the European Union, and the United States [internet]. 2007. Available from: http://www.nsf.gov/statistics/nsf07319/
28. Tijssen RJW, Waltman L, Eck NJV. Research Collaboration and the Expanding Science Grid: Measuring globalization process worldwide [internet]. 2012. Available from: http://arxiv.org/abs/1203.4194
29. Hou H, Kretschmer H, Liu Z. The structure of scientific collaboration networks in Scientometrics. *Scientometrics* 2008; 75: 189–202.
30. Iranian Ministry of Health. Ranking Iranina Medical universities according to research performance indicators [internet]. 2013. [cited 2013 Nov 17]. Available from: http://www.hbi.ir/NSite/FullStory/News/?Id=2184
31. Halevi G, Moed HF. Country Trends: Emerging scientific networks. Research Trends [serial on the internet]. 2011 Sep. Available from: http://www.researchtrends.com/issue24-september-2011/emerging-scientific-networks/
32. Abramo G, D'Angelo CA, Costa FD. Research collaboration and productivity: is there correlation? *Higher Education* 2009; 57:155–71.
33. Harirchi G, Melin G, Etemad S. An exploratory study of the feature of Iranian co-authorships in biology, chemistry and physics. *Scientometrics* 2007; 72: 11–24.
34. Melin G. Pragmatism and self-organization: research collaboration on the individual level. *Res Policy* 2000; 29: 31–40.
35. Kim KW. Measuring international research collaboration of peripheral countries: Taking the context into consideration. *Scientometrics* 2006; 66: 231–40.
36. Persson O. Are highly cited papers more international? *Scientometrics* 2010; 83: 397–401.
37. Frenken K. The geography of collaborative knowledge production: Entropy techniques and results for the European Union [internet]. 2002. Available from: http://www-sre.wu-wien.ac.at/ersa/ersaconfs/ersa02/cd-rom/papers/029.pdf
38. Mattsson P, Laget P, Vindefjard AN, Sundberg CJ. What do european research collaboration networks in life science look like? *Res Eval* 2010; 19: 373–84.
39. Onyancha OB, Maluleka JR. Knowledge production through Collaborative research in sub-saharan Africa: How much do countries contribute to each other's knowledge output and citation impact? *Scientometrics* 2011; 87: 315–36.

Key Messages

Implications for policy makers

- Institut Pasteur International Network (IPIN) collaboration patterns are mostly presented as tight connections among American, European and Eastern Asian Institutions.
- Research and collaboration indicators of IPIN members are proposed as tools in evaluating research performance and allocating research funds within the network.
- Presentation of collaboration patterns among research collaborative members is informative to explore how these members work together towards their common goals.
- A world snapshot on IPIN collaboration patterns in major research domains is provided to indicate how IPIN members work together towards their common goals.

Implications for public

Institut Pasteur International Network (IPIN), since 1888, is intended to fight against infectious diseases. Now with 32 members around the world, IPIN provides a unique capacity for research and public health network collaborations to the prevention and treatment of infectious diseases and promotion of public health.

IPIN members are united and have close scientific relationship with each other within the network. They share the same Pasteurian culture, the same scientific rigor and the same values. Biochemistry and molecular biology, microbiology, infectious diseases and immunology are the IPIN's major research domains. IPIN members prefer to have close collaboration with European members, especially Paris; they also have collaboration with 726 non-Pasteurian institutes around the world. Such examples of successful cross-national research collaborations would herald an immense boost in public health promotion worldwide.