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MEDICOMETRIC PORTRAIT OF DR. (PROF) VISHAL U S RAO, HEAD AND NECK SURGICAL ONCOLOGIST, THE CREATOR OF 'AUM VOICE PROSTHESIS', WORLD'S CHEAPEST SPEAKING DEVICE DESIGNED FOR THROAT CANCER PATIENTS

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Abstract *Vishal Rao, a Bangalore-based doctor is recognized as an eminent head and neck oncologist and robotic surgeon in India. This bibliometric study is exhibited his 195 publications during 2007-2024 and biographical story of the real 'Bharat Ratna" of medical world. His first paper appeared in 2007, when he was 30 years old. His research contributions include 10 non-collaborative and 185 collaborative papers along with total 727 collaborators (individual name wise 247). This scientometric study also draws scientist's social activities through medical services and journey of his ground breaking social innovation of world's cheapest voice device and depicts a quantitative analysis of his contributions highlighting different bibliometric indicators such as age-wise publications, authorship patterns, collaborative works, degree of collaboration, status as main author and co-authors, peak period of publications, contributions in publication channels, leading collaborators. His most closed collaborators are Anand Subash, and Shalini Thakur who are involved in 57 and 55 papers respectively with Vishal. Vishal's favorite journal is Oral Oncology (IF 5.337) wherein maximum number of his papers i.e. 44 have been published. This study also has enumerated annual and compound annual growth rate, relative growth rate and doubling time, and counts citation received from his papers and frequency distribution of keywords. Finally, this study also examines whether the data set does satisfy Lotka's Law and Bradford's Law or not.*

Keywords: *Vishal Uchila Shishir Rao, Vishal U S Rao, Vishal Rao, Head & Neck Surgical Oncologist, Throat Cancer, Aum Voice Prosthesis Speaking Device, Tobacco-Free World, HealthCare Global (HGC) Centre (Bangalore), Entrepreneur*

INTRODUCTION

Cancer has no answer. Yet if it is detected at the very primary stage, it may cure totally. Later than its possibility of complete cure is not possible for most cases of cancers, but due to rapid development of modern technology, a cancer patient may alive more years than earlier. Over the world, research in cancer is continuously going on in various cancer research institutions. While complete elimination may not be possible, prevention is more effective than cure. Looking in information, it is observed that throat cancer patient is also gradually increased in India and abroad mostly due to intake tobacco, alcohol consumption, poor diet, some viral infections and environmental factors, etc. This burden is prompting cancer specialists to give serious thought to throat cancer. Dr. Vishal Uchila Shishir Rao, shortly Vishal U S Rao or Dr. Vishal Rao is one of the well-skilled surgeons for throat cancer. This cancer can lead to loss of ability to speak and its treatment is very costly. Considering the financial condition of poor people in India, he has invented a world's cheapest speaking device for throat cancer patients that is namely called '*Aum Voice Prosthesis'*. Today's episode is being started about this Indian celebrated throat cancer specialist; a Bangalore based physician. He is the chief of Head and Neck surgical oncology and Robotic surgery at HealthCare Global (HGC) Centre, Bangalore, India. He has extensive knowledge and expertise in diagnosing and treating both non-cancerous and cancerous tumors in the organ of the thyroid, parotid, and salivary glands. Dr. Vishal is highly skilled in conducting surgeries such as modified neck dissections, carotid body removal, and the treatment of vascular tumors and parapharyngeal space tumors. Now, he

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is a World-renowned oncologist, leading inventor, selfless entrepreneur. He is passionate about cancer prevention and is actively involved in anti-tobacco campaigns to build the world tobacco-free. Dr. Vishal is an international advisor to World Health Organization Tobacco Free initiatives.

Throat Cancer

Throat cancer is not an appropriate medical term. Within the throat, there are different parts with their specific names such as thyroid gland, trachea, nasopharynx, oropharynx, larynx and the esophagus. Cancers are categorized according to organ of the body and the type of cell they began from. (Cancer Research, UK, 2022). However, throat cancer refers to cancerous tumors that grow in the throat (pharynx), voice box (larynx), tonsils, thyroid gland, etc. So, there are various kinds of throat cancers.

Types of Throat Cancer

It may be categorized based on the part of the throat affected (Cancer Research, UK, 2022; Mayo Clinic, 2022):

- *Pharyngeal Cancer:* Occurs in the pharynx, the hollow tube that runs from behind the nose to the top of the esophagus: (a) *Nasopharyngeal Cancer:* Affects the upper part of the pharynx (throat) behind the nose; (b) *Oropharyngeal Cancer:* Involves the middle part of the pharynx, including the back of the mouth, tonsils, and base of the tongue; (c) *Hypopharyngeal Cancer:* Affects the bottom part of the pharynx just above the esophagus and windpipe.
- *Laryngeal Cancer:* Involves the voice box (larynx) including the vocal cords. It is also called Glottic cancer.
- *Tonsil Cancer:* Affects the tonsils, parts of the lymphatic system and located at the back of the throat.

Throat cancer may occur in one of two main areas of throat that are called (i) pharynx (throat) and (ii) parts of head and neck such as the tongue, the nose or the ear, mouth, voice box, thyroid gland, food pipe, etc.

Symptoms

Common symptoms of throat cancer include (Cancer Research, UK, 2022; Mayo Clinic, 2022):

- Ear pain.
- A sore throat.
- A lump in throat or neck.
- Difficulty in swallowing or eating.
- Change in the voice or speech such as rough sound in voice or not speaking clearly.
- Unexplained weight loss
- A cough
- Shortness of breath
- A feeling of jammed in the throat

Causes and Risk Factors

Some of the causes and risk factors are (Mayo Clinic, 2022):

- *Tobacco Use:* Smoking (smoke) such as cigarettes, bidi, cigars, pipes, and chewing tobacco (smokeless) like ghutka, khaini, pan masala etc.
- Excessive alcohol drinking like hard liquor, wine, beer, etc.
- Viral Infections to oropharyngeal via
  - Human papillomavirus (HPV), a sexually transmitted infection, and
  - Epstein-Barr virus best known as 'mono' or the 'kissing disease', spreading through kissing, sharing drinks and cigarette, eating utensils or coughing and sneezes, sometime mother to child during birth.
- *Poor Diet:* Lacking of colour fruits and vegetables.
- Poor oral hygiene.
- *Certain Chemical Hazards:* Like asbestos and wood dust.
- *Gastroesophageal Reflux Disease (GERD):* Chronic acid reflux, which is common in babies under two years old and a chronic digestive disorder. It also causes injury in Pharynx.

In India, 80 to 90% of oral and throat cancer cases are attributed to tobacco use (RGCIRC Team, 2024).

Diagnosis

Throat cancer is diagnosed through various tests and procedures (Cancer Research, UK, 2022):

- *Physical Examination:* Checking for lumps or abnormalities in the throat.
- *Endoscopy:* Examination by inserting a thin, flexible tube along with a light and camera into the throat.
- *Biopsy:* Culture of a tissue sample for checking cancer cells.
- *Imaging Tests:* CT scans, MRIs, or PET scans for seeing the cancer's extent.

Treatment

Common treatments include (Cancer Research, UK, 2022; Mayo Clinic, 2022):

- *Surgery:* Ejection of the tumor or affected tissues.
- *Radiation Therapy:* Use of high-power rays for killing cancer cells.
- *Chemotherapy:* Application of drugs (Chemical) to ruin cancer cells.
- *Targeted Therapy:* Use of drugs or other substances to precisely identify and attack cancer cells to stop their growth.
- *Immunotherapy:* To increase body's immune power to fight the cancer.

Besides, everyone should stop smoking, not drink alcohol, eat a variety of colorful fruits and vegetables, avoid more sexual partners and take proper protection every time or take HVP vaccine, etc.

Throat Cancer Statistics

Table 1 and Fig. 1 highlights statistics of throat cancer cases and mortality rate in India. Indian cancer patients are mostly suffering and died from larynx, hypopharynx, oropharynx, and thyroid cancer respectively according to the number of cases. As per WHO Global Cancer Observatory data fact (WHO Global Cancer Observatory, 2022), out of total cases, four top leading throat cancers larynx, hypopharynx, oropharynx and thyroid have been reported rank wise by the number of affected cases i.e. 35,855 (2.54%), 30,510 (2.15 %), 23174 (1.64%), and 21,873 (1.55%) respectively. In case of mortality, among throat cancers, highest number of patients is died by larynx cancer (2.45%), followed by oropharynx (1.55%), hypopharynx (1.26%), and thyroid (0.60%). Different cancers cases are recorded by 14,13,316, out of which 1,26,038 (i.e. 8.92% nearly) cases are belonged to throat cancers. It is estimated at least 10,000 patients in India each year are losing their voice box due to throat cancer (Radjou, 2024).

Table 1: Statistics of Throat Cancer Cases and Mortality Rate in India

Cancer Sites	Cancer Cases		Deaths	
	Number	%-age	Number	%-age
Larynx	35,855	2.54	22,467	2.45
Hypopharynx	30,510	2.15	11,618	1.26
Oropharynx	23,174	1.64	14,202	1.55
Thyroid	21,873	1.55	5,455	0.60
Salivary glands	8,107	0.57	4,879	0.53
Nasopharynx	6,519	0.47	4,780	0.52
Total	126038	--	63401	-
Others	12,87,278	91.08	8,53,426	93.08
Grand Total	14,13,316	100.00	9,16,827	100.00

Data Source: (WHO Global Cancer Observatory, 2022).

Region-Wise Throat Cancer Cases in India

Table 2 has enumerated and listed data of region-wise throat cancer cases in India. As per data for head and neck cancer cases (2012-2019), mouth, tongue, larynx, and hypopharynx cancer (as throat cancer) cases have occupied top rank throughout India (Chauhan et al., 2022). Among males, larynx was the common leading cancer site all over India in the ranges from 3.2 to 5.7 per 1, 00, 000 persons. Hypopharynx

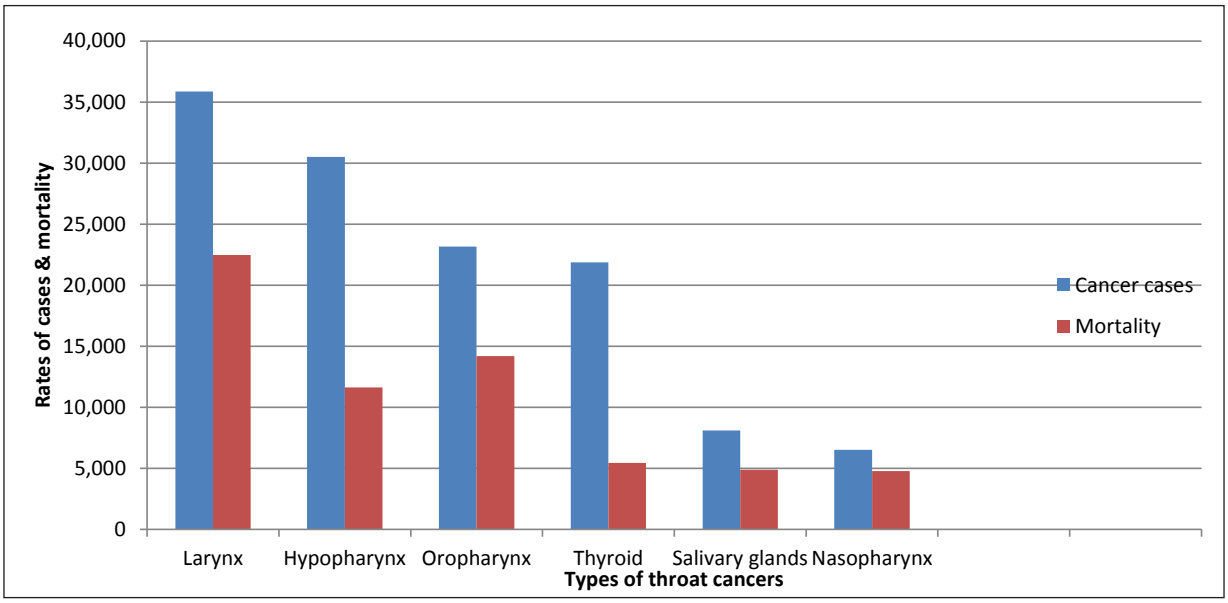

Fig. 1: Showing Various Throat Cancer Cases and Deaths in India

cases per lakh population were reported by 8.0 among male patients in northeastern region only. In case of females, larynx, and hypopharynx of various throat cancers were the top two leading cancer sites in India. Larynx cancer was in the range of 0.6 to 0.7 per 1, 00, 000 persons in only eastern and northern India, and hypopharynx cancer was one of the common cancer sites among female patients. This was in the range of 1.2 to 0.9 per 1, 00,000 persons occupying third rank in central, northeastern, southern and western India. During that period, top cancer sites were mouth, tongue, larynx, and hypopharynx. Northeastern region has been more affected by hypopharynx cancer and this cancer was ranked in first in this region, and larynx was always in the third rank in other regions of India among female patients (Chauhan et al., 2022; Bagal et al., 2023).

Table 2: Region-Wise Throat Cancer Cases Region-Wise in India (2012-2019)

Regions of India	Male		Throat Cancer Types	Female	
	Head Neck Cancer Cases (Total)	No. of Throat Cancer Cases Per 1,00,000 Population		No. of Throat Cancer Cases Per 1,00,000 Population	Head Neck Cancer Cases (Total)
Central	28.3	4.3	Larynx	00	9.4
		00	Hypopharynx	0.6	
Eastern	18.3	4.3	Larynx	0.6	6.2
Northern	28.5	5.7	Larynx	0.7	6.8
Northeastern	31.7	5.2	Larynx	00	10.1
		8.0	Hypopharynx	1.2	
Southern	23.9	4.3	Larynx	00	8.4
		00	Hypopharynx	0.9	
Western	24.4	3.2	Larynx	00	7.3
		00	Hypopharynx	0.6	

Data Source: (Chauhan et al., 2022).

Main Causes for Throat Cancer

Throat cancer causes for many factors such as intake tobacco and alcohol drinking, HPV infections, and poor diet, etc. India has 42.4% men and 14.2% women became cancer patient due to intake tobacco either in smoke or smokeless and 15.8% men and 3.2% women cancer patients are affected owing to consumption of alcohol in all form, including hard liquor, wine, and beer, etc. (Times of India, 2024). Other reports reveal that the overall cancer cases due to tobacco (smoke or and smokeless) in India was estimated to be 169 thousand in 2015 that will reach to around 236 thousand by 2025. That means an increase of nearly 40%. Number of tobacco smokers is projected to increase in urban India from 101.8 million in the year 2015 to 106.2 million by 2025 (Prasad & Dhar, 2020). WHO Cancer Observatory also reports that more and less 0.63% to 2.4% male cancer patients and 11.4% to 20.0% female cancer patients are infected by HPV in India (WHO Global Cancer Observatory, 2022). As an anti-tobacco activist. Dr Vishal blames smoking and consumption of ghutka as primary causes for throat cancer (Prasad, 2018). Besides, nearly 750,000 cases of cancer diagnosed worldwide in 2020, or 4%, are attributable to alcohol use, according to a study of World Health Organization (WHO). Number of cancer cases depend on level of daily alcohol consumption. A report (Reynolds, 2021) shows that if the level is 60 grams or more daily, it may cause 3.464 lakh cancer cases; if between 20 to 60 grams, 2.918 lakh cases, and if 20 grams or less, 1.031 lakh cases. Across the globe, the highest percentages of cancer cases linked to alcohol consumption were found in eastern Asia and central and eastern Europe, while northern Africa and western Asia exhibited the lowest rates (Reynolds, 2021).

Early Life and Education

Dr. Vishal Rao was born in 1977 in Mangaluru, Karnataka, India. His grandfather was U Sunder Rao (1923-2010), the writer of the book "*Reminiscences of an I.N.A Soldier"* (Facebook.com, 2024), a tribute to the enduring legacy of Netaji Subhas Chandra Bose and the fearless warriors of the Indian National Army, whose sacrifices ignited the flame of independence in our hearts. With great humility, I regret to note that the names of the parents of the well-known Bangalore-based oncologist could not be confirmed after a comprehensive search of multiple online sources. Vishal studied at St. Aloysius High School, and science

at St. Aloysius' College (Mangalore). Dr. Vishal completed his MBBS at Rajiv Gandhi University of Health Sciences, Bangalore in 2002 and MS in ENT (otorhinolaryngology) from Rajiv Gandhi University of Health Sciences in 2006 under KLE Society College of Health Sciences (formerly Jawaharlal Nehru College) in Belgaum, Karnataka. He then received fellowship in Head & Neck oncology surgery from Tata Memorial Hospital in Mumbai in 2008 (Allcar's Easy Way, 2024; Rao, 2024; ClinicSpots, 2015; Eka.care, 2024). His wife is Megha, who is a corporate lawyer and a massive back-up for Dr. Vishal's work. They have a 9-years old son Aayan. Presently they live in Bangalore, India.

Professional Life

Dr Vishal, Otorhinolaryngology Professor, is now a widely travelled surgeon with varied experience, especially in the field of Oncology and Head & Neck Surgery. He worked as visiting Scholar at the Department of Otolaryngology, University of Pittsburgh School of Medicine, USA from 2008 to 2008. He was a fellow of Tata Memorial Hospital during April 2006 to Nov 2008. Dr. Vishal also attached as Assistant Professor in Kidwai Memorial Institute from Jan 2009 to Dec 2011. He played a role of consultant as an oncologist Head and Neck Surgeon at HCG Curie center of Oncology from July 2012 to Mar 2013. He worked as a consultant Oncologist Head and Neck Surgeon at BGS Global Hospital & Cancer Institute, Kengeri, Bangalore from 15 Mar 2013 to 30 Nov 2014, and Dr. Rao is the Group Director of Head and Neck Surgical Oncology and Robotic Surgery, HealthCare Global Cancer Centre - HCG Cancer Center, Sampangi Ram Nagar, Bangalore, India from 1 Dec 2014 to Present. He is also the Dean of the Center for Academic Research at the Center. He is a consultant at the Institute of Public Health, an Executive director of the Cancer Prevention and Tobacco Control Project with W.H.O., and a visiting faculty of John Hopkins University School of Medicine. Apart, he has been on the guest faculty for numerous national and international conferences and CME (Trustwellhospitals, 2019; Allcar's Easy Way, 2024; Rao, 2024; Saez, 2022; Amazon.com, 1996-2024; ClinicSpots, 2015).

Research Contribution

There is none without problem in the world. Playing with problems and finding their solutions is an adventure that has to move systematically towards a solution i.e. problems lead to solution, just like 'Necessity is the mother of invention'. He loves to strive hard to be an innovator and problem solver. His journey of discovery was pertaining to social perspective. He saw in his practical field of medical treatment that a patient who had throat cancer, lost his voice and later lost his job. It worried him that how would help him to get his voice and his job back. On the other side, then there were two voice prostheses available, one from the U.S., and the other one from Europe, which was not under the financial capacity of all patients. From all such situations he began the journey of his outstanding creation '*Aum Voice Prosthesis'*. At this time, he along with his co-inventor friend, Shashank Mahesh decided to do a bike ride to collect funds for bringing one of those two voice prostheses for the patients. After that, they thought that biking fundraising could not be possible to continue long time. So, Dr. Vishal decided to build such device himself and would solve their problems. For this purpose, he started thinking and quickly realized the need of technical knowledge that he did not have, like silicon and machinery expertise. Thus, later he became a silicon expert. From 2013 to 2015 they worked on the product, with the help of material experts, physicists, and scientists. Finally, the product sees the light of the day and gives the patient security guard. Patient regains his voice in an affordable manner. In their words, their device is giving back the patient speech and communication power, that is one of the constitutional rights in our society. Dr. Vishal wants his device is to be available, affordable, and accessible. Every person over the globe should have the right to speech, dignity, and quality of life. He has more than 13 patents filed for his innovations on medical devices, drugs, techniques and theories (Saez, 2022; HCGoncology, n.d.).

Patents

Dr. Vishal Rao is a prolific innovator with numerous patents covering medical devices, drugs, techniques, and theories (Drvishalrao.in, n.d.). Some of them are: Aum: 1$ voice prosthesis Shushruth: Prosthetic inserter and plunger; Dhwani: Double lumen tracheotomy tube Capsule Insertion Technique; Ravi Retractors: For performing Robotic neck dissections; OncoTheology: Trademark filed for a research initiative: Electron Acceptance, Theory for Carcinogenesis, Oral Cisplatin using Nanotechnology, Fish Eye C-Knife, etc. (Saez, 2022).

Aum Voice Prosthesis and Its Naming Episode

Aum is made of imported platinum-cured medical-grade silicone and other materials. Its weight is 25 grams. It measures 2.5 cm in length and its price is Rs. 50 in Indian rupees, equivalent to $1 (one dollar) (Prasad, 2018; Singh, 2015). His discovery is recognised as a part of 100 global social innovations across the world (Drvishalrao.in, n.d.)**.** Its naming episode is very interesting and focuses on the devotion to Indian mythology. 'Om' in Sanskrit and Indian mythology is a soulful word that is basically revealed by creating a sound. Indian mythology believes that 'Om' is the evolution of humanity. Here, he has used it as a sound

'Aum'. He has described the *'Aum'* into four sounds: 'A' for creation, 'U' for sustenance, and 'M' for annihilation. The last one remains silent, repeating the previous sounds all over again. 'Aum' creates a connection between the soul and the universe. This aggregation brings a peaceful state in mind. As the first patient uttered the sound of 'Aum', the device was named so in accordance with it, because the person who had been unable to speak, started on empathetic journey from silence to sound (Saez, 2022).

Research Implications

'Aum' voice prosthesis is a special valve that is made of medical-grade platinum silicone. It is designed to be fitted into throats of the patients. Voice box of throat cancers is removed by surgery and obviously patient losses his/her ability to speak. After surgery, they have a hole in the throat. Then they breathe through the hole instead of their nose. The device is placed between the air pipe and the food pipe. At that time, the food pipe is converted into a voice box. In this way, the device stimulates the brain to recover its ability to speak. The throat itself doesn't speak, yet it serves as the hardware for the device. If the brain is deceived into believing that the food pipe is the voice box, it can restore the patient's ability to speak. The latest voice machine has been designed with improved clarity and voice modulation compared to the earlier models. Till now, there are more than 1,700 patients who are speaking using the device. Some of them were not be able to speak for over a decade. With more than 10 countries already reached, the next target is to serve 144 countries that are poor, deprived and in the low- and middle-income level including the countries for providing cost-effective solutions that are truly available to everyone (Saez, 2022). There were two global marketing companies for voice prosthesis: one American and one European and their cost is nearly Rs. 15,000 to 35,000. So, those who could not bear it for the device remained voiceless for the rest of their lives. Now Visha's product is the third one from India and affordable (Rs. 50/-) to all. Apart from Government of India, the WHO and many other countries have already expressed interest in the product (Prasad, 2018; Singh, 2015).

Future Research

His innovation is dedicated to social innovations that's aim is better access and cost-effectiveness to all people. He believes that innovators should focus on solving individual issues or problems rather than seeking commercial gains. He emphasizes the significance of patenting social innovations, discusses the expansion of cost-effective devices for poor communities globally, and shares his vision for the future of medicine and treatment of throat cancer patients (Saez, 2022).

AWARDS AND RECOGNITIONS

Dr. Vishal Rao received many awards and honors in different ways. Some of them are (Drvishalrao.in, n.d.; (Onco.com, 2024; ClinicSpots, 2015; Eka.care, 2024; HCGoncology, n.d.)**:**

- 2004: Best Poster Award for presentation on "Schwannoma of The Larynx", the 36th MENTCON, Maharashtra State ENT Conference.
- 2004: Best Video and Poster Award for presentation on "Spindle Cell Tumor of the Larynx", the 36th MENTCON, Maharashtra State ENT Conference, Mahabaleshwar.
- 2004: Certificate of Acknowledgement for audiovisuals presentations, the 36th MENTCON, Maharashtra State ENT Conference.
- 2006: Gold Medal on "Role of Vitamin A in the Evolution of Cholesteatoma".
- at the Otolaryngology Association of India - South Zone Conference held in Belgaum.
- 2012: Marquis Who's Who in Medicine & Healthcare.
- 2015: Innovation award - N. D. Purushottam for 1$ voice prosthesis, Conference of Otolaryngologists & Head Neck Surgery.
- [2015?]: Wide recognition from BBC, Harvard Business Review & Forbes.
- 2016: Rotary Vocational Training Award for innovation of AUM Voice prosthesis.
- 2017: Judy Wilkenfeld Award for Excellence in Global Tobacco Control.
- 2018: FRCS, Royal College of Surgeons Glasgow.
- 2018: Karnataka Man of Year for Science and Techno, News18.
- 2018: Recipient of multiple state level awards including the Kempegowda award.

Organizational Membership

Vishal is a member of various national & international bodies. Some are: Member of the Union for International Cancer control (UICC) Globalink: Global Tobacco Control (WHO); Member of Indian Medical Association, (No.1375, 2009); a Member of National Executive Committee for the Foundation of Head and Neck Oncology (FHNO) for 2011-2012; Executive Board Member of the State Association for Otolaryngology: Head Neck Surgery, Karnataka; Member of the state committee on tobacco control, Ministry of Health & Family Welfare, Government of Karnataka, India, and a Member of the Action Council against Tobacco (ACT), India (Allcar's Easy Way, 2024; Rao, 2024; Shekhar, 2015; Trustwellhospitals, 2019; ClinicSpots, 2015; Onco.com,

2024; Eka.care, 2024). He is also a panel member for the Wolters Kluwer Health India (2021). Dr. Rao is a charter member of the National Association of Credential Evaluation Services i.e. FACS (Foreign Academic Credentials Services), USA.

OBJECTIVES

The main aims of the study are:

- To list year-wise publications of Dr. Vishal Rao with authorship pattern.
- To observe the position of Vishal as main author and co-author.
- To calculate the degree of collaboration.
- To measure author productivity.
- To identify age-wise publication pattern.
- To find the research team with co-authors.
- To draw a graph of peak period of productivity.
- To identify the preferred journals.
- To find annual and compound annual growth rate.
- To calculate relative growth rate and doubling time.
- To analyze citations received and Citation Growth Rate.
- To test validation of the Lotka's Law and Bradford's Law.

MATERIALS AND METHODOLOGY

This analytical study covers 195 publications of Dr. Vishal Rao with special reference to throat cancer during the period 2007-2024. His publications include 180 journal articles, 10 preprints, 3 poster presentations, 1 letter and 1 conference paper published in different communication media in India and abroad. All the publications have been extracted from ResearchGate (RG) and Google Scholar (GS) databases. In addition, other data has been collected from various offline and online sources. A compiled data sheet of his publications was prepared for this study. Then all data were taken into MS-excel and Words and tabulated for reaching to the points as per objectives of this study such as year and age-wise authorship pattern, position as main authors and co-authors, author productivity and research team, collaboration coefficient, peak time of publications, favorite communication media, publication growth and citation analysis, etc. At last, this scientometric study has also been examined the validation of Lotka's Law and Bradford's law for the data set of authorship and communication channels. Thus, finding statements are prepared one by one and discussed in the following sections.

REVIEW OF LITERATURE

From the archives of bibliometric literature studies, it is observed that a number of bio-bibliometric studies on or about Novel Laureates, scientists, medical scientists, economists, missile scientists, film actress, librarians and information scientists, bankers etc. were carried out by many librarians and information scientists. If regularly published journals, and indexing and abstracting databases are opened, one or more such studies in every volume and issue is/are publishing every year. So, to mention all the literatures list would be quite long. However, some of them which were studied subject wise on the persons may mention: on Nobel laureates in Physics (Kademami, Kalyane, & Kademani, 1994); Nuclear Physicist (Kademani & Kalyane, 1998); Physiologist (Koley & Sen, 2006); Plant biologist (Srimurugan & Nattar, 2008); Biometeorologist (Hazarika, Sarma, & Sen, 2010); Linguist and businessman, a founder of bibliometrics and scientometrics (Sangam & Savanur, 2010); Statistician (Mondal, Raychoudhury, & Sarkhel, 2018); Librarian, information scientist and scientometrician (Dutta, 2019); Physicist (Teli & Maity, 2021); Ecologist and environmental scientist (Seidlingappa et al., 2023); Medical scientist (Koley, 2024); Economist (Behera & Meher, 2024); and many more. Despite of such worked out studies available on various persons either living or death, there is no bibliometric study on Dr. Vishal U S Rao, a well-experienced and renowned Indian throat oncologist so far. So, it is an original and important work.

FINDINGS AND DISCUSSIONS

Year-Wise Paper Publications and Authorship Pattern

Table 3 highlights year-wise publications of Dr. Vishal according to number of author(s) per paper. There are 195 papers which are written by either from one to nine or ten or more than ten authors including 11-, 13- and 20-authors. To reduce the length of table, all are categorized into eleven groups like single-authored (IA), two-authored (IIA), and thus up to more than 10-authored (< XA). It also shows number of co-authors year-wise. Out of 195, the maximum number of papers are five-authored i.e. 45 followed by four-authored papers (N 42), second-and fifth-authored papers (N24 each), eight-authored and seven-authored paper i.e. 11 and 10 respectively according to the production. The scientist solely has published 10 papers i.e. single authored papers. It has counted 737 co-authors for 195 papers. Of which, the maximum number of co-authors i.e. 242 (32.84%) was involved for preparing 53 papers in the year

2020 that is the highly yielding year of production. Next 95 and 94 co-authors were produced 22 and 26 papers in 2022 and 2021 respectively in association with Dr. Vishal. Highly yield years exist between 2019-2023, during which more than 67% (67.69%) papers were produced. His first paper was appeared in 2007 in collaboration with 3 co-authors. Unfortunately, he has no paper in 2015.

Table 3: Year-Wise Publications According to the Number of Authors

Year	TP	CTP	IA	IIA	IIIA	IVA	VA	VIA	VIIA	VIIIA	IXA	XA	< XA	CoA
2007	1	1				1								3
2008	4	5	1			1		2						13
2009	4	9	1		1	1	1							9
2010	9	18	4	2	1		2							12
2011	2	20				2								6
2012	3	23					2				1			16
2013	1	24			1									2
2014	3	27		1		1				1				11
2016	5	32	1	1		1		2						14
2017	13	47	1	3	2	2	2		2	1				40
2018	9	54		3	4		2							19
2019	18	72		5	1	6	5	1						49
2020	53	125		1	10	13	8	7	4	6			4	242
2021	26	151		2	4	8	5	4	2	1				94
2022	22	173	2	1		3	8	4	1	1		1	1	95
2023	13	186				3	7	1	1				1	67
2024	9	195		1			3	3		1		1		45
Total	195		10	20	24	42	45	24	10	11	1	2	6	737
%-age			5.13	10.25	12.31	21.53	23.07	12.32	5.13	5.64	0.52	1.03	3.07	100

Abbreviations: TP= Total papers; CTP=Cumulative total paper; SA= Single authored; IA- one authored, and so on; CoA= Co-authors.

Age-Wise Papers and Status

Table 4 shows age-wise papers and authorship status as main author and co-authors. Out of 195, scientist has published ten papers without any collaboration and the highest number of single-authored paper i.e. 4 has been produced by him at the age of 33 followed by 2 in 2022 when he was 45 years old. He has worked as author in 1st position in 42 papers and the highest publication in this position was 12 in 2020 at the age 43 followed by 6 in 2021 (age 44) and 4 in 2010 (age 33). He appeared as author in 44 papers in second position and mostly has figured during 2018-2021 (age range 41-44). Dr. Vishal stood 3rd position in 34 papers and was visible in the highest 11 papers as 3rd position in 2020 (age 43). Apart he has 23 and 24 papers to his credit where he has occupied 4th and 5th position. He has participated as author as 6th, 7th, 8th and 9th position in 9, 3, 1, and 1 paper respectively. He also has ranked more than ten position in 6 papers (i.e. 11-, 13- and 20-authored paper). In other words, out of 195, he has played an important role in research team as main author in 52 papers and co-author in 143 papers. Number of papers has been gradually increased as he gets older which has observed from the year 2017 onwards.

Table 4: Age-Wise Papers and Vishal's Status as Author

Year	Authorship status as author in										TP	MAP	CA	DC = MAP/ TP	CT	Age [1978]	PPA
	Single author	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	< 10th							
2007		1										1	1		1.00	1	30	1
2008	1	1	2									4	2	2	0.5	5	31	2
2009	1	3										4	4		1.00	9	32	3
2010	4	4	1									9	8	1	0.89	18	33	4
2011		1			1							2	1	1	0.5	20	34	5
2012			1	2								3		3	0	23	35	6
2013		1										1	1		1.00	24	36	7
2014		1	1	1								3	1	2	0.33	27	37	8
2015																	38	9
2016	1	3		1								5	4	1	0.8	32	39	10
2017	1	5	3	1	3							13	6	7	0.46	47	40	11
2018			6	3								9		9	1.00	54	41	12
2019		2	6	5	3	2						18	2	16	0.11	72	42	13
2020		12	8	11	9	5	5	1			2	53	12	41	0.23	125	43	14
2021		6	6	7	2	4		1				26	6	20	0.23	151	44	15
2022	2	2	2	2	3	4	3	1	1	1	1	22	4	18	0.18	173	45	16
2023			4	1	1	6					1	13		13	0	186	46	17
2024			4		1	3	1					9		9	0	195	47	18
Total	10	42	44	34	23	24	9	3	1	1	4	195	52	143				

Abbreviations: 1st =first position and son; TP= Total papers; MAP= Multiple authored Paper; CA=Co-authors; DC= Degree of collaboration; CT= Cumulative total; PPA Paper Productive age.

Publication by Quinquennium

Table 5 lists a statistical data according to quinquennium i.e. five years interval Number of papers has been gradually increased from the first quinquennium (N20, 4%) to third quinquennium (N119, 28.3%) i.e. increase of 24.3%. at the age range 40-44. That was his peaked period of publications and shows it in Fig. 2. In immediate next, it drops down to 44 (8.8%). Though, publications of all years are yet to include in the last quinquennium, 2022-[26]. On average, he published nearly 28 papers per year in collaboration with others, when he was 40-44 years old.

Table 5: Statistics of Publication by Quinquennium

Quinquennium	Age (Years)	TP	Productivity Per Year
2007-2011	30-34	20	4
2012-2016	35-39	12	2.4
2017-2021	40-44	119	28.3
2022- [2026]	45-[49]	44	8.8
Total		195	

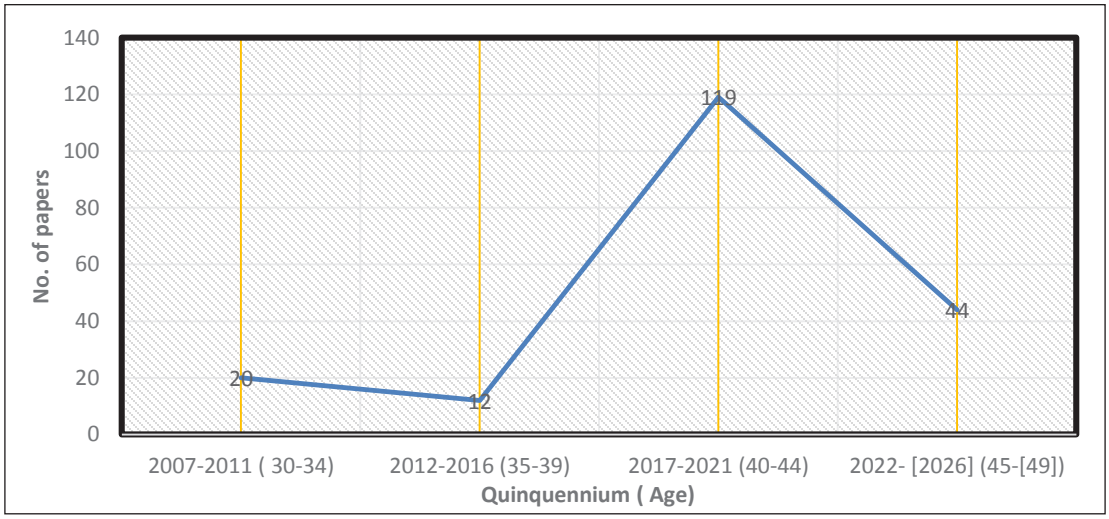

Fig. 2: Peaked Period of Vishal's Publications

Pattern of Collaborative Papers

Table 6 highlights authorship pattern of collaborative papers. He has 185 collaborative papers to his credit during the period of this study. He has as many as 45 five-authored paper followed by 42 forth-authored, 24 each three-and six-authored, 20 two-authored paper. There are 10 seven-authored and 11 eight-authored paper. Besides, he has two ten-authored and only one nine-authored paper. His six papers have been published in collaboration with more than ten authors (i.e. 3 eleven-authored, 1 thirteen-authored and 2 nineteen-authored paper).

Table 6: Collaborative Publication Patterns

No. of Author / Paper Type	IA	IIA	IIIA	IVA	VA	VIA	VIIA	VIIIA	IXA	XA	< XA	Total
Non-collaborative	10											10
Collaborative		20	24	42	45	24	10	11	1	2	6	185

Time Span of Publications

Table 7 counts time span of authorship i.e. according to authorship pattern, papers have been produced taking how many years. It is observed that his 10 single-authored and 20 two-authored papers took 15 years each to publish and first publication years were 2008 and 2010 respectively. Twenty-two three-authored paper His highest number of papers are belonged to fifth-authored i.e. 45 has been published in 16 years whereas 42 four-authored and 24 six-authored papers took long time, 17 years each, one year more than earlier. He has published 10 seven-authored and 11 eight-authored papers during a time span of 7 years and 11 years respectively. Aside, his one nine-authored and two ten-authored papers were published just in a time span of one year each.

Table 7: Authorship Pattern with Time Span

No. of Authors	IA	IIA	IIIA	IVA	VA	VIA	VIIA	VIIIA	IXA	XA	< XA
No. of papers (195)	10	20	24	42	45	24	10	11	1	2	6
Time span	15	15	13	17	16	17	7	11	1	1	4
Time span in years	2008-2022	2010-2024	2009-2021	2007-2023	2009-2024	2008-2024	2017-2023	2014-2024	2012-2012	2024-2024	2020-2023

Author Status in Byline of Authors

Table 8 reveals the rank of Vishal in the by line of authors in collaborative publications. He appeared as second author in maximum number i.e. 44 papers. He worked as first author in as many as 42 papers, third position in 34 papers, fourth position in 23 and fifth position in 24 papers. He also occupied the sixth position in 9 papers; seventh position in 3 papers; 12th position in 2 papers. Vishal has produced 1 paper each as 8th, 9th, 11th and 19th position holder in byline of authors.

Table 8: Authorship Status in Collaborative Papers

	Positions												Total
Authorships	**IA**	**IIA**	**IIIA**	**IVA**	**VA**	**VIA**	**VIIA**	**VIIIA**	**IXA**	**XIA**	**XIIA**	**XIXA**	
2a	6	14											20
3a	6	5	13										24
4a	7	7	12	16									42
5a	9	9	6	3	18								45
6a	5	6	2		4	7							24
7a	2	2		1	2	1	2						10
8a	6	1		2		1		1					11
9a			1										1
10a				1					1				2
11a	1						1			1			3
13a											1		1
20a											1	1	2
Total	42	44	34	23	24	9	3	1	1	1	2	1	185

Leading Collaborators

Table 9 lists top nine leading collaborators according to the number of publications and Fig. 3 represents them graphically. Vishal has worked with 247 collaborators during 2007-2024 and produced the highest number of papers i.e. 57 with Anand Subash in a time span of 6 years, average (ave.) approximately (ca.) 10 papers per year, followed by 55 papers (time span 6 years, ave. ca. 9 papers per year) with Shalini Thakur; 33 (time span 5 years, ave. ca. 7 papers per year) with Gururaj Arakeri; 26 papers with Akshay Kudpaje (2019-2022), 19 with Sameep S Shetty (2018-2020); 18 with Peter A Brennan (2020-2024); 17 with Peter A Brennan (2020-2024) and 15 papers with Piyush Sinha (2019-2023). Remaining co-authors have been grouped into several 11 categories as per number of papers i.e. separate groups of authors who are having publication 12 to 1 papers.

Table 9: Leading Collaborators of Vishal

Rank	Author's Name (FYP-LYP)	No. of Papers
1	Vishal Rao US (2007-2024)	195
2	Subash, Anand (2018-2024)	57
3	Thakur, Shalini (2019-2024)	55
4	Arakeri, Gururaj (2020-2024)	33
5	Kudpaje, Akshay (2019-2022)	26
6	Shetty, Sameep S. (2018-2020)	19
7	Nayar, Ravi (2016-2021)	18
8	Brennan, Peter A (2020-2024)	17
9	Sinha, Piyush (2019-2023)	15
10	02 authors	12 papers each
11	03 authors	11 papers each
12	01 author	9 papers
13	04 authors	8 papers each
14	01 author	7 papers
15	6 authors	6 papers each
16	6 authors	5 papers each
17	10 authors (6.75%)	4 papers each
18	22 authors (24.28%)	3 papers each
19	36 authors (24.32%)	2 papers each
20	148 authors (59.91%, ca. 60%)	1 paper each
Total	248 authors [247 co-authors]	

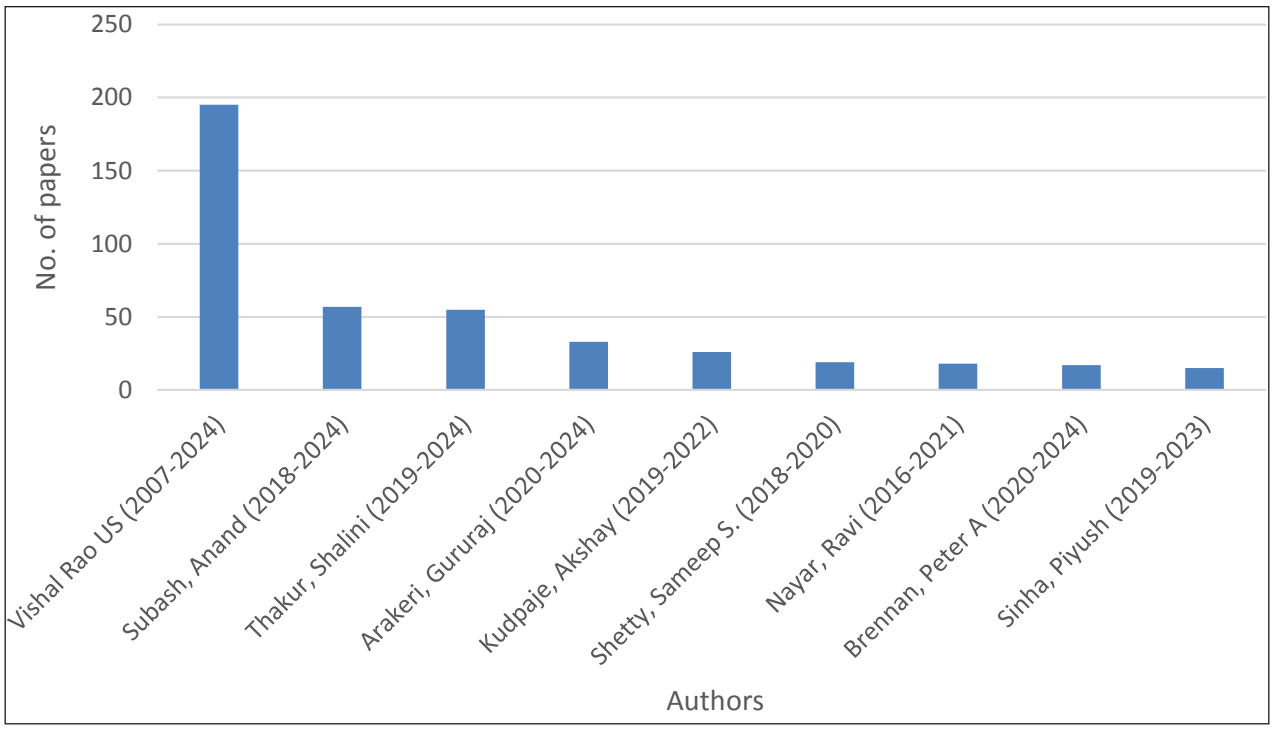

Fig. 3: Leading Collaborators with Vishal in Publishing Team

Testing of Lotka's Law Validation

Out of 247 co-authors of Vishal, 148 authors (59.91%, ca. 60%) have 1 paper each; 36 authors (24.32%) have 2 papers each; 22 (14.86%) authors have 3 apers each; and 10 authors (6.75%) have 4 papers each; and so on. Therefore, Lotka's Law has been satisfied by the dataset of this study.

Preferred Journals

Vishal's publications have been scattered in 72 national and international communication channels which are listed in the Table 10. He has published 180 papers (92.31%) as journal articles using 31 journals. 15 papers, 7.69% as other various publication channels. *Oral oncology (IF5.337), and Journal of Precision Oncology* are his most favorite journals wherein 44 (22.56%), and 11 (5.65%) papers have been published, followed by *Journal of Cancer Research & Therapeutics (8 papers), Journal of Clinical Oncology* (IF42.1) *(7 papers), and British Journal of Oral and Maxillofacial Surgery* (7 papers). It is notable that Vishal Rao is the chief editor *of Journal of Precision Oncology.* His papers have published in a group of five journals with 6 papers each, including *Indian Journal of Otolaryngology and Head & Neck Surgery, International Journal of Head and Neck Surgery, Journal of Head & Neck Physicians and Surgeons, and Medical Hypotheses.* He also published 5 papers in *Indian Journal of Surgical Oncology*, and 3 papers in International Journal of Otorhinolaryngology and Head and Neck Surgery. A group of three journals has published 4 papers each, and another group of 11 journals also has published 2 papers each including high impact factor journal viz, The Lancet (IF 202.731), BMJ: British Medical Journal (IF93.6), The Lancet Oncology (IF62.1), etc. There are 31 journals with one paper each. Apart from this, there are also 15 other communication channels where he has published one paper each. Table 10 also shows that Vishal's most of the papers have originated India, USA, UK, Netherlands, Denmark, and France, etc. Only 51 (nearly 26%) papers are national level publications that have been published from India. His papers have published in high impact factor-oriented journals, though, IF of few journals could not be ascertained. Apart, Fig. 3 highlights a map of country wise scattering of his publications in leading journals.

Table 10: List of Preferred Journals for Publications

Sr. No.	Publication Channels	Papers	%-age	Cum-%-age	FPY	LPY	Place of Publications	IF
	Journals							
1	Oral oncology	44	22.56	22.56	2007	2024	Netherlands	5.337
2	Journal of Precision Oncology	11	5.65	28.21	2020	2022	Karnataka (India)	
3	Journal of Cancer Research & Therapeutics	8	4.1	32.31	2009	2017	Kolkata (India)	1.4
4	Journal of Clinical Oncology	7	3.58		2008	2024	USA	42.1
5	British Journal of Oral and Maxillofacial Surgery	7	3.58	39.47	2019	2023	UK	1.7
6	Indian Journal of Otolaryngology and Head & Neck Surgery	6	3.07	38.95	2009	2024	Kolkata (India)	0.6
7	International Journal of Head and Neck Surgery	6	3.07		2010	2014	Gujrat (India)	
8	Journal of Head & Neck Physicians and Surgeons	6	3.07		2020	2024	Maharashtra (India)	0.2
9	Journal of Oral Pathology & Medicine.	6	3.07		2020	2024	Denmark	3.3
10	Medical Hypotheses	6	3.07	54.82	2020	2023	Netherlands	4.411
11	Indian Journal of Surgical Oncology.	5	2.56	57.38	2012	2021	Chennai (India)	0.6
12	Head & Neck	4	2.06		2019	2020	USA	2.3
13	Indian Journal of Medical Sciences	4	2.06		2020	2021	Maharashtra (India)	
14	Oral Oncology Reports	4	2.06	63.56	2023	2023	Netherlands	0.2
15	International Journal of Otorhinolaryngology and Head and Neck Surgery	3	1.53	65.09	2017	2019	Gujrat (India)	0.56
16	Archives of Otolaryngology: Head & Neck Surgery	2	1.03		2009	2009	USA	
17	Biomedical Journal of Scientific and Technological Research	2	1.03		2017	2017	USA	0.548
18	BMJ: British Medical Journal	2	1.03		2021	2022	UK	93.6
19	Cancer: an international interdisciplinary journal of the American Cancer Society	2	1.03		2018	2020	USA	6.1
20	International Journal of Oral and Maxillofacial Surgery	2	1.03		2020	2021	Netherlands	2.789
21	Journal of Global Oral Health	2	1.03		2020	2020	Mumbai (India)	
22	Journal of Oral Medicine and Oral Surgery	2	1.03		2020	2021	France	
23	Oral Surgery Journal	2	1.03		2019	2022	USA	0.9
24	The Lancet	2	1.03		2024	2024	UK	202.731
25	The Lancet Oncology.	2	1.03		2010	2010	UK	62.1

Sr. No.	Publication Channels	Papers	%-age	Cum-%-age	FPY	LPY	Place of Publications	IF
26	The Laryngoscope	2	1.03	76.42	2008	2020	UK	2.442
27-57	31 journals @1 paper each	31	15.89	92.31				
58-72	Other Channels	15	7.69	100				
	Total	195	100					

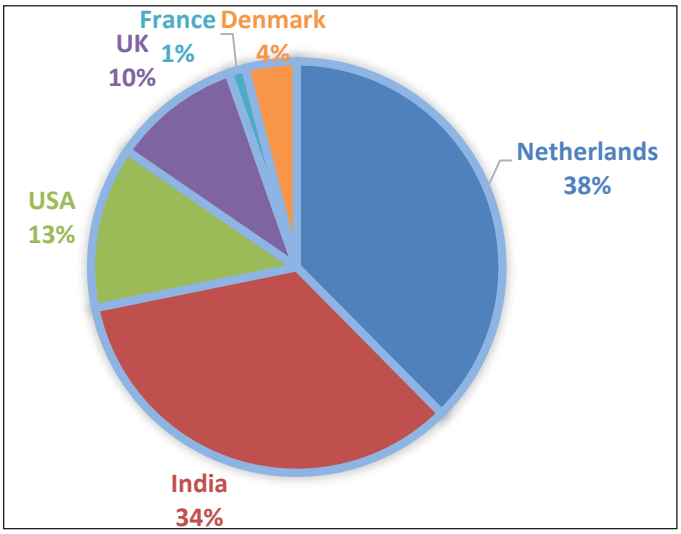

Fig. 4: Country-Wise Publication in Most Favourite Journals

Testing of Bradford's Law Validation

In this study, three zones of the law comprise of 39.95% papers from first 5 journals, 33.86% from next 18 journals, and 20.01% from the rest 34 journals. As per Bradford's low, every zone should have around 33% of total publications. Alternatively, 1: n: n^2, on the basis of zone wise number of communication medias i.e. 5:18:34 = 1:3.6:6.8. Since here, last zone could not cover 33% or ratio method does not satisfy, Bradford's law could not validate for the dataset.

Top 11 Highly Cited Scholarly Works

Table 11 highlights Vishal's 11 highly cited scholarly works and citation growth rates (CGR) during 2007-2024. He received the highest number of citations i.e. 136 in GS and 156 in RG from the article "*Carotid body tumors: objective criteria to predict the Shamblin group on MR imaging".* Age of this paper is 16 and CGR is 8.5 GS and 9.75 in RG. Next is "*COVID-19: Loss of bridging between innate and adaptive immunity?",* 4 years old and CGR counts 9.75 in GS and 6.75 in RG. The maximum CGR has been counted in the first two papers that is 9.75 in both the databases RG and GS respectively.

Table 11: Citation Analysis

Sr. No.	Name of Articles	Publication Channels (Year)	Times Cited (TC)		Ranks		Articles' Age (A) in 2024	Citation Growth Rate =TC/ A	
			GS	RG	GS	RG		GS	RG
01	Carotid body tumors: objective criteria to predict the Shamblin group on MR imaging	American Journal of Neuroradiology (2008)	136	156	1	1	16	8.5	9.75
02	COVID-19: Loss of bridging between innate and adaptive immunity?	Medical Hypotheses (2020)	39	27	2	3	4	9.75	6.75
03	Mesenchymal stem cells-bridge catalyst between innate and adaptive immunity in COVID 19	Medical Hypotheses (2020)	33	30	3	2	4	8.25	7.5
04	Is EGFR really a therapeutic target in head and neck cancers?	Journal of Surgical Oncology (2019)	23	12	4	5	5	4.6	2.4

Sr. No.	Name of Articles	Publication Channels (Year)	Times Cited (TC)		Ranks		Articles' Age (A) in 2024	Citation Growth Rate =TC/ A	
			GS	RG	GS	RG		GS	RG
06	Incidence of micrometastasis and isolated tumour cells in clinicopathologically node-negative head and neck squamous cell carcinoma	Journal of Maxillofacial and Oral Surgery (2020)	20	17	5	4	4	5.00	4.25
07	Role of angiogenetic markers to predict neck node metastasis in head and neck cancers	Journal of Cancer Research and Therapeutics (2010)	19	12	6	5	14	1.36	0.86
08	Tongue cancer: a discrete oral cavity subsite	Oral Oncology (2019)	18	12	7	5	5	3.6	2.4
09	8" S" in oral cancer	Oral Oncology (2018)	14	-	8	8	6	2.33	-
10	COVID-associated mucormycosis (CAM): is the Delta variant a cause?	The British Journal of Oral & Maxillofacial Surgery (2022)	11	9	9	7	2	5.5	4.5
11	Reactive artificial intelligence using big data in the era of precision medicine	JAMA Surgery (2020)	11	10	10	6	4	2.75	2.5

Annual Growth Rate (AGR) and Cumulative Growth Rate (CGR)

Table 12 counts AGR and CGR. There are several formulae used for calculation of AGR. One of the popular methods may use to determine its value. AGR may be calculated for each year or longer than one year. Formula for AGR is $AGR= (C_V-I_V) \times 100/ I_V$,

where

C_V = Current value,

I_V = Initial value,

n= number of years,

here n=1 year.

For example (data from Table 12), Paper published by the scientist is 1 in 2007 and 4 in 2008. Since 2008 is the latest year, current value is 4 and 2007 is the starting year, initial value is 1between the two years. Year difference = 2008-2007 = 1 year. So, AGR = (4-1) x100/1 = 300/1 = 300, and so on.

Table 12: Annual Growth Rate of Vishal's Publications

Year	YPC	CYPC	AGR %	CGR %
2007	1	1	0.00	0.00
2008	4	5	300	400
2009	4	9	0.00	80
2010	9	18	125	100
2011	2	20	-77.78	44.44
2012	3	23	50	15
2013	1	24	-66.67	4.34
2014	3	27	200	12.5
2015	0	27	-100	0.00
2016	5	32	0.00	18.52
2017	13	47	160	46.87
2018	9	54	-30.77	14.89
2019	18	72	100	33.33
2020	53	125	194.44	73.61
2021	26	151	-50.94	20.80
2022	22	173	-15.38	14.57
2023	13	186	-40.91	7.51
2024	9	195	--	--

Abbreviations: YCP = Yearly Publication Count; CYPC = Cumulative Yearly Publication Count.

Compound Annual Growth Rate (CAGR)

CAGR is calculated over a specified period of time longer than one year. Formula for CAGR is: $CAGR = \{(C_V/I_V)^{1/n} -1\} \times 100$

Where,

C_V = Current value

I_V = Initial value,

n = number of years = difference between initial year and current year.

For example (data from Table 12), one paper has published by the scientist in 2007 and 13 in 2023. Note that as the publications in year 2024 are not yet fully ascertained, this year has not been taken as current year. Since 2023 is the latest year, current value is 14 and 2007 is the starting year, initial value is 1 between 2007 and 2023. Year difference = 2023-2007 = 16 years. So, CAGR = $\{(14/1)^{1/16} -1\}$x100 = $\{(14)^{1/16} -1\}$ x100 = $\{(14)^{0.0625} -1\}$ x100 = {1.1793 -1}x100 = 0.1793 x100 = 17.93%. It means that over 16 years, the publication grew at an average rate of 17.93%, compounded each year.

Relative Growth Rate (ReGR) and Doubling Time (DoT)

ReGR and DoT are two important indicators in bibliometric study and there is a direct relation between them. ReGR is the decrease in the number of research article per unit of time. Table 13 counts values of ReGR and DoT from 2007-2024; and Fig. 5 shows a graphical relationship between them. ReGR is calculated year-wise. The following formula has been used to find the values of RGR and DoT (Mondal & Raychoudhury, 2017; Jain & Meera, 2022; Sawale & Mete, 2021; Mondal, 2021):

$ReGR = X_2 – X_1 / Y_2 – Y_1$

Where, X_1 = Natural log of initial number of published articles

X_2 = Natural log of final number of published articles

$Y_1 – Y_2$ = Unit difference between the initial year (time) and final year (time)

Here, time difference is one year. So, formula shortly is $ReGR = X_2 – X_1$

In case of this study, it is observed that value of ReGr has decreased from 0.588 in 2008 to 0.073 in 2024 whereas value of DoT has increased 1.1178 in 2009 to 9.493 in 2023.

Table 13: ReGR and DoT of Research Articles Published

Year	AP	CmP	X_1	X_2	ReGR = (X_2 - X_1) / 1	DoT = 0.693/ ReGR
2007	1	1	-	‘0.00	-	-
2008	4	5	0.00	1.6094	-	-
2009	4	9	1.6094	2.1972	0.588	1.178
2010	9	18	2.1972	2.8903	0.693	1.000
2011	2	20	2.8903	2.9957	0.105	6.600
2012	3	23	2.9957	3.1354	0.139	4.985
2013	1	24	3.1354	3.1780	0.043	16.12
2014	3	27	3.1780	3.2958	0.118	5.872
2016	5	32	3.2958	3.4657	0.169	4.101
2017	13	47	3.4657	3.8501	0.384	1.805
2018	9	54	3.8501	3.9889	0.139	4.985
2019	18	72	3.9889	4.2766	0.287	2.415
2020	53	125	4.2766	4.8283	0.552	1.255
2021	26	151	4.8283	5.0172	0.189	3.667
2022	22	173	5.0172	5.1532	0.136	5.095
2023	13	186	5.1532	5.2257	0.073	9.493
2024	9	195	5.2257	--	--	--

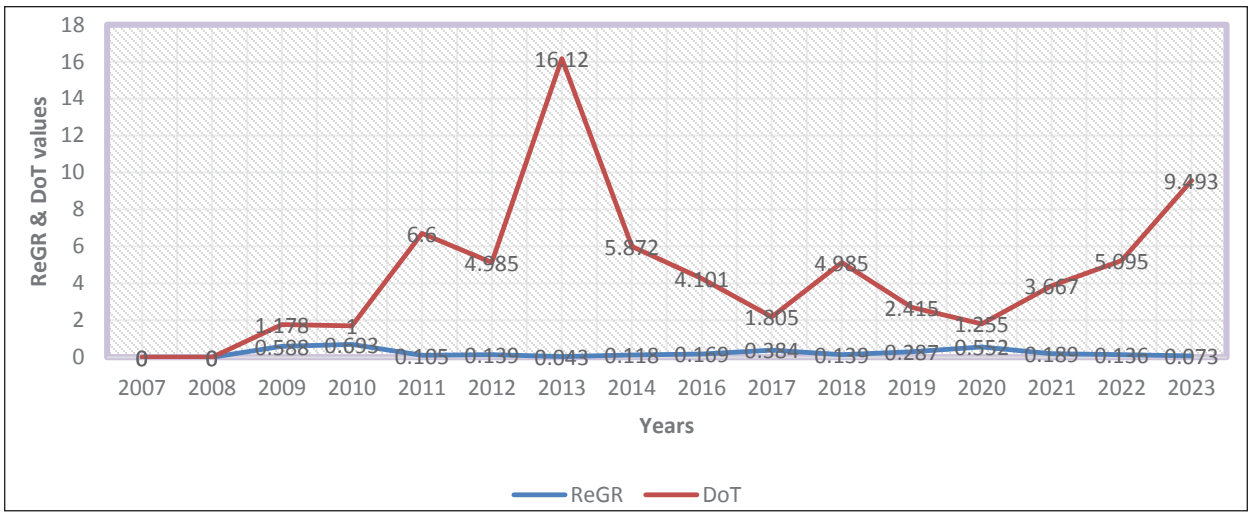

Fig. 5: Graphical Relationship Between ReGR and DoT

CONCLUSION

Dr. Vishal Rao is a prominent head and neck oncologist and robotic surgeon, well known for his innovative contributions to the field of throat cancer treatment. He is recognized for his dedication to affordable healthcare, particularly through the invention of the Aum Voice Prosthesis, a world's cheapest (only Rs. 50/- and the best voice device that helps throat cancer patients whose voice boxes have been removed by surgery to get their voice back. Its cost in other countries is nearly Rs. 15,000-35,000 so far. Dr. Rao is also an advocate for tobacco control and public health, actively working to raise awareness about cancer patient prevention. His work reflects a deep commitment to both patient care and social impact in the medical community. He is not only just an oncologist, also he motivates many in the medical field, clinical excellence, research, and humanitarian efforts. In his desperate effort, he has an important role behind the setting up the Karnataka state's first plasma bank in Centre of Academics & Research, HCG Cancer Hospital. Many critical Covid-19 patients were cure using Convalescent Plasma Therapy (CPT) in crisis of Corona vaccine (Thakur, 2020). He is one of the stallers in Indian medical research and deserves the "Bhart Ratna" award for his outstanding contribution medical health care. Let's all appeal to our government to confer the award to the real Bharat Ratna, Dr. Vishal Rao. Everyone should express deep gratitude for his incredible kindness that is truly appreciated us. Dr Vishal, before making his own innovation 'Aum Voice Prosthesis', donated imported speaking device (which was very costly) to the patients in need. Besides, he also collected money for his charity through his trust for the poor patients. It may conclude stating his important words: "The pain of cancer is the same for all, whether one is rich or poor" (Prasad, 2018) and it was his main reason to develop the world's cheapest speaking device "Aum" that is a great social innovation of 20th century. Dr. Vishal is a "possibilitarian", not just a dreamer, a doer who has great intent on transforming possibility into reality (Saez, 2022).

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