Observational analysis of ayurvedic principles, ayurvedic hospital data, and patient outcomes

Vinay Mahajan

Guides:

Dr. Ashwini Mathur

Dr. Girish Tillu

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# Statement of purpose:

## Title:

Observational analysis of ayurvedic principles, ayurvedic hospital data, and patient outcomes By Vinay Mahajan, Girish Tillu, Ashwini Mathur, Darshan Shankar

## Short background:

Ayurveda has been practiced over many centuries in India. It will be safe to assume that the conceptual developments in ayurvedic knowledge base have taken place through every day observations and basic laws of nature. These fundamentals have been adjusted to the relevant times as per the passage of time, which is quite evident from vast literary history of Ayurveda which covers subjects like pharmacology, principle of diagnosis and treatment for all branches of medicine and surgery, philosophical framework and logic, pharmacy and numerous pharmacopeias. Traditional texts enumerate more than described for each disease condition (1).

Generating credible evidence for such a large pool only through modern experimental means such as trials is very challenging. Current hierarchical evidence model is being challenged by methodologists and the circular model comprising observational research methods are proposed for CAM research (2). Ayurveda like any other system of medicine, is practiced more in clinics than in clinical research setting, where there are no artificial restrictions on usage of medicines, duration of treatment or type of patients to treat, which is next to impossible in a protocol driven clinical trial setting. To plug the gap of missing empirical evidence, systematic analysis of observational clinical data is required. (3, 4) This project is focused on I-AIM clinical data for study of efficacy and safety trends. In our study of modern regulatory framework, we recognized similarity between concepts written by Charaka and ICH guidelines. This will form the philosophical basis for the research question.

## Problem:

To develop a replicable clinical documentation and HMIS system in I-AIM hospital setting, that can generate reliable data on disease classification, treatment protocols and outcomes. To test this system for assessing clinical and patient reported outcomes in musculoskeletal and metabolic diseases at I-AIM hospital.

## What is the present status in understanding the problem?

The problem of observational data analysis is split into 4 parts and is presented below. Each of the problem area is explained, the specific actions and possible outcomes are outlined.

### Literature review:

Philosophical commonalities between the ICH and ayurvedic system:

*Charaka Samhita* will be studied and interpreted on broad parameters used by ICH framework quality, efficacy and safety. This will provide philosophical connections between two systems and will create evidence base for the subsequent research work. This work is an effort to bridge the gap between ayurvedic and bio medicinal researchers. Furthermore, *Charaka Samhita* will be studied to understand diagnosis and treatment paradigm and outcome measures. To keep the work within practical limits we will focus on musculoskeletal and metabolic diseases. In depth study of various possible variations of the disease, treatment options, diagnostic and prognostic parameters will be carried out.

**Specific actions:**

1. Study ICH guidelines (quality, efficacy, safety) and *Charaka Samhita* (e.g. Vimana sthana) – see Appendix table 1 below
2. Diagnosis approaches (e.g. *Dashavidhapariksha*)
3. Treatment options (See Appendix figure 1)
4. Outcome measures (Ayurvedic as well as bio medicinal endpoints)

### Hospital data analysis methods:

Over the years, digitization of the hospital data has helped analytic discoveries, rather than only the straight facts. The day to day hospital settings generate a multifold data than clinical trials. This revolution has not been used by the ayurvedic medical industry. These advances should be used to improve patient wellness, better clinical decisions, better care coordination, cut down treatment abuse, and even to cut down costs.

**Specific actions:**

1. Review of the literature to understand the current methods employed across world
2. Check for potential solutions to be implemented at hospital (e.g. patient data dash boards)
3. Provide suggestions for improvements in day to day functioning at hospital

### Data analysis of Treatment SOPs and implementation:

The I-AIM hospital has generated 91,000 patient visits data over the years and perhaps the largest electronically available ayurvedic treatment database. What insights would come out of such a large database? A study will be carried out on patients in 2 disease areas musculoskeletal diseases, and metabolic diseases. This would provide us guidance for the future empirical research and analysis. The concepts explained in the ancient texts have not been proven empirically but have never been disproved either. The analysis of this database would present us with empirical insights never seen before.

**Inspection of the current database:**

1. I-AIM hospital database **INSTA** will be studied for
   1. What kind of data is collected?
   2. What are the issues with the current data
   3. Potential fixes for the future
2. Queries will be posted to the IT team
3. Specific reports or lists will be requested if considered necessary e.g. treatment data is not reported by INSTA reports fully.

Currently, as of August 2016, at IAIM hospital, treatment SOPs are written for musculoskeletal diseases, and metabolic diseases. Several modifications for diagnosis, treatment and outcome measures have been suggested. These will be implemented in the hospital practice over the coming months. The collected data based on these revised SOPs will be analyzed to validate the findings.

**Specific actions:**

1. Statistical methods to be employed:
   1. Graphical methods to display a lot of data in a concise form, trellis graphics, heat maps, etc.
   2. Pattern or trend analysis: to understand the underlying clusters within the data
   3. Decision theory analysis: to understand how the treatment gets assigned and what calculations, algorithms go through a doctor’s mind
   4. Multi-variate analysis: to model the data and gain more insights
2. Innovative and emerging tools and techniques from Omics / bioinformatics etc.

### Development of robust and replicable clinical documentation based on SOP:

**Specific actions:**

1. Define factors for the completeness, robustness of SOPs
2. Create a detailed analysis plan for analyzing the implementation
3. Analyze the results for completeness, robustness and replicability of the SOPs,
4. If any shortcomings are observed then revisions to the SOPs will be suggested

## Expected outcomes:

1. Philosophical linking between the ayurvedic scientific concepts and western medicinal concepts – building bridges between sciences
2. Baseline understanding of the data and descriptive analysis of the current facts of ayurvedic hospital data
3. Hospital data analysis methods development

**Reference:**

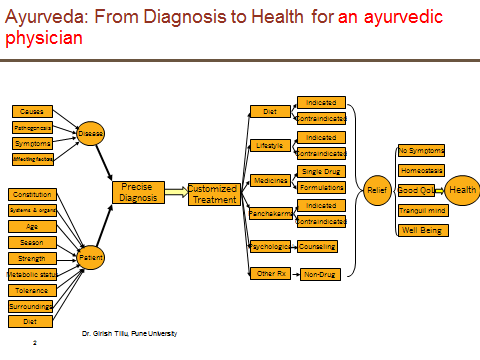
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3. Vaidya Rama, Observational therapeutics: Scope, challenges, and organization, <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3255445/>
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**Appendix:**

Table 1: Cells highlighted in Green show similarities between ICH framework and *Charaka Samhita*.

|  |  |  |  |
| --- | --- | --- | --- |
| Quality | Efficacy | | Safety |
| Q1A – Q1F Stability | E1 Clinical Safety for Drugs used in Long-Term Treatment | E14 Clinical Evaluation of QT | S1A - S1C Carcinogenicity Studies |
| Q2 Analytical Validation | E2A – E2F Pharmacovigilance | E15 Definitions in Pharmacogenetics / Pharmacogenomics | S2 Genotoxicity Studies |
| Q3A – Q3D Impurities | E3 Clinical Study Reports | E16 Qualification of Genomic Biomarkers | S3A - S3B Toxicokinetics and Pharmacokinetics |
| Q4 – Q4B Pharmacopeias | E4 Dose-Response Studies | E17 Multi-Regional Clinical Trials | S4 Toxicity Testing |
| Q5A – Q5E Quality of Biotechnological Products | E5 Ethnic Factors | E18 Genomic Sampling | S5 Reproductive Toxicology |
| Q6A – Q6B Specifications | E6 Good Clinical Practice |  | S6 Biotechnological Products |
| Q7 Good manufacturing practice | E7 Clinical Trials in Geriatrics Population |  | S7A - S7B Pharmacology Studies |
| Q8 Pharmaceutical Development | E8 General Considerations for Clinical Trials |  | S8 Immunotoxicology Studies |
| Q9 Quality Risk Management | E9 Statistical Principles |  | S9 Nonclinical Evaluation for Anticancer Pharmaceuticals |
| Q10 Pharmaceutical Quality system | E10 Choice of Control Group |  | S10 Photosafety Evaluation |
| Q11 Development and manufacturing of Drug Substance | E11 Clinical Trials in Pediatric Population |  | S11 Nonclinical Safety Testing |
| Q12 Lifecycle Management | E12 Clinical Evaluation by Therapeutic Category |  |  |

Figure 1:



# Introduction

The practice of medicine has a history of three thousand years in India. Ayurvedic medicine is one of the world’s oldest medicinal systems. Caraka samhita and Sushrut samhita, two of the ancient texts written in Sanskrit are considered to be the back bone of the ayurvedic medicines. But there is a belief that these practices would have started much before these two samhitas were written. Ayurveda combines a number of approaches, such as changes in lifestyle, Ayurvedic medicines, cleansing or detoxifying, massage, exercise, and meditation. Overall, it aims to strengthen and purify the body and mind and increase spiritual awareness.

Modern medicine took giant strides in the 19th century with advances in chemistry and laboratory equipment. The western medicinal system has surged ahead and has witnessed many fantastic breakthroughs which are helping human kind. For any science to remain relevant to the era there should be ongoing research activities. Any science which is stagnant cannot remain attractive and will soon lose its usefulness. This is even applicable to Ayurvedic medical science.

Ayurveda is considered to be a science based on pure logical explanation. These are called Darshana. But in more than 2000 – 3000 years there have not been major conceptual additions to the science. The concepts written in samhitas are lagging behind compared to the present knowledge base. But this does not make the science less important. There is a huge opportunity to use the traditional understanding in combination with newer available technology like x-rays, ECGs, CT scans, biomarker understanding, etc. to achieve cure for diseases.

Ayurvedic medical system has always been an individualized therapy due to its very nature. For this to have worked, there would have been very good scientific basis. Traditionally, “one fits all” or “big block buster drugs” has been the approach in western medicine system. But with the scientific advances and many biomarkers coming into existence, the focus is moving towards customized medicine, which only seemed possible in sci-fi movies.

There is no documented reference within the samhitas or other historic texts about how did the great sages understand the intricacies of treating different diseases, identifying the medicinal plants, their formulations, etc. Could we assume that did they conduct experiments to understand these properties and somehow that did not get documented at all? Or could it be attributed to our inability to understand the cryptic nature of the shlokas? Could we even dare to assume that there were clinical trials conducted? If not then, could we put a concerted effort on gaining more understanding via good quality clinical trials?

One should not go with the impression that classical Ayurveda has no evidence base. In fact, Ayurveda has always been evidence conscious, and most of the principles and treatment modalities seem to have been critically tested and validated for the conditions existing in their own time frame. The ancient concept of evidence is based on fourfold testing, viz., (1) Pratyaksha pramana (direct observation), (2) Anumana pramana (inferential evidence), (3) Aptopadesa (scriptural evidence) and (4) Yukti pramana (planned rational experimental evidence).

This fourfold battery of testing new knowledge is classical of ancient Indian scientific tradition, which seems to be highly contemporary.

The evidence base of contemporary Ayurveda is to be visualized in several forms, including (1) Textual evidence and folklore claims, (2) Experience-based evidence, (3) Longstanding traditional use, (4) Mass acceptability and (5) New scientific evidence. It cannot be overemphasized that in spite of all the strengths of primary evidence, one cannot deny the need to develop new supportive scientific evidence without which contemporary Ayurveda cannot attain the status of a real global science accessible for the larger benefit of humanity at large. WHO also holds a similar view. However, it must be emphasized that fruitful strategies for developing new scientific evidence cannot succeed if traditional primary evidence is ignored. New research is to be planned on the foundations of existing textual and experience-based evidence. The frequently used term "evidence" essentially means a relevant and reasonable proof for a fact or truth; such a proof need not be necessarily in words or terms of today's science alone.

Even after accepting major differences, there are quite a lot of similarities in the principles of the traditional ayurvedic medicine and western medicine. What *Charaka* and some of the earliest “doctors” defined in the historical texts still holds validity in today’s world.

# Chapter 1: Philosophical commonalities between the ICH and ayurvedic system:

Big pharmaceutical companies have become one of the targets of critics for high prices and not doing enough for society. The health authorities are becoming more stringent in their safety review which has also resulted in less drug approvals and many drugs withdrawn from the market. To add to this the insurance companies are becoming stricter in their coverage making it difficult for a common man to afford lifesaving drugs.

We have a generic market which again base their studies on the big pharmaceuticals and keep battling for a good market price. With innovation taking a back seat here there is only a mad run for money.

In this rage for drugs v/s money v/s life can we look at any alternate solution to combat the prevailing situation? Is there no means of getting the need identified through means which are less invasive and much affordable?

Why do we not look at our own long historic tradition of medicine “The Ayurveda”.

Approximately 3000 – 5000 year old Indian traditional medicinal system is based on 2 major treaties *Charaka Samhita* (for physicians) and *Sushruta Samhita* (for surgeons)Earliest texts date on Ayurveda, which is written by *Charaka,* back to 760 BC, around 660 BC Sushruta wrote *Sushruta Samhita,* a medical text about the surgical approaches used in that period.

Ayurvedic medical system is a world of medicine and the most holistic system available. *Charaka Samhita* is considered to be a very highly technical text, which deals with 8 branches of *ayurveda*. (1) Internal medicine (*kayachikitsa*), (2) Ear, nose, throat (*Shalakya Tantra*), (3) Toxicology (*Vishagara-vairodh Tantra*), (4) Pediatrics (*Kaumara bhritya*), (5) Surgery (*Shalya Tantra*), (6) Psychiatry (*Bhuta Vidya*), (7) Aphrodisiacs (*Vajikarana*), (8) Rejuvenation (*Rasayana*). These details point to holistic approach. These could rival various franchisees.

*Rig-veda* (a lot of things, a lot of medical content), *Sam-veda* (Soma sacrifice), *Yajur-veda* (entire sacrificial rite), *Athar-veda* with a lot of medical text are the 4 vedas which could be considered to be the first of its kind encyclopedias written by human kind. These are considered to be written around 1500 to 2000 BC. *Athar-veda* is considered to be written in 1200 BC. Ayurveda is considered to be based on these vedas.

Under the rule of king *Ashoka* Ayurveda flourished. The ayurvedic treatment was in use till 12th century, but the decline started after the invasion of India by the Muslims.

No documentation of any major development on ayurvedic text or ayurvedic discipline has been documented post 12th century.

Similar developments have been seen happening in China around 300 BC and few evidences of medicinal science development in Middle East around 980 AD known as Unani medicine are also seen.

Physician Hippocrates of Kos (ca. 460 BC – ca. 370 BC), is considered the “father of modern medicine”. The Hippocratic Corpus is a collection of around 70 early medical works from ancient Greece, associated with Hippocrates and his students. Hippocrates and his followers were first to describe many diseases and medical conditions.

There are major differences in ayurvedic medicinal system and western medicinal system, in terms of what is the origin of the disease, what causes it, how to treat the same? But the ultimate aim in both the systems is to have disease free existence for human beings. Modern medicine took giant strides in the 19th century with advances in chemistry and laboratory equipment. The western medicinal system has witnessed many fantastic breakthroughs which are helping human kind. Some of these have come at a huge cost not just monetary but sometimes at a cost of ethics and integrity.

Traditionally, “one fits all” or “big block buster drugs” has been the approach in western medicine system. But with the scientific advances and many biomarkers coming into existence, the focus is moving towards customized medicine, which only seemed possible in sci-fi movies. Today the western medicine is aiming towards customized therapies for patients by thinking in terms of disease and patient as one constraint and solution very patient centric i.e. one patient – one solution.

Ayurvedic medical system has always been an individualized therapy due to its very nature. For this to have worked, there would have been very good scientific basis.

Despite of these major differences in their ideologies, there are quite a lot of similarities in the principles of the traditional ayurvedic medicine and western medicine. What *Charaka* and some of the earliest “vidyas (doctors)” defined in the historical texts is still valid in today’s world. The concepts defined in the Helsinki declaration, GxP guidelines and the ICH guidelines concur with what is in the historic books.

- What is a hospital?

- Who is a doctor?

- How to treat patients?

- Who should be treated, how much money should be charged?

- How should the special populations (e.g. pediatric population, geriatric population) be treated?

These questions have similar answers in both the worlds. Why is it important to know this? This could be a very crucial step in order to achieve the evidence which western world is expecting. The similarities are very stark and would even prompt us to think “are we trying to re-do what we know for so many years?”

It is up to us now to expedite this process of finding similarities and identify strategy to capitalize on the same. This step would help in building confidence amongst the two medicinal systems. Below are few examples of the like mindedness of the two systems:

|  |  |  |
| --- | --- | --- |
| Topic | Modern guidelines | Historic text |
| Well-being of patients | Helsinki declaration:  The first and foremost thing in a clinical practice or a clinical trial would be of patient safety. World Medical Health (WMA), in their 18th General assembly, 1964 came up with “Ethical Principles for Medical Research Involving Human Subjects”. The declaration covers various principles of medical research and medical care. Focus on protection, well-being of the human beings participating in the clinical research.  As per the current version of the declaration, 59th WMA General Assembly, Seoul, October 2008, there are 35 sections across 3 major headings A. Introduction, B. Principles for all medical research, C. Additional principles for medical research combined with medical care.  One of the most important sentences: The health of my patient will be my first consideration and a physician shall act in the patient’s best interest when providing medical care.  This declaration protects various types of vulnerable populations. | Ayurveda is considered to be eternal in nature. As a part of “study” in *Charaka Samhita*, the ayurvedic physician was taught to keep all the living things before. He was taught to make all the efforts to provide health to the patients. He was taught to think about the welfare of society and not to think ill about any of the patients.  The physician should not treat female patients or kids (pediatrics) without the required consent, which could be a parallel to the “vulnerable population”.  The physician is expected to keep all the data about patient confidential. *Charaka Samhita Viamansthana* *8 #13*  Page 113 of part I has explanation related to what should be done |
| Qualifications of a doctor and concept of a hospital | In this world of documentation and audit trails, every single item needs to be documented. This evidence has to be submitted along with each and every Clinical Study Report to various health authorities around the world.  ICH E6 “Guidelines for Good Clinical Practice”, outline international ethical and scientific quality standard for designing, conducting, recording and reporting trials that involve the participation of human subjects.  Section 4 of the guidelines focuses on “INVESTIGATOR” which is defined as in section 1.34 of the guideline: “A person responsible for the conduct of the clinical trial at a trial site. If a trial is conducted by a team of individuals at a trial site, the investigator is the responsible leader of the team and may be called the principal investigator. See also Subinvestigator.”  Section 4.2 talks about “Adequate Resources”. | *Charaka* defined how a hospital should be in *Sutrashtan adhyaya 15 shloka 7* According to *Charaka,* thehospital should be designed by an architect, someone who is trained in “*vastu shastra*”.  The concept of a hospital defined in the texts is in line with the modern thought process. The thought process of having a clean place which is accessible to common man, a pharmacy with abundant medicines and availability of medicinal equipments still holds good in these times.  There are references to the number of attendants (16 in number), furniture, livestock, fixtures which should be available in the hospital “house”.  The building should be strong and well-built in  a location free from high winds, although it should be constructed in such a way that gentle winds can pass through it if desired, freshening the interior environment. The building should not be built in  mountainous places (for lack of accessibility), and  nor should it be located next to a bigger building (which brings misfortune upon it). Dusty locations, wet environments, or locations with foul or toxic smells should be rejected as building sites. The attendants that work in the clinic or hospital should be enthusiastic, skilled and compassionate. Caraka states that people well versed in music and poetry should also be encouraged to participate in the healing centre. Outside the building a herb and vegetable garden should supply medications and food for the clinic or hospital, and certain animals, such as a cow and her calf, and birds such as quail and partridge, should be kept by the facility for the benefit and enjoyment of the patients and faculty.  He defined quadraple concept for successful medical practice which included *vaiyda* (the doctor), *paricharika* (a nurse), good medicine and good patient. *Sutrashtan adhyaya 15 shloka 9*  In *Sushruta samhita Sutra sthan adhyaya 2 shloka* |
| Informed use of treatment | As per ICH E6 guidelines, section 4.6.6, it is important to tell a patient about what is being administered to him or her.  4.6.6 The investigator, or a person designated by the investigator/institution, should explain the correct use of the investigational product(s) to each subject and should check, at intervals appropriate for the trial, that each subject is following the instructions properly.  This is a very important GCP constraint before administering any kind of a drug to any patient or a subject. | There are a lot substances used as medicines in the ayurvedic treatments, documented in various texts. Different types of flora, fauna, poisonous materials, meat, etc. are used. It is a *vaidya’s* duty to inform the patient what is being administered before administering the medicine. A drug, if unknown, is fatal like poison, weapon, fire and thunderbolt while, if known, is vitalizer like nector, as per *SutraSthan adhyaya 1 shloka 124-125*. |
| Pediatric population and concerns | The pediatric population represents a vulnerable subgroup. Therefore, special measures are needed to protect the rights of pediatric study participants and to shield them from undue risk.  ICH E11 guideline “CLINICAL INVESTIGATION OF MEDICINAL PRODUCTS IN THE PEDIATRIC POPULATION” is designed to provide an outline of critical issues in pediatric drug development and approaches to the safe, efficient, and ethical study of medicinal products in the pediatric population.  There are very limited number of medicinal products available labeled for pediatric usage. Ages are defined in completed days, months, or years.   * 1. Preterm newborn infants   2. Term newborn infants (0 to 27 days)   3. Infants and toddlers (28 days to 23 months)   4. Children (2 to 11 years)   5. Adolescents (12 to 16-18 years (dependent on region))   This kind of classification is very important to correctly identify the dose level.  Similarly, these are covered under Helsinki declaration. | *Charaka* specifically talks about the pediatric diseases in one of the 8 branches of ayurveda, *Kaumarabhrtya.*  Some of the diseases which are seen in adults are the same in pediatrics, but only in less quantity. These are very difficult to identify as pediatric patients are unable to express what they are going through. Smaller doses should be given and formulations of drugs should be sweet and soft. These are the problems which are still worked on even in the modern times.  *Charaka* defines age groups in *vimansthan adhyaya 8 and shloka 122.* He has classified life into 3 age groups, childhood (up to 16 years), middle age (up to 60 years) and old age (up to 100 years). |
| Ethnic suitability | ICH guideline E5 “ETHNIC FACTORS IN THE ACCEPTABILITY OF FOREIGN CLINICAL DATA” outlines guidelines for usage of a medicinal product across various parts of the world. It provides a framework for evaluating the impact of ethnic factors upon a medicine’s effect, i.e., its efficacy and safety at a particular dosage and dose regimen. | *Chikitasasthan adhyaya 30 and shloka 316-328* in these shlokas Charaka has written about the benefits of using suitable foods.  A drug could fail if the doctor does not take age, sex, strength, body, etc. into account before prescribing it.  There is a reference to different parts of “India” and what kind of food and drugs could be suitable to them. Madhya desa, south region, eastern region, Chinese parts.    For patients, the drug should be administered along with the items suitable to them because the suitable medicine provides strength quickly and does not harm even if taken plentiful. [Even if taken in large dose.]  Other than just ethnic suitability there are references to how males should be treated differently than females. |
| Formulations, route, type of doses, frequency, Food effect | In the development cycle of a drug, there are different type studies conducted to understand the properties of the drug. These could be bioavailability, formulation-route-dosing frequency studies, drug-drug interaction studies, food effect studies, QT studies, organ impairment studies (renal, hepatic, etc. impairment studies)  These studies help in making the label of the drug. | There are a lot of references in various texts about when should drug be given, how much should it be given, and so on.  They had understood the importance of considering route of administration, time, place, suitability and dose.  “*anupana*” is a special category of the Ayurvedic pharmacy which relates to the usage of certain additional substances given along with the medicines. Water, milk, *ghee*, *jaggery,* honey,fresh plant juices, meat broths, etc. could be some of the examples.  Dosing strategies: *Abhakta* (dosing on empty stomach), adhobhakt (dosing after meal), *muhuh muhuh* (multiple times a day), *nisa* (dose to be taken before sleeping) etc.  The following shlokas from *Chikitasasthan adhyaya 30 and shloka 298-300,* explain time of administration, which could be equated to Food effect.  (page 550 in part I)  ebooksclub[1].org\_\_Ayurveda\_\_The\_Divine\_Science\_of\_Life.pdf: page 93, 6.13 dosing strategy. |
| Dose toxicity (under dosing and over-doing) | In the modern day medicine, finding the right dose is a huge problem. There has been considerable amount of research which is ongoing.  Under dosing is not going cure the disease and over dosing may end up creating significant side effects.  This problem is a very important problem in cancer trial as the drugs can be very toxic. | *Chikitasasthan adhyaya 30 shlokas 313-314* in *Charaka Samhita,* talk about under dosing or over dosing of the drug and what are the consequences.  Very less dose of any medicine is ineffective and too much of it could prove harmful. |
| Commercial aspect: |  | In ChikistaSthan  The doctor should not use his knowledge of medicine to make money to wealthy. Instead, the powers which he has gained through studying ayurveda should be used for welfare of the society. Someone who helps patients come out jaws of death enjoys maximum happiness.  Page 467 of Part I book talks about the non commercial aspect: |
| Repeatability | Clinical trials are nothing but experiments conducted on human beings. For any scientific experiment to be considered as reliable, is should have the property of producing similar results time and again. | Page 114 su29#7, page 133 Vi8#101 |
| Classification of diseases (Girish) | > 4500 type of disease | ICD 10 |
| Sushruta’s concept of sterlization |  |  |

All of the above points contribute to the analyses which is performed for the modern medicines and submitted as a part of the submission dossiers. Could this help change the perception of Ayurveda being only “evidence based” or “nonscientific” to something better? Could these potential similarities help lessen the gap?

Ayurveda to further focus on the treatment therapies has been split in to 8 branches which are very closely related to the branches of western medicine. Below is the list of the 8 branches of Ayurveda and its equivalent in the western medicine.

|  |  |  |
| --- | --- | --- |
| Ayurveda Branch | English translation | Branch in Western medicine |
| Kayacikitsa | medicine | General Medicine |
| Salakya | dealing with diseases of supra-clavicular  region | ENT |
| Salyapahartrka | dealing with extraction of foreign bodies | Surgery |
| Visa-gara-vairodhika-prasamana | dealing with alleviation of poisons, artificial  poisons and toxic symptoms due to intake of  antagonistic substances | Toxicology |
| Bhuta vidya | dealing with spirits or organisms | psychology and psychiatry |
| Kaumarabhrtya | pediatrics | Obstetrics, Gynecology and Pediatrics |
| Rasayana | promotive measures | Therapies on wellbeing and wellness |
| Vajikarana | aphrodisiacs | Fertility and Sexual studies |

It is very well known and understood that Ayurveda is an observational science and there is no scientific evidence to its outcome/benefit. But on further reading of the Charaka Samhita on the evaluation of the treatment effect we can see that it closely comparable to how treatment effect is statistically evaluated in the western medicine.

All the factors that could cause an interaction effect during treatment evaluation can be seen below in the means of success in treatment.

(Charaka Samhita 2003rev2vol1 , Edited by Gabriel Van Loon)

The following properties are known as “Paradi” (“Beginning with Para”). They

**are the means of success in treatment:**

paratva (excellence)

aparatva (non-excellence)-- These 2 are used in relation to place, time, age,

measure, vipaka, virya, rasa etc.

yukti (rationale)-- is the rational planning of therapeutic measures

sankhya (enumeration)-- is mathematics including statistics

samyoga (conjunction)-- is the joining together of entities. It is of three types

according to the active participation of both, all or only one partner. It is non-eternal.

[this last statement is a profound philosophical one; no union is permanent, but rather

only temporary. All entities are made of the temporary bonding of other entities. All

living creatures are only the temporary union of the foods they have eaten, and will

eventually disperse to become the foods of a different union or creature.] [Samyoga also

refers to conjunction of herbs into formulas, of doshas and dhatus into disease, of

multiple etiologies into single etiology, etc.]

vibhaga (disjunction)-- it is also of 3 types; vibhakti (excision), viyoga

(disjoining) and bhagaso graha (division).

prthaktva (separateness) – is of 3 types; asamyoga (spatial separateness),

vailaksanya (class separateness) and anekata (individual separateness).

parimana (measurement)-- denotes measures (of all types- including weights).

samskara (processing)-- this is processing

abhyasa (practice)–is regular use of substance, habituation and practice.

–Thus all the paradi properties are said with their definitions, which if

unknown, do not let the therapy proceed properly.

The historic texts are indicative of the fact that the doctors practicing Ayurveda somehow knew these things. Only thing lacking here is the supporting data to confirm these claims.

Our aim here is not to outdo or supersede one system over the other but rather to bring about awareness and change in our thought process by moving from calling “Alternative” to “Supplemental” in both ways?

Appendix:

1. Well-being of patients: 
2. Qualifications of a doctor and concept of a hospital
3. Informed use of treatment



1. Pediatric population and concerns









1. Formulations, type of doses, frequency, Food effect (page 550 in part I)



1. Ethnic suitability



1. Dose toxicity (under dosing and over-dosing)





1. Commercial aspect: Page 467 of Part I book talks about the non-commercial aspect:





1. Repeatability: Page 114 su29#7, page 133 Vi8#101

These texts have extensive references to various disease areas. E.g. Cancer—an ayurvedic perspective (\*), in this paper, the authors have elaborated about integrated approach towards management of cancer.

# Chapter 2: Narrative reviews of the published trials

# 2.1 Introduction

Use of Ayurveda and other traditional medicines has expanded globally not only in the poor countries but also in the developed countries where conventional medicine is predominant. Due to this expansion documentation of the safety and efficacy of Ayurveda and other traditional medicines has become an important concern

As per Ayurvedic philosophy the entire cosmos is made up of energies of five elements: air, water, fire, earth, ether (space). The human body is also made up of these elements. These elements form the cognitive aspect of human beings. Ayurvedic medicine is oriented toward prevention, health maintenance, and treatment. The belief in Ayurvedic medicine is that a disease is the product of an imbalance in the body and mental elements that reduce the body’s resistance to diseases. If the imbalance is corrected and the body’s defense mechanisms are strengthened, then the body will resist a disease with a goal of eliminating it. The first goal is health promotion and disease prevention. The second goal is to treat physical, mental and spiritual illness. [3]

As the basic principles of Ayurveda and other Traditional systems are different from the Western medicine there is a perceived lack of evidence for all Traditional systems of medicine including Ayurveda. This has resulted in a situation, where in we see that a large section of the population is using these systems of medicine, but it is not accepted as a part of mainstream health care.

The western medicines are developed using a method called as hierarchical method where it tries answering the questions with limited scope e.g. what is the efficacy of a particular drug, what is the safety profile of a drug? This method assumes a step wise approach and deals with the problem in successively conducted clinical trials of various types in a specific sequence. The pharmacology of the molecule is ascertained first at the very beginning. These studies are followed by cohort studies, Open-label randomized studies. The process ends with the blinded, randomized, placebo controlled trials (RCT). The RCTs offer most internal validity and reduce the bias. These studies could be complemented by then moving onto case studies, case series. This “one step at a time” approach has worked very well in the western medicine framework.

There are some other models proposed by various authors to handle complex and tricky situations arising in defining and understanding the action of mechanism of Ayurvedic intervention.

Huge observational data for ayurvedic medicines [9]: There are more than 1,00,000 books and manuscripts, 57 authentic books (Drug and cosmetic act 1940), > 4500 diseases including subtypes and conditions (Ayusoft database), > 81,000 formulations (TKDL database), > 4,00,000 Practitioners (Planning Commission - 11th Plan) in India, Infinite documents, references, experiential data, Living tradition and knowledge in public domain. Dravyaguna (Pharmacology), Bhaisajya Kalpana (Pharmaceutics), Nidana (Diagnosis) and Chikitsa (Management principles), this data points to a validated knowledge base and it is acceptable that Ayurveda is an evidence based knowledge system.

Dr. Ashok D. B. Vaidya has explained the concept of reverse pharmacology to understand the action mechanism of Ayurvedic intervention. Reverse pharmacology is the science of integrating documented clinical/experiential hits, into leads by trans-disciplinary exploratory studies and further developing these into drug candidates by experimental and clinical research. It comprises of three stages - experiential, exploratory and experimental.

* Experiential robust documentation of clinical observations of the biodynamic effects of standardized ayurvedic drugs by meticulous record keeping.
* Exploratory studies for tolerability, drug interactions, dose range finding in ambulant patients of defined subsets of the disease and para-clinical studies in relevant in vitro and in vivo models to evaluate the target activity.
* Experimental studies, basic and clinical, at several levels of biological organization, to identify and validate the reverse pharmacological correlate of ayurvedic drug safety and efficacy.

Based on the huge observational data and the relatively low rate of side effects, it is rather easy to test Ayurvedic intervention in larger clinical trials. This would help build the required safety and efficacy information relevant to the Ayurvedic intervention under question. Once these key parameters are established, the pharmacokinetic properties can be understood. This process is economical may take lesser amount of time when compared with the hierarchical model used in western medicine.

Harald Walach et al. [8] have discussed a circular method to develop medicines. This would imply a multiplicity of methods, using different designs, counterbalancing their individual strengths and weaknesses to arrive at pragmatic but equally rigorous evidence which would provide significant assistance in clinical and health systems innovation.

Experimental methods that test specifically for efficacy have to be complemented by observational, non-experimental methods that are more descriptive in nature and describe real-life effects and applicability. The latter can range from retrospective audit studies, prospective case series to one armed to multiple armed cohort studies. Matched pairs studies can be conducted as experimental studies, by forming first pairs and then randomizing them, or as quasi-experimental studies by forming pairs from naturally occurring cohorts according to matching criteria.

ICH guidelines E2E for Pharmacovigilance planning, and E9 for statistical principles of clinical trials, provide a lot of different study designs to build the necessary evidence base either in form of a RCT or in any other form deemed fit for purpose. Case series, active and passive surveillance, sentinel site surveillance, drug and exposure registries are a few types of study designs to generate necessary data. Comparative observational studies like cross sectional survey, case-control study, cohort study, descriptive study and drug utilization study have been suggested. This is not an exhaustive list, but should be considered as a good starting point.

Similar to the Traditional Indian Medicine, there are other medicinal systems in existence e.g. traditional Chinese medicine (TCM), herbal medicines, etc. These systems are complex and they face similar sort of questions. TCM individualized its treatment protocol or clinical practice without considering the principles of modern medicine. The standard methodology of random selection, blinding and placebo control, followed by statistical analysis was generally overlooked. This had a negative effect on the development of TCM. Since 2000 onward, the volume of applied research in Chinese medicine is growing rapidly and the quality is improving. There is good evidence supporting the use of some Chinese patent medicine treatments. Further, there is a more open attitude to Chinese medicine among conventional health professionals, partly explained by the rise of evidence-based medicine (EBM). They have been reasonably successful in developing CONSORT like standards to define the quality, improve the standard of reporting.

On the other hand, the Western medicine is primarily oriented toward the treatment of disease. The drugs are developed based on the concept that the elimination of specific causes of a disease will cure a disease. Western medicine has been the dominant medical system of the world of the last century due to various reasons. Hence, there has been a tendency to test the effectiveness of all other medical systems and the cures they offer using the framework and methods of Western medicine which rely heavily on pharmacology, safety and efficacy of the drugs in principle. Those molecules which meet these criteria are allowed to be marketed as the drugs. The methods to come up with and test western medicines have undergone a lot of improvements and have developed validated methods which cater to the specific needs e.g. CONSORT, Jadad Score, ICH, GCP guidelines to name a few.

It is very evident that generating evidence which fits into the western medicine frame-work for Ayurvedic system is the need of the hour. But it is a very complex task as Ayurvedic intervention is just not a tablet or a capsule but is a holistic approach towards life. In order to achieve this seemingly very difficult task, it is important to find correlation between different systems. The efforts should be made to convert the evidence which is rooted in Ayurvedic discipline to be converted into “trans-disciplinary” evidence.

2.2 The Consolidated Standards for Reporting of Trials (CONSORT) statement

To comprehend the results of a randomized controlled trial (RCT), readers must understand its design, conduct, analysis and interpretation. That goal can only be achieved through complete transparency from authors. Despite several decades of educational efforts, the reporting of RCTs needed improvement. Investigators and editors developed the CONSORT (Consolidated Standards of Reporting Trials) statement to help improve reporting by using a checklist and flow diagram. The CONSORT statement was developed to assist investigators, authors, reviewers and editors on the necessary information to be included in reports of controlled clinical trials [4]. It is intended to improve the reporting of a Randomized Control Trial, enabling readers to understand a trial’s conduct and to assess the validity of its results. The checklist items includes 25-items selected because empirical evidence indicates that not reporting the information is associated with biased estimates of treatment effect or the information is essential to judge the reliability or relevance of the findings. The flow diagram depicts the passage of participants through an RCT.

The CONSORT statement was first published in 1996, revised in 2001, and 2010[4]. This statement consists of a checklist and flow diagram to guide writers and reviewers on the information that should be available from published reports of two-group parallel RCTs [4]. The CONSORT statement has been endorsed by many leading medical journals, editorial associations, professional societies, and funding agencies [4]. Since its inception, several extensions of the CONSORT statement have been developed [4]. CONSORT was extended to cluster randomized trials [4] and for trials examining harms [4]. Also, an international group of acupuncture researchers developed a set of recommendations for improving reporting of the interventions in parallel group trials of acupunctured the Standards for Reporting Interventions in Controlled Trials of Acupuncture or STRICTA [4].

# 2.3 Jadad score

A numerical score between 0-5 is assigned as rough measures of study design/reporting quality (0 being weakest and 5 being strongest). This number is based on a well-established, validated scale developed by Jadad et al [5]. This calculation does not account for all study elements that may be used to assess quality. A Jadad score is calculated using the seven items in the table below. The first five items are indications of good quality, and each counts as one point towards an overall quality score. The final two items indicate poor quality, and a point is subtracted for each if its criteria are met. The range of possible scores is 0 to 5.

|  |  |
| --- | --- |
| **Jadad Score Calculation** |  |
| **Item** | **Score** |
| Was the study described as randomized (this includes words such as randomly, random, and randomization)? | 0/1 |
| Was the method used to generate the sequence of randomization described and appropriate (table of random numbers, computer-generated, etc)? | 0/1 |
| Was the study described as double blind? | 0/1 |
| Was the method of double blinding described and appropriate (identical placebo, active placebo, dummy, etc)? | 0/1 |
| Was there a description of withdrawals and dropouts? | 0/1 |
| Deduct one point if the method used to generate the sequence of randomization was described and it was inappropriate (patients were allocated alternately, or according to date of birth, hospital number, etc). | 0/-1 |
| Deduct one point if the study was described as double blind but the method of blinding was inappropriate (e.g., comparison of tablet vs. injection with no double dummy). | 0/-1 |

# 2.4 Narrative review

In order to understand the existing practices of Ayurvedic therapy the following systematic review was done.

## 2.4.1 Objectives

The objective of the report was to conduct a search of published literature on how the clinical trials are conducted and reported for Ayurvedic medicines.

## 2.4.2 Search strategy and Selection criteria

This search result could be biased as it was only electronic and restricted to language English. As this research is aimed for academic purpose, no papers were bought.

As per figure 1,

Broad search:

* Cochrane library database was used as a search engine with the key word “Ayurved” OR “ayurvedic” OR “traditional Indian” for papers published on or before 2nd August 2016. 397 potentially relevant papers were retrieved.
* 123 paper were eliminated for the following reasons: 61 duplicate entries, 37 non-interventional studies, 23 studies irrelevant to the study and 2 non-ayurvedic papers.
* Thus, there were 274 papers left for analysis.

Narrowed to specific necessity:

* 274 studies satisfied the inclusion criteria of which for 147 (53.65%) trials were fully available, for 119 (43.43%) trials abstracts were available and 8 (2.92%) trials had no info available in the papers.

These 274 trials were used in the following analyses.

Major versions of CONSORT statements were published in 2001 and 2010. For any new guidance to come in full effect, it usually takes a couple of years, hence the analysis will be done on the overall studies, as well as studies conducted on or before year 2003, between years 2004 and 2012 and 3rd category is between years 2013 and 2016.

Status of each of the paper

Full text available = 147 (53.65%)

Abstract available = 119 (43.43%)

Not available = 8 (2.92%)

Time frame = Till August 2016

Database searched = Cochrane library

Number of studies published before

On or before 2003 = 52 (18.98%)

Between 2004 and 2012 = 130 (47.45%)

Between 2013 and 2016 = 92 (33.58%)

Potentially relevant papers identified

Search words used: ayurved\* OR ayurvedic OR traditional indian\*

(N = 397)

Papers eliminated from the analysis

(N=123)

Non Ayurveda = 2

Non interventional = 37

Non relevant = 23

Duplication = 61

Papers (studies) used in the analysis

(N=274)

Figure 1: Search strategy and Selection criteria

## 2.4.3 Main results

1. Publication trend: Till the year 2004 the number of studies published was in single digits, but post 2004, the publications have reached 20 to 30 studies per year. The following show the trend of the published clinical trials. Increased publications are a positive sign as the overall research efforts are increasing.

|  |  |
| --- | --- |
| Year | Number of studies published |
| Till 1980s | 6 |
| 1981 to 1990 | 3 |
| 1991 to 2000 | 28 |
| 2001 to 2005 | 24 |
| 2006 to 2010 | 85 |
| 2011 to 2016 | 128 |

52 (18.98%) papers were published before or within 2 years the publication of 2001 version of CONSORT. 130 (47.44%) papers were published within 2004 and 2012, remaining 92 (33.58%) papers were published between 2013 and August 2016.

1. Journals: Majority of the papers were published in Indian based journals (173 out of 274). Total 19 different counties were identified to have journal offices. The list of countries is displayed below.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Count of Journal type** |  |  |  |  |
|  | **Abstract** | **Available** | **Not available** | **Grand Total** |
| Indian | 57 | 112 | 4 | 173 |
| American | 25 | 13 | 1 | 39 |
| UK based | 6 | 10 | 2 | 18 |
| Irish | 4 | 6 |  | 10 |
| German | 8 | 2 |  | 10 |
| Dutch | 4 | 1 |  | 5 |
| Pakistani | 3 |  |  | 3 |
| \*\* Unknown | 2 |  | 1 | 3 |
| Bangladeshi | 2 |  |  | 2 |
| Irani |  | 2 |  | 2 |
| Turkish | 1 |  |  | 1 |
| Swiss | 1 |  |  | 1 |
| Canadian | 1 |  |  | 1 |
| Japanese | 1 |  |  | 1 |
| Thai | 1 |  |  | 1 |
| Croatian |  | 1 |  | 1 |
| Belgian | 1 |  |  | 1 |
| Romanian | 1 |  |  | 1 |
| Sri Lankan | 1 |  |  | 1 |
| **Grand Total** | **119** | **147** | **8** | **274** |

Papers were published in 119 different journals. AYU had 58 studies, International Journal of Research in Ayurveda and Pharmacy had 47 studies, Journal of Ayurveda and Integrative Medicine had 15 studies and Journal of ethnopharmacology had 9 studies published.

1. ICD-10 has 22 major categories listed, out of which for 21 categories at least 1 study was conducted. This is an indication that Ayurveda as a medical science even though is ancient still is relevant in today’s modern world.

Traditional areas managed by ayurvedic treatments appear as the most frequently disease areas. E.g. Endocrine, nutritional and metabolic diseases, Diseases of the musculoskeletal system and connective tissue, Mental and behavioural disorders, Diseases of the genitourinary system, Diseases of the digestive system make the top 5. There are 5 studies done for Neoplasm, but mostly in the palliative setting.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Count of Disease area** | **Column Labels** |  |  |  |
| **Row Labels** | **Abstract** | **Available** | **Not available** | **Grand Total** |
| Endocrine, nutritional and metabolic diseases | 19 | 22 |  | 41 |
| Diseases of the musculoskeletal system and connective tissue | 18 | 19 | 1 | 38 |
| Mental and behavioural disorders | 13 | 13 | 2 | 28 |
| Diseases of the genitourinary system | 10 | 13 |  | 23 |
| Diseases of the digestive system | 12 | 10 |  | 22 |
| Diseases of the respiratory system | 4 | 12 | 1 | 17 |
| Diseases of the skin and subcutaneous tissue | 3 | 13 |  | 16 |
| Certain Infectious and parasitic diseases | 5 | 7 | 3 | 15 |
| Diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism | 2 | 9 |  | 11 |
| Diseases of the circulatory system | 8 | 2 |  | 10 |
| Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified | 3 | 6 |  | 9 |
| Diseases of the eye and adnexa | 7 | 1 |  | 8 |
| NOT APPLICABLE (studies on healthy volunteers) | 4 | 3 |  | 7 |
| Diseases of the nervous system | 3 | 4 |  | 7 |
| Pregnancy, childbirth and the puerperium | 1 | 4 |  | 5 |
| Neoplasms | 3 | 1 | 1 | 5 |
| Injury, poisoning and certain other consequences of external causes | 2 | 3 |  | 5 |
| Factors influencing health status and contact with health services | 2 | 1 |  | 3 |
| Diseases of the ear and mastoid process |  | 2 |  | 2 |
| Certain conditions originating in the perinatal period |  | 1 |  | 1 |
| External causes of morbidity and mortality |  | 1 |  | 1 |
| **Grand Total** | **119** | **147** | **8** | **274** |

1. Location of studies: Most of the studies 227 out of 274 were conducted in India, for 17 studies the location was Unknown, 7 studies were carried out in Sri Lanka, 4 in Australia and 3 in the USA. Overall 16 countries have conducted at least 1 study.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Count of Location** | **Column Labels** |  |  |  |
| **Row Labels** | **On or before 2003** | **Between 2004 and 2012** | **Between 2013 and 2016** | **Grand Total** |
| India | 38 | 107 | 82 | 227 |
| \*\* Unknown | 4 | 9 | 4 | 17 |
| Sri Lanka | 1 | 6 |  | 7 |
| Australia | 2 | 1 | 1 | 4 |
| USA | 1 | 1 | 1 | 3 |
| Germany | 2 |  |  | 2 |
| Pakistan |  | 2 |  | 2 |
| UK |  | 1 | 1 | 2 |
| Bangladesh | 2 |  |  | 2 |
| Canada | 1 |  |  | 1 |
| Thailand |  | 1 |  | 1 |
| Switzerland |  |  | 1 | 1 |
| Iran |  |  | 1 | 1 |
| Singapore | 1 |  |  | 1 |
| Norway |  | 1 |  | 1 |
| Italy |  | 1 |  | 1 |
| Japan |  |  | 1 | 1 |
| **Grand Total** | **52** | **130** | **92** | **274** |

1. What kind of trial designs are used in the clinical trials: Out of 274 studies, there were 127 (46.35%) of studies did not mention study design or noted it as “Randomly”. 126 (45.99%) studies mentioned word “randomized” in the study design. Remaining 21 studies were “Open label”, “Double blind”, “Series”, “Observational”, “Single blind”.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Count of Design** | **Column Labels** |  |  |  |
| **Row Labels** | **Abstract** | **Available** | **Not available** | **Grand Total** |
| Randomised Double Blind | 33 | 33 | 3 | 69 |
| Unknown | 36 | 26 | 4 | 66 |
| Randomly | 18 | 43 |  | 61 |
| Randomised Open label | 10 | 12 |  | 22 |
| Randomised | 6 | 15 |  | 21 |
| Randomised Single Blind | 5 | 8 |  | 13 |
| Open label | 3 | 8 |  | 11 |
| Double Blind | 4 |  | 1 | 5 |
| Series | 2 |  |  | 2 |
| Observational |  | 2 |  | 2 |
| Single Blind | 1 |  |  | 1 |
| Randomised Triple Blind | 1 |  |  | 1 |
| **Grand Total** | **119** | **147** | **8** | **274** |

The number of studies noting “Randomly” or “Unknown” has not gone down as the years have passed by. Researchers should make efforts to document and use the correct study design to make the results reproducible.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Count of Design** | **Column Labels** |  |  |  |
| **Row Labels** | **On or before**  **2003** | **Between**  **2004 and 2012** | **Between**  **2013 and 2016** | **Grand Total** |
| Randomised Double Blind | 24 | 31 | 14 | 69 |
| Unknown | 13 | 36 | 17 | 66 |
| Randomly | 5 | 31 | 25 | 61 |
| Randomised Open label | 4 | 9 | 9 | 22 |
| Randomised |  | 8 | 13 | 21 |
| Randomised Single Blind |  | 6 | 7 | 13 |
| Open label | 3 | 5 | 3 | 11 |
| Double Blind | 2 | 1 | 2 | 5 |
| Series | 1 | 1 |  | 2 |
| Observational |  | 1 | 1 | 2 |
| Single Blind |  |  | 1 | 1 |
| Randomised Triple Blind |  | 1 |  | 1 |
| **Grand Total** | **52** | **130** | **92** | **274** |

1. Most of the study designs were parallel group 228 (83.21%), only 11 (4.01%) studies were cross over in nature. 24 (8.76%) studies did not mention or is not applicable due to single arm study.
2. 241 studies out of 274 were carried out in single center, 16 were multicenter studies (all conducted in India) and for 17 studies, it was not clear if the studies were carried out in a single center setting or a multi-center setting.
3. Duration of studies and the size of the studies: 211 (77%) of the trials reported duration of the trial and 250 (91%) trials reported number of patients in the trial. There were nearly 17,637 patients/healthy volunteers treated in more than 42 years of treatment duration in all these studies put together. In general, the studies were of short duration (median 8 weeks) with lesser patients (median 46 patients). The duration may not be reflective of the true clinical setting, giving rise to meaningless results. Smaller studies tend to overestimate the treatment effects.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Duration (weeks) | Total patients | Males | Females |
| n (%) | 211 (77%) | 250 (91%) | 94 (34%) | 93 (34%) |
| Mean | 10.4 | 70.5 | 28.5 | 28.8 |
| SD | 9.78 | 118.85 | 32.07 | 34.69 |
| Median | 8 | 46 | 20.5 | 19 |
| Minimum | 0.1 | 8 | 0 | 0 |
| Maximum | 74 | 1646 | 180 | 214 |
|  | Total duration =  2199  ~ 42.28 years | Total patients  = 17637 | Total males  = 2683 | Total females  = 2678 |

1. There were 105 (38.32%) papers/studies discussed the Ayurvedic definition of disease, or ayurvedic endpoint. There were 216 (78.83%) of studies used Western end points. 31 (11.31%) studies used both ayurvedic and western endpoints. This data reflects the attempts made by various people to force fit traditional medicine in western framework. There is a huge scope for improvement in order to develop alternative methods to test the traditional medicines in modern scientific ways.

The standard ways of data collection forms should be one important aspect taken up at the national level. The way CDISC group is driving standardized data collection forms for western clinical trials, similar efforts should be made. TCM is making a lot of progress in this area and has started working with CDISC team for standard data collection pages. <https://www.cdisc.org/system/files/all/standard/CFAST-TA-Project-Status.pdf>

1. The quality of 126 Randomized Clinical Trials was assessed based on Jadad score and only 34 (26.98%) trials had a score of greater than or equal to 3. This reflects areas of improvements from methodological stand point. This is very essential to improve the credibility outside the fraternity.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Count of Jadad Score** | **Column Labels** |  |  |  |  |
| **Row Labels** | **Abstract** | **Available** | **Not available** | **Grand Total** | **%** |
| 0 | 3 | 4 |  | 7 | 5.56% |
| 1 | 18 | 16 | 2 | 36 | 28.57% |
| 2 | 28 | 20 | 1 | 49 | 38.89% |
| 3 | 6 | 20 |  | 26 | 20.63% |
| 4 |  | 6 |  | 6 | 4.76% |
| 5 |  | 2 |  | 2 | 1.59% |
| **Grand Total** | **55** | **68** | **3** | **126** |  |

The quality of reporting is going up across the time frames. There were only 8 studies on or before 2003 with a Jadad score of 3 or more, this has gone up to 16 in years between 2004 and 2012, and 10 studies between 2013 and 2016.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Count of Jadad Score** | **Column Labels** |  |  |  |
| **Row Labels** | **On or before 2003** | **Between**  **2004 and 2012** | **Between**  **2013 and 2016** | **Grand Total** |
| 0 | 3 | 3 | 1 | 7 |
| 1 | 3 | 13 | 20 | 36 |
| 2 | 14 | 23 | 12 | 49 |
| 3 | 8 | 11 | 7 | 26 |
| 4 |  | 3 | 3 | 6 |
| 5 |  | 2 |  | 2 |
| **Grand Total** | **28** | **55** | **43** | **126** |

1. Further analysis was carried out to check if there is any publication bias towards only reporting positive findings. There was a huge difference in published studies with positive results (62.77%) vs. negative results (6.93%). It is very important to build the correct scientific basis for future, to be open about what has worked and what has not. Across different periods, the tendency to report only positive studies continues as is.
2. CONSORT scores: CONSORT scores were determined based on the 25 point checklist version 2011. 126 studies with design identified as “randomized” were analyzed. 67 studies had scores of less than or equal to 10. 47 studies had scores going from 11 to 15 both inclusive. 12 studies had scores of greater than or equal to 16, with 2 studies having maximum score of 22 out of 25. These 2 studies were conducted between 2013 and 2016.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Count of CONSORT Score** | **Column Labels** |  |  |  |
| **Row Labels** | **On or before 2003** | **Between**  **2004 and 2012** | **Between**  **2013 and 2016** | **Grand Total** |
| 1 |  | 1 |  | 1 |
| 2 | 1 | 3 | 1 | 5 |
| 3 | 1 |  |  | 1 |
| 4 | 1 | 1 |  | 2 |
| 5 | 4 |  |  | 4 |
| 6 | 2 |  | 4 | 6 |
| 7 | 4 | 4 | 3 | 11 |
| 8 | 3 | 5 | 7 | 15 |
| 9 | 1 | 5 | 1 | 7 |
| 10 | 3 | 5 | 7 | 15 |
| 11 | 1 | 4 | 6 | 11 |
| 12 | 1 | 8 | 5 | 14 |
| 13 | 2 | 7 |  | 9 |
| 14 | 4 | 3 | 1 | 8 |
| 15 |  | 2 | 3 | 5 |
| 16 |  | 3 | 1 | 4 |
| 17 |  | 1 |  | 1 |
| 18 |  | 1 |  | 1 |
| 19 |  | 1 | 1 | 2 |
| 20 |  | 1 |  | 1 |
| 21 |  |  | 1 | 1 |
| 22 |  |  | 2 | 2 |
| **Grand Total** | **28** | **55** | **43** | **126** |
|  |  |  |  |  |
| <= 10 | 20 | 24 | 23 |  |
| Between 11 and 15 | 8 | 24 | 12 |  |
| Greater than equal to 16 |  | 7 | 5 |  |

In 3 different reporting periods, the scores are going up. Studies reported on or before 2003, has the maximum score of 14, and 20 out of 28 studies have scores of <= 10.

When the full study details are available the COSNORT scores are higher than when only an abstract is available. If all the complete papers were available then there would certainly have been improvement in the scores, but would not have been drastic either.

The consolidation of scores across 274 studies and in the 126 randomized trials.

|  |  |  |
| --- | --- | --- |
| CONSORT point | Total Overall | Only randomized (N=126) |
| Title & abstract | 118 | 59 |
| Introduction | 170 | 83 |
| Trial Design | 101 | 50 |
| Participants | 166 | 84 |
| Interventions | 158 | 79 |
| Outcomes | 169 | 82 |
| Sample size | 8 | 2 |
| Sequence generation | 3 | 3 |
| Allocation concealment | 10 | 7 |
| Implementation | 3 | 2 |
| Blinding | 44 | 20 |
| Statistical Methods | 47 | 23 |
| Participant Flow | 10 | 6 |
| Recruitment | 72 | 36 |
| Baseline Data | 68 | 34 |
| Number Analyzed | 50 | 27 |
| Outcomes and estimation | 154 | 76 |
| Ancillary Analyses | 2 | 2 |
| Harms | 65 | 34 |
| Limitations | 20 | 13 |
| Generalizability | 14 | 10 |
| Interpretation | 141 | 71 |
| Registration | 54 | 25 |
| Protocol | 11 | 6 |
| Funding | 38 | 15 |

Explanation of trial design, sample size calculations, sequence generation, allocation concealment and implementation has not been done in majority of the studies. Blinding and statistical methods are 2 other major areas requiring a lot of detailed attention. Participant flow diagram has been prepared only for 10 out of 274 studies and 6 out of 126 studies. The baseline data is not presented. Limitations and generalizability related points have been overlooked.

1. How many treatment or groups or conditions tested in a study? 175 out of 274 studies had 2 treatment groups, with 1 study having 7 treatment groups, for 25 studies the number of treatment groups was not clearly defined.
2. 93 (33.94%) studies reported adverse events. This number is considerably low. This should be improved to build transdisciplinary trust.

# 2.5 Discussion

## 2.5.1 Transparency issues

The sample of trials may not have been representative. Our search would not have located all published trials. But there are trials published in many journals not indexed by the databases chosen for the search. The trials conducted could have been reported in language other than English. There seems to be tendency of publishing more positive studies vs. negative studies. This publication bias would result in building biased scientific literature.

## 2.5.2 Scientific issues

The published studies were of short duration with lesser patients. The duration may not reflective of the true clinical setting, giving rise to meaningless results. Smaller studies tend to overestimate the treatment effects. Methodological quality of the trials was suboptimal. There is a scope for improvement in designing and conducting clinical trials which will improve credibility.

## 2.5.3 Ethical issues

Smaller sample sizes, unpublished work, application of western endpoints to traditional methods would all raise some question or the other. We observed that the basic principle of clinical trial; randomization, was never explained in most of the cases; leading to concerns on reproducibility and bias.

A high chance of fraud during the conduct of the clinical trial due to no standardized process for diagnosis, dosing, follow up and conclusion.

# 2.6 Summary

1. There is a need to be more systematic in reporting the clinical studies in the journals which are available electronically. There is a need to database the existing vast pool of data.
2. There is a need to come up with guidelines to conduct, design and report clinical trials for the Ayurvedic interventions to enhance the credibility of the already existing vast pool of data.
3. As per the proposals made in the “hierarchical view”, “reverse pharmacology view”, various methods suggested in ICH guidelines and “circular method view” there is a need to define what kind of clinical trials could be performed at what point of time in the whole drug development process for Ayurveda. Internal validity has to be balanced by external validity, and this can rarely be achieved with one single research method such as the RCT, but involves other strategies such as outcomes and cohort studies. In order to answer the questions about the safety, efficacy of a drug, there is a need to optimize the use all three approaches.
4. There is a need to standardize the following:

* How to write a protocol, what type of information should go in and how much detail
  + Rationale for a specific study
  + Ayurvedic definition of disease
  + Ayurvedic definition of patient / how to identify the patient?
  + Ayurvedic interventions (treatments and duration)
  + Ayurvedic endpoints
  + Inclusion and exclusion criteria for patients
  + Visit schedule
* How to collect the data based on the protocol?
  + How to capture required information?
  + Categorical variables?
* How to define the statistical analysis plan?
  + Tables, Listings and Figures how many? Is it possible to follow various ICH guidelines (E3)
  + Statistical methods
  + Derivations of the required variables
  + Imputation rules for missing data

**Reference:**

[1] Ayurveda and Traditional Chinese Medicine: A Comparative Overview

Bhushan Patwardhan, Dnyaneshwar Warude, P. Pushpangadan and Narendra Bhatt

© The Author (2005). Published by Oxford University Press. All rights reserved.

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[7] Zhao-Xiang BIAN, You-Ping Li, David MOHER, Simon DAGENAIS, Liang LIU, Tai-Xiang WU, Jiang Xia MIAO, Andrew K. L. KWAN, Lisa SONG. Improving quality of randomized controlled trials in Chinese herbal medicine Part I- IV, Journal of Chinese Integrative Medicine, March 2006 Vol 4, No 2.

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[9] Girish Tillu Ayurveda: From Diagnosis to Health.

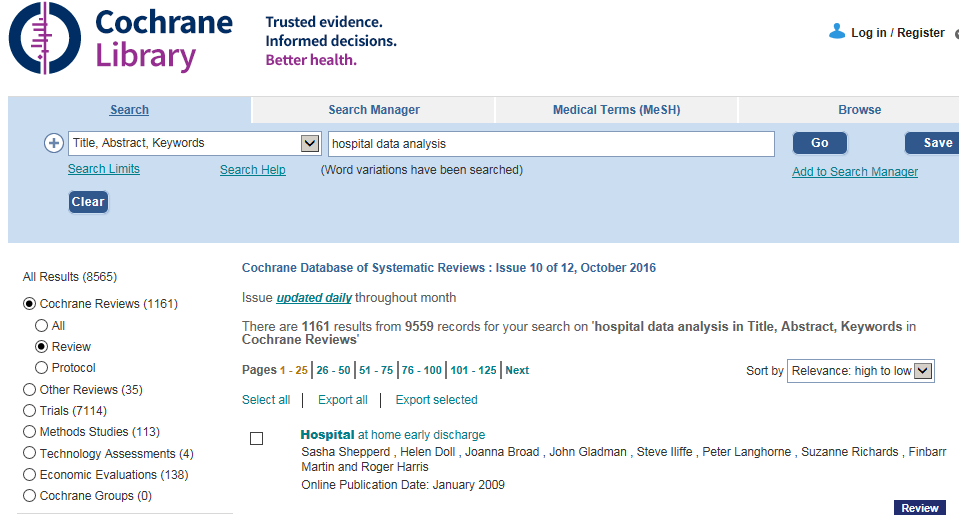
# Chapter 3: Review of the hospital data analysis methods

# 3 Background

# 3.1 What is hospital data

# 3.2 Review

On 4th Oct 2016, Cochrane library review was done for “Hospital data analysis”. There were 113 method studies, 4 technological assessments and 138 economic evaluations identified. There were no time limits imposed.



# Chapter 4: Hospital data descriptive analysis

# 4 Background

# 4.1 Hospital database INSTA

# 4.2 Data collection methods

# 4.3 Analysis plan

# 4.4 Description of data

# Total number of distinct patients

Based on the Vitals sign, Lab results and diagnosis report data dated 31st July 2016, the following numbers are derived:

|  |  |
| --- | --- |
| All patients present in the database | 41,094 |
| Only In-patients | 4,016 |
| Only out-patients | 33,709 |
| Common patients with in-patient and out-patient | 3,368 |

Summary statistics of the patient’s age (years) in 3 types of patient categories:

|  |  |  |  |
| --- | --- | --- | --- |
| Age (years) | Only in-patient | Only out-patients | Common |
| n | 4017 | 37077 | 3368 |
| Mean | 51.98 | 44.88 | 51.09 |
| SD | 17.89 | 18.48 | 17.99 |
| Median | 53 | 45 | 52 |
| Minimum | 2 | 1 | 2 |
| Maximum | 103 | 108 | 98 |

The median age for in-patient (53 years) is greater by 8 years than that for the out-patient group (45 years).

Summary statistics of age by gender and type of patient:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Age  (years) | Only  in-patient  (Male) | Only  in-patient  (Female) | Only  out-patient  (Male) | Only  out-patient  (Female) | Common  (Male) | Common  (Female) |
| n | 1959 | 2058 | 19021 | 18057 | 1652 | 1716 |
| Mean | 51.85 | 52.10 | 45.08 | 44.68 | 50.77 | 51.40 |
| SD | 17.76 | 17.01 | 18.93 | 17.98 | 18.79 | 17.18 |
| Median | 53 | 54 | 45 | 45 | 51 | 53 |
| Minimum | 2 | 3 | 2 | 1 | 2 | 3 |
| Maximum | 103 | 94 | 108 | 101 | 98 | 90 |

The age for males and females did not differ a lot in each of the 3 categories. The ratio of male to female patients is approximately 50% across each of the 3 categories.

Age group frequency by 10 year age categorization:

Only in-patients:

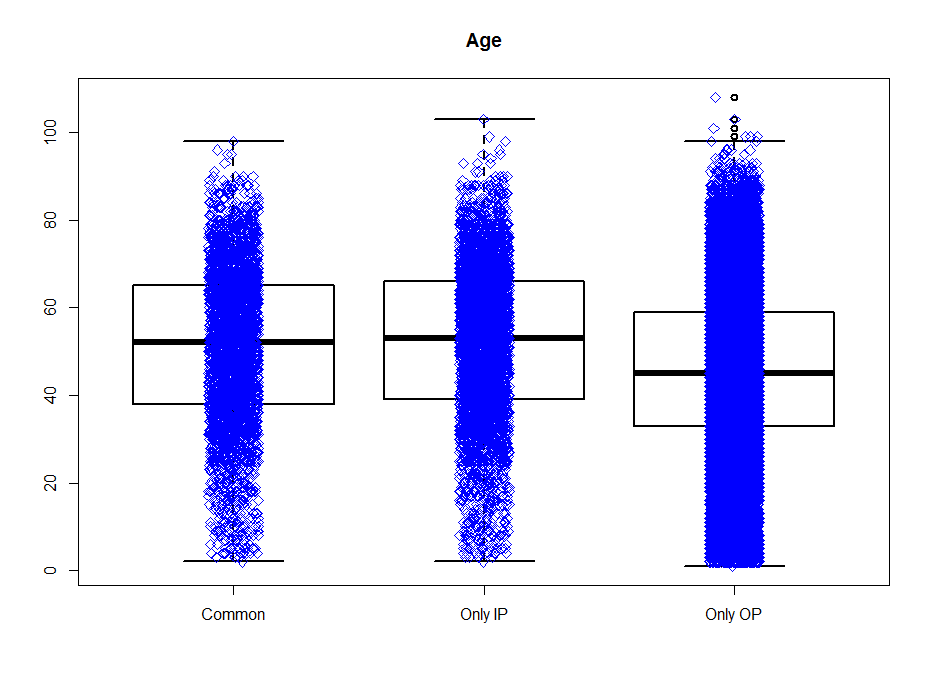
Only out-patients:

Common patients:

There is 1 patient above 100 years in Only IP group and 3 patients above 100 years in Only OP group, not displayed on the histograms.

All 3 categories on the same graph:

Boxplot representation of the age summary statistics and the individual age values overlayed is displayed below. Age categories are statistically significantly different in 3 groups. The number of patients in “Only IP” category under age of 20 is less than for the other 2 categories.



Patients’ residential status: Majority of patients were from Bengaluru city (~ 75% of overall patients).

Patients’ blood group: For 19,500 (47.45%) out of 41,094 patients the blood group has been captured. These numbers are quite consistent with the proportions reported for India. The cells in yellow should be checked.

|  |  |  |
| --- | --- | --- |
| A- | 258 | 1% |
| A+ | 3708 | 19% |
| A1 -ve | 2 | 0% |
| A1 +ve | 25 | 0% |
| A1B +ve | 6 | 0% |
| A2 +ve | 1 | 0% |
| A2B +ve | 1 | 0% |
| AB- | 94 | 0% |
| AB+ | 1152 | 6% |
| B- | 326 | 2% |
| B+ | 5730 | 29% |
| O- | 518 | 3% |
| O+ | 7679 | 39% |

Analysis on the diseases experienced by patients in 3 groups by age categories is done as follows. The patients are categorized into 3 age group categories: Age <= 18 years, age in between 18 and 65 years and age >= 65 years. The following tables display cross tabulation of ACD code and 3 groups (Only IP, Only OP and Common) for different age categories.

Expectation: The diseases requiring hospitalization should be different from the diseases not requiring hospitalization. The most frequently occurring diseases should be different across age groups.

Check the 2 csv files created with the frequency counts and distinct patients having the disease at least once.

Total number of patients in Outpatient section

Total number of patients in Inpatient section

Total number of patients only in Outpatient section

Total number of patients only in Inpatient section

Total number of patients present in both Outpatient and Inpatient sections

Demographics of patients

Number of patients checked by different departments

**Institutional Ethics Committee for Human Research**

**Application for Ethical Review of Research Protocol**

To Date:

The Member Secretary

Institutional Ethics Committee

Institute of Tran-disciplinary Health Sciences and Technology

Bengaluru

|  |  |
| --- | --- |
| Full name of Principal Investigator: |  |
| Designation: |  |
| Complete Postal Address: |  |
| Tel. No: Office and Fax. No. |  |
| E-mail: |  |

|  |  |
| --- | --- |
| Site of study: |  |
| Title of Project: |  |
| Sponsor Name and address: |  |

|  |  |  |  |
| --- | --- | --- | --- |
| **Sl. No.** | **Name** | **Signature** | |
| Principal Investigator |  |  | |
| Co-Investigator |  |  | |
| Co-Investigator |  |  | |
| Type of study: Local / National / International | | |  | |
| Type of Trial: Multi center / Single center | | |  | |

**Name & Signature of Principal Investigator Date:**

*{Application must be submitted along with the study protocol, consent form (English and local language), Approval letters (if any, other scientific committee or ethics committee) and other essential documents for the review}.*

**PROTOCOL COVER PAGE**

**PROTOCOL NAME**

**Use of Real World Evidence methods to drive clinical practice**

**PROTOCOL NUMBER:** To be filled by IEC office (any amendments should bear the amendment number)

**PROTOCOL VERSION & DATE:**

**V1.0 & 21st Dec 2018**

**GENERAL INFORMATION**

**Name and address of the sponsor of the study**

**Dr. Girish Tillu**

**Dr. Ashwini Mathur**

**Vinay Mahajan**

**Name and address of the person authorized to sign the protocol and amendments**

**Name and address of study monitor**

**Name, title, address and telephone number(s) of the medical expert for the trial**

**Name and title of the investigator(s) and sub-investigators responsible for the trial with address and phone number(s)**

**Name and addresses of the clinical laboratories and/or other institutions involved in the trial**

**Not applicable**

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**List of Abbreviations**

(e.g.)

CFR Code of Federal Regulations

ICH International Conference on Harmonisation

CRF Case Report Form

FDA Food and Drug Administration

GCP Good Clinical Practice

IRB Institutional Review Board

# 1 Background

Real world datais the data relating to patient health status and/or the delivery of health care routinely collected from a variety of sources. This data holds potential to allow us to better design and conduct clinical trials and studies in the health care setting to answer questions previously though infeasible. In addition, with the development of sophisticated, new analytical capabilities, we are better able to analyze these data and apply the results of our analyses to support standardized medical practice/methods, medical product development and approval.

Reported lack of efficacy of Ayurvedic treatments in clinical trials is often not due to inefficacy of the treatment itself, but arises from inadequacies of trial design and standardized/uniform administration practices. Ayurveda and other traditional medical systems often prescribe complex treatments consisting of a combination of drugs, diet, detoxification procedures, lifestyle changes, and yoga practices, customized to the needs of individual patients. To replicate these daily complexities into a clinical trial becomes a scientific and operational challenge; hence holistic treatment never gets tested. A lot of the clinical trials conducted and reported for ayurvedic treatments have come under criticism due to “reductionist” nature. Through our narrative review of 260+ clinical trials we have shown the quality of trials has been sub-optimal as well.

Efficacy of a drug or treatment method explains whether “it works”, effectiveness of a treatment explains whether “it works for population”. This is the fundamental gap between a clinical study designed and real world medical practice carried out on a day to day basis. Effectiveness of a drug could be defined as interactions between various components at play. These interactions could be defined in different contexts,

* Use of actual drug,
* Individual patient and disease characteristics and
* Healthcare system related characteristics.

The purpose of the effectiveness research is to assess these interactions. This covers the entire span of epidemiologic and public health research methods. Some of the following questions are answered through this investigation:

* Which interactions are universal,
* How do they distribute locally,
* What is magnitude of impact,
* What is the mechanism of action, etc?

Effectiveness of individual drug is of utmost importance as well as there is a need to understand comparative effectiveness when there is more than one treatment option available. Effectiveness of a drug could be under question due multiple reasons. Population using the drug may not be consistent with the population for which the drug was developed. Effectiveness could be affected by lack of adherence to the intended schedule of usage or intended practice. These situations could misrepresent the data and a perceived gap between efficacy and effectiveness could emerge. Methodological options for an integrated efficacy and effectiveness evidence generation plan should be explored.

## Investigational Agent

The study is based on the already treated patients at IAIM hospital over the years. All the relevant prescribed treatments available in the database will be utilized for the analysis purpose.

## Preclinical Data

The study will be carried out on the existing patient data.

## Risk/Benefits

Benefits: the existing patient data will be used retrospectively. The planned study will provide the following insights:

* What kind of data has been collected so far for each patient visit?
* What part of data is related to the every day to day operations
* What part of the data is related to the patient background characteristics, disease conditions, prescribed medicines?
* What are the strengths of the collected data and what are the areas of improvement going forward.
* What kinds of diseases are getting treated more frequently?
* What kinds of treatments are prescribed for what kinds of diseases?

This analysis would add to the evidence base of ayurvedic treatment principles.

Risks: the existing database contains sensitive information related to individual patients. All the efforts will be made to protect sensitive information like

* Name of patient,
* Full address,
* Phone numbers,
* Socio economic status, etc.

This information will not be extracted from source data so that the patient cannot be traced back and contacted. The individual information cannot be used for any untoward purpose.

## Dose Rationale

The existing prescribed medicines as well as procedure data will be used as is to understand the ayurvedic treatment principles.

## Trial Conduct

Ayurvedic hospital in TDU is operational since year 2011 and perhaps hosts one of the largest electronic databases of Ayurvedic medical practice. The hospital database contains clinical data for more than 51000 patients since 2011 to October 2017. The Ayurvedic disease classification dictionary (ACD) is used to code the diseases [Dictionary developed at the University, and CDAC, Pune]. There are approximately 170,000 visits recorded, covering more than 900 unique diseases, more than 3000 medicinal procedures\*, in-patient as well as out-patient visits.

The existing patient level data will be utilized. This data will be referred to as “Source data”. Source data will be accessed from the existing database. Source data reported from day 1 of hospital will used till the latest available date. Additional variables based on the source data will be created in datasets called as “analysis data”.

## Population

Source data for patients having reported at least one disease in:

* Metabolic diseases area,
* Rheumatic and Musculoskeletal disease area, and
* Neuroscience area will be used.

## Literature

Hospital database, Ayurvedic reference material, Statistical methodological reference material, R software reference material, Tableau software reference material, SQL software reference material, US FDA website, EMA website, References for Real World Evidence.

# Trial Objectives

Real World Evidence methods, epidemiological research methods like quantitative, qualitative and mixed methods research would be employed to explore the available data. In qualitative health research observational methods provide direct access to what people do, as well as to what they say and think. These generate an emerging understanding about research questions with two main objectives:

1. Preliminary analysis leads to the identification of issues where data need to be further enriched;
2. It informs the sampling process, in the sense that researchers are aware of the point in the data collection in which no new categories/themes emerge – data saturation -, signaling that data collection is complete.

Studies of causation, prognosis, and clinical prediction will be carried out according to the quality of preceding evidence, using the optimal study design.

This proposed analysis, due to scale and size of the data, with no artificial limitations of inclusion and exclusion criteria should provide real world evidence view or the epidemiological view for the stated period (from the beginning of hospital in 2011 to October 2017). This will provide additional understanding about ayurvedic data that may be inaccessible using quantitative methods. Basic understanding of the demographic, background history, visit pattern, treatments prescribed at such a large scale should help in building empirical evidence.

# Trial Design

The scientific integrity of the trial and the credibility of the data from the trial depend substantially on the trial design. A description of the trial design includes:

The database captures complete picture of patient experience in day to day clinical practice. It captures modern medical parameters obtained through various blood tests, scans, ECGs, etc. as well as it captures Ayurvedic parameters in carefully designed Case Report Forms. The source data is secured in a controlled environment with SQL database at the back end. This data is accessed using SQL queries and then using R programming language for necessary calculations. Summarization and tabulation are carried out using R libraries; visuals are built using tableau software for a very easy to use end user experience. The following steps were followed to convert an individual observation to a meaningful table or a visual (References in supplementary material, Fig 1, 2, 3, and 4). The source data is captured in multiple data tables or views, and these need to be combined or aggregated into meaningful data tables for further processing. To get to a consolidated Data version of 25 variables, 15 different data tables had to be processed.

R is a programming language and free software environment for statistical computing and graphics that is supported by the R Foundation for Statistical Computing. The R language is widely used among statisticians and data miners for developing statistical software and data analysis.

Tableau (French for 'little table' literally, also used to mean 'picture'; pl. tableauxor, rarely, tableaus) is a software providing visual query language interface to convert large amounts of data into beautiful interactive graphical displays.

All these softwares are freeware softwares or open source, hence there is no additional financial burden on researchers to procure the best in class analytical capabilities.

Fig 1:

Use R program to generate tabular or graphical analysis

Use R program to create analysis data tables

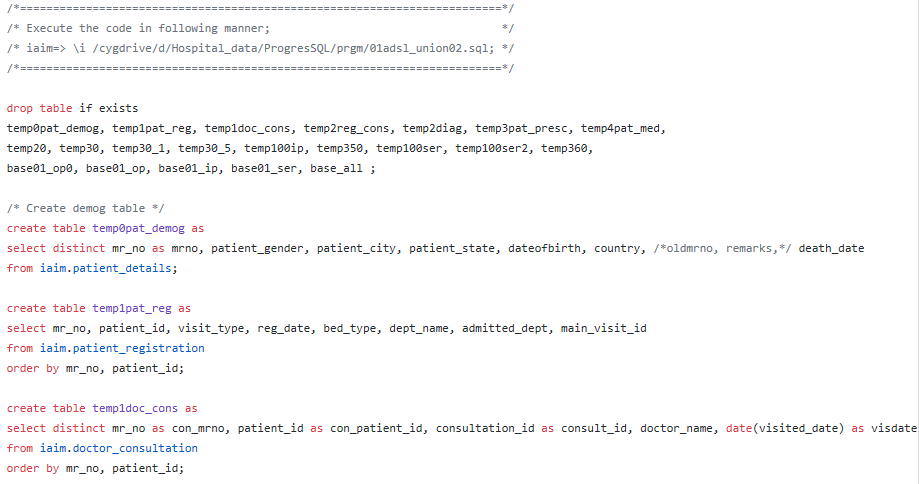
Use source tables from the SQLserver

Use SQL queries to combine necessary tables

Use Tableau to generate interactive visual analysis

1. Login on the SQL server using the credentials
2. Use the IAIM schema and access the following tables to generate base table with Demographics information, Patient Visit information and prescribed treatments
   1. STATE\_MASTER
   2. COUNTRY\_MASTER
   3. CITY
   4. STATE
   5. PATIENT\_DETAILS
   6. PATIENT\_REGISTRATION
   7. MRD\_DIAGNOSIS
   8. PATIENT\_PRESCRIPTION
   9. PATIENT\_MEDICINE\_PRESCRIPTIONS
   10. IP\_PRESCRIPTION
   11. SERVICES\_PRESCRIBED
   12. SERVICES
   13. MEDICINE\_SALES\_VIEW
3. There are many CRF pages built to collect relevant Ayurvedic data, measurement data, Hospital visit data, food / exercise advice, etc. This data is present in the following tables:
   1. PATIENT\_SECTION\_DETAILS
   2. PATIENT\_SECTION\_VALUES
   3. SECTION\_MASTER
   4. SECTION\_FIELD\_OPTIONS
   5. SECTION\_FIELD\_DESC
   6. PATIENT\_CONSULTATION\_FIELD\_VALUES
4. The datasets created in steps 2 and 3 are further processed using R programming language and the analysis ready datasets are created

Fig 2: SQL code to extract data from the SQL database



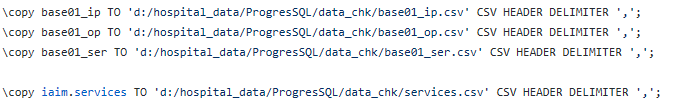


Fig 3: R code, use the input files created using SQL queries



...

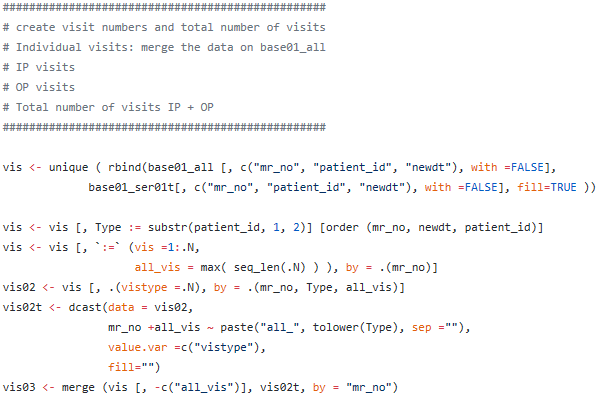
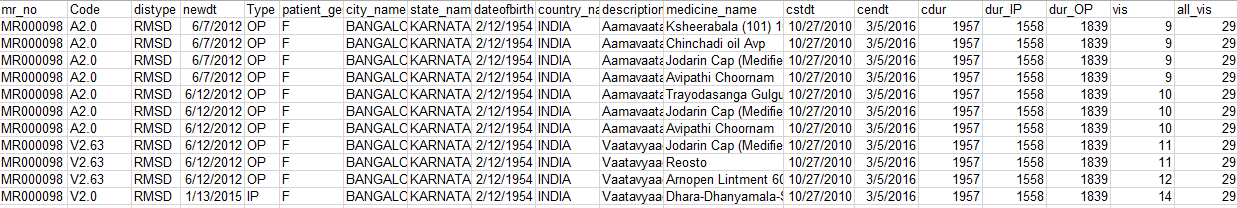


Fig 4: One of the datasets with key variables



The snapshot shows following variables:

1. patient ID,
2. Disease code,
3. Disease type,
4. Date of visit,
5. visit type (IP, OP),
6. gender,
7. city,
8. state,
9. date of birth,
10. Country,
11. Description of disease,
12. Medicine name,
13. Start date,
14. End date,
15. Total duration,
16. In Patient duration,
17. Outpatient duration,
18. Visit number,
19. Total number of visits, etc.

## Primary Study Endpoints/Secondary Endpoints

Insert a specific statement of the primary endpoints and the secondary endpoints, if any to be measured during the trial.

## Study Design/Type

Real World evidence approach employed to the existing data.

## Randomization

Not applicable

## Maintenance

Insert a description of the maintenance of the randomization codes and the procedure for breaking codes.

## Trial Treatment

Insert a description of the trial treatment(s) and the dosage and dosage regimen of the investigational product(s). Also include a description of the dosage form, packaging, and labeling of the investigational product(s).

## Duration

Insert the expected duration of subject participation and a description of the sequence and duration of all trial periods, including follow-up if any.

## Discontinuation

Insert a description of the stopping rules or discontinuation criteria for individual subjects, parts of the trial, and entire trial.

## Product Accountability

Insert accountability procedures for the investigational product(s), including the placebo(s) and comparator(s) if any.

## Data Identification

Insert the identification of any data to be recorded directly on the CRFs (i.e. no prior written or electronic record of data), and to be considered to be source data.

# Selection and Withdrawal of Subjects

## Inclusion Criteria

Patients having the following diseases reported at least once in the hospital database

Metabolic diseases list

|  |  |  |
| --- | --- | --- |
| M10.0 | Medoroga | Metabolic |
| M10.1 | Medoroga - Sthula medho roga | Metabolic |
| M10.2 | Medoroga - Sukshma medho roga | Metabolic |
| M2.0 | Madhumeha | Metabolic |
| P5.0 | Prameha | Metabolic |
| P5.1 | Prameha - Krusha | Metabolic |
| P5.2 | Prameha - Pidaka | Metabolic |
| P5.3 | Prameha - Sthula | Metabolic |
| P5.4 | Prameha - Upadrava | Metabolic |

Rheumatic and Musculoskeletal diseases list:

|  |  |  |
| --- | --- | --- |
| A2.0 | Aamavaata | RMSD |
| A2.1 | Aamavaata - Kaphaja | RMSD |
| A2.2 | Aamavaata - Pittaja | RMSD |
| A2.3 | Aamavaata - Vaataja | RMSD |
| A3.0 | Abhighataja Shoola | RMSD |
| S10.0 | Stambha | RMSD |
| S10.1 | Stambha - Baahu Stambha | RMSD |
| S10.10 | Stambha - Prishtha Stambha | RMSD |
| S10.12 | Stambha - Sandhi Stambha | RMSD |
| S10.13 | Stambha - Siraa Stambha | RMSD |
| S10.14 | Stambha - Uru Stambha | RMSD |
| S10.4 | Stambha - Greevaa Stambha | RMSD |
| S10.5 | Stambha - Hanu Stambha | RMSD |
| S10.6 | Stambha - Hridaya Stambha | RMSD |
| S13.0 | Sthaanabhedena Graha | RMSD |
| S13.1 | Sthaanabhedena Graha - Anga Graha | RMSD |
| S13.11 | Sthaanabhedena Graha - Katee Graha | RMSD |
| S13.13 | Sthaanabhedena Graha - Manyaa Graha | RMSD |
| S13.14 | Sthaanabhedena Graha - Marma Graha | RMSD |
| S13.17 | Sthaanabhedena Graha - Paada Graha | RMSD |
| S13.18 | Sthaanabhedena Graha - Paarshva Graha | RMSD |
| S13.19 | Sthaanabhedena Graha - Prishtha Graha | RMSD |
| S13.20 | Sthaanabhedena Graha - Shiro Graha | RMSD |
| S13.22 | Sthaanabhedena Graha - Uro Graha | RMSD |
| S13.23 | Sthaanabhedena Graha - Vaak Graha | RMSD |
| S13.3 | Sthaanabhedena Graha - Gala Graha | RMSD |
| S13.5 | Sthaanabhedena Graha - Hanu Graha | RMSD |
| S13.6 | Sthaanabhedena Graha - Hrid Graha | RMSD |
| S13.7 | Sthaanabhedena Graha - Jaanugraha | RMSD |
| S13.8 | Sthaanabhedena Graha - Janghaa Graha | RMSD |
| S14.0 | Sthaanabhedena Shoola | RMSD |
| S14.11 | Sthaanabhedena Shoola - Guda Shoola | RMSD |
| S14.13 | Sthaanabhedena Shoola - Gulpha Shoola | RMSD |
| S14.14 | Sthaanabhedena Shoola - Hanu Shoola | RMSD |
| S14.15 | Sthaanabhedena Shoola - Hasta Shoola | RMSD |
| S14.16 | Sthaanabhedena Shoola - Hrid Shoola | RMSD |
| S14.17 | Sthaanabhedena Shoola - Jaanu Shoola | RMSD |
| S14.18 | Sthaanabhedena Shoola - Janghaa Shoola | RMSD |
| S14.19 | Sthaanabhedena Shoola - Kantha Shoola | RMSD |
| S14.21 | Sthaanabhedena Shoola - Katee Shoola | RMSD |
| S14.23 | Sthaanabhedena Shoola - Kukshi Shoola | RMSD |
| S14.24 | Sthaanabhedena Shoola - Manyaa Shoola | RMSD |
| S14.3 | Sthaanabhedena Shoola - Amsa Shoola | RMSD |
| S14.4 | Sthaanabhedena Shoola - Anga Shoola | RMSD |
| S14.5 | Sthaanabhedena Shoola - Anguli Shoola | RMSD |
| S14.6 | Sthaanabhedena Shoola - Asthi Shoola | RMSD |
| S14.7 | Sthaanabhedena Shoola - Baahu Shoola | RMSD |
| S15.28 | Sthaanabhedena Shoola - Nakha Shoola | RMSD |
| S15.31 | Sthaanabhedena Shoola - Paada Shoola | RMSD |
| S15.32 | Sthaanabhedena Shoola - Paarshni Shoola | RMSD |
| S15.34 | Sthaanabhedena Shoola - Parva Shoola | RMSD |
| S15.36 | Sthaanabhedena Shoola - Prishtha Shoola | RMSD |
| S15.41 | Sthaanabhedena Shoola - Sakthi Shoola | RMSD |
| S15.42 | Sthaanabhedena Shoola - Sandhi Shoola | RMSD |
| S15.43 | Sthaanabhedena Shoola - Skandha Shoola | RMSD |
| S15.44 | Sthaanabhedena Shoola - Snaayu Shoola | RMSD |
| S15.45 | Sthaanabhedena Shoola - Sphik Shoola | RMSD |
| S15.46 | Sthaanabhedena Shoola - Stanaanta Shoola | RMSD |
| S15.47 | Sthaanabhedena Shoola - Trika Shoola | RMSD |
| S15.48 | Sthaanabhedena Shoola - Urah Shoola | RMSD |
| S1A.0 | Shoola | RMSD |
| V1.0 | Vaatarakta | RMSD |
| V1.1 | Vaatarakta - Dvandvaja | RMSD |
| V1.2 | Vaatarakta - Gambheera | RMSD |
| V1.3 | Vaatarakta - Kapha Vaataja | RMSD |
| V1.4 | Vaatarakta - Kaphaadhika Vaatarakta | RMSD |
| V1.5 | Vaatarakta - Pittaadhika Vaatarakta | RMSD |
| V1.7 | Vaatarakta - Uttaana | RMSD |
| V1.8 | Vaatarakta - Vaata Kaphaja | RMSD |
| V1.9 | Vaatarakta - Vaataadhika Vaatarakta | RMSD |
| V2.0 | Vaatavyaadhi | RMSD |
| V2.12 | Vaatavyaadhi - Stabdhagaatra | RMSD |
| V2.16 | Vaatavyaadhi - Baahugata Vaata | RMSD |
| V2.23 | Vaatavyaadhi - Gridhrasee | RMSD |
| V2.30 | Vaatavyaadhi - Jaanugata Vaata | RMSD |
| V2.31 | Vaatavyaadhi - Janghaagata Vaata | RMSD |
| V2.36 | Vaatavyaadhi - Kateegata Vaata | RMSD |
| V2.42 | Vaatavyaadhi - Maamsagata Vaata | RMSD |
| V2.43 | Vaatavyaadhi - Maamsamedogata Vaata | RMSD |
| V2.44 | Vaatavyaadhi - Majjaagata Vaata | RMSD |
| V2.45 | Vaatavyaadhi - Majjaasthigata Vaata | RMSD |
| V2.46 | Vaatavyaadhi - Manyaagata Vaata | RMSD |
| V2.47 | Vaatavyaadhi - Manyaastambha | RMSD |
| V2.48 | Vaatavyaadhi - Medogata Vaata | RMSD |
| V2.61 | Vaatavyaadhi - Prishthagata Vaata | RMSD |
| V2.63 | Vaatavyaadhi - Sandhigata Vaata | RMSD |
| V2.64 | Vaatavyaadhi - Sarvaangagata Vaata | RMSD |
| V2.65 | Vaatavyaadhi - Shaakhaagata Vaata | RMSD |
| V2.68 | Vaatavyaadhi - Siraagata Vaata | RMSD |
| V2.69 | Vaatavyaadhi - Siraagraha | RMSD |
| V2.70 | Vaatavyaadhi - Snaayugata Vaata | RMSD |
| V2.72 | Vaatavyaadhi - Trikgata Vaata | RMSD |
| V2.73 | Vaatavyaadhi - Tvaggata Vaata | RMSD |
| V2.74 | Vaatavyaadhi - Urugata Vaata | RMSD |
| V2.75 | Vaatavyaadhi - Vaatakantaka | RMSD |
| V2.77 | Vaatavyaadhi - Vishvaachee | RMSD |
| V2.9 | Vaatavyaadhi - Asthigata Vaata | RMSD |

Neuroscience diseases list:

|  |  |  |
| --- | --- | --- |
|  |  | NEURO |
|  |  | NEURO |
|  |  | NEURO |

## Exclusion Criteria

Patients who do not have any of the above reported diseases in the hospital database.

## Subject Withdrawal

Insert subject withdrawal criteria (i.e. terminating investigational product treatment/trial treatment) and procedures specifying:

1. When and how to withdraw subjects from the trial/investigational product treatment.
2. The type and timing of the data to be collected for withdrawal of subjects.
3. Whether and how subjects are to be replaced.
4. The follow-up for subjects withdrawn from investigational treatment/trial treatment.

## Treatment of Subjects

Insert how the treatment(s) is(are) to be administered, including the name(s) of all the product(s), the dose(s), the dosing schedule(s), the route/mode(s) of administration, and the treatment period(s), including follow-up period(s) for subjects for each investigational product treatment/trial treatment group/arm of the trial.

## Medication

Insert medication(s)/treatment(s) permitted (including rescue medication) and not permitted before and/or during the trial.

## Monitoring for subject compliance

Insert the procedures for monitoring subject compliance

# Assessment of Efficacy

## Efficacy Parameters

Insert the specifications of the efficacy parameters.

## Method and Timing

Insert methods and timing for assessing, recording and analyzing efficacy parameters.

# Assessment of Safety

## Safety Parameters

Insert specifications for safety parameters.

## Method and Timing

Insert the methods and timing for assessing, recording and analyzing safety parameters.

## Adverse Event Reporting

Insert a statement about compliance with the local IRB requirements and the requirements of other regulatory authorities that may apply (most commonly the Food and Drug Administration).

Procedures for eliciting reports of and for recording and reporting adverse event and intercurrent illnesses should be described in this section.

## Definitions

See <http://www.research.umn.edu/irb/ae/> prior to completing this section. Insert definitions for how you will apply the terms “unanticipated”, “serious”, and “related” to problems that arise during the study.

See definitions for adverse events and serious adverse events under the Code of Federal Regulations at: <http://www.ahc.umn.edu/research/indide/definitions/home.html>.

## Adverse Event Follow-up

Insert the type and duration of the follow-up of subjects after adverse events.

# Statistical Plan

## Statistical Methods

Insert a description of the statistical methods to be employed including timing of any planned interim analysis(ses).

## Subject Population(s) for Analysis

Insert the number of subjects planned to be enrolled. In multi-center trials, the number of enrolled subjects projected for each trial site should be specified. Provide a reason for choice of sample size, including reflection on (or calculations of) the power of the trial and clinical justification. Also include, here, how you will select the group of subjects for analysis (e.g., all randomized subjects, all dosed subjects, all eligible subjects, and only evaluable subjects).

## Significance

Insert the level of significance to be used.

## Termination Criteria

Insert the criteria for the termination of the trial.

## Accountability Procedure

Insert the procedure for accounting for missing, unused and spurious data.

## Deviation Reporting

Insert the procedures for reporting any deviation(s) from the original statistical plan. Any deviation(s) from the original statistical plan should be described and justified in the protocol and/or in the final report.

# Direct Access to Source Data/Documentation

It should be specified in the protocol or other written agreement the investigator(s)/institution(s) will permit trial-related monitoring, audits,

IRB/IEC(s) review and regulatory inspection(s) by providing direct access

to source data/documentation.

# Quality Control and Quality Assurance

Insert how you will ensure that this study is conducted – and that data are generated, documented (recorded), and reported - in compliance with this protocol, with GCP, and any other applicable regulatory requirements.

# Ethical Considerations

Describe the ethical considerations relating to this study. The following language is an example:

This study will be conducted according to US and international standards of Good Clinical Practice (FDA regulations 21 CFR 312 for IND studies and FDA guidance E6) for all studies. Applicable government regulations and University of Minnesota research policies and procedures will also be followed.

This protocol and any amendments will be submitted to the University of Minnesota Institutional Review Board (IRB) for formal approval to conduct the study. The decision of the IRB concerning the conduct of the study will be made in writing to the investigator.

All subjects for this study will be provided a consent form describing this study and providing sufficient information for subjects to make an informed decision about their participation in this study. This consent form will be submitted with the protocol for review and approval by the IRB. The formal consent of a subject, using the IRB-approved consent form, will be obtained before that subject is submitted to any study procedure. This consent form must be signed by the subject or legally acceptable surrogate, and the investigator-designated research professional obtaining the consent.

# Data Handling and Record Keeping

Insert a description of who, what, where and why

# Finance and Insurance

Insert financing and insurance statements if not addressed in a separate agreement. Who will be responsible for paying for research related costs? Who will be responsible for paying for injuries in case of accident?

# Publication Plan

Where ownership of the data is not in question – this section may be omitted. Otherwise, insert a publication policy, if not addressed in a separate agreement (most commonly a contract).

# Supplements

Insert any other documentation for the trial.

**Following documents must be submitted:**

1. Application form (scanned copy/original can be submitted while applying for review; original must be submitted to receive approval letter)

2. Study protocol

3. Data collection tools

4. Consent form (English and local language)

5. CV of investigators

6. Any other relevant documents

# Analysis description and details:

## Understanding the hospital database

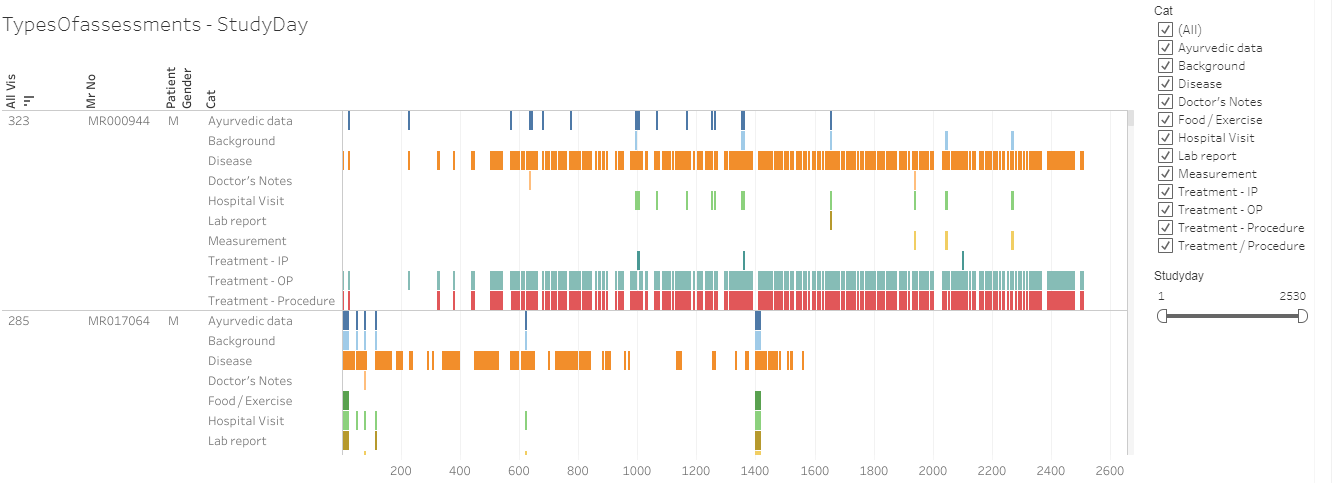
The hospital database has been created to capture patient level information as well as operational information. The data is collected in various Case Report forms and in various columns called as “variables”. Each Case Report form is systematically stored in a logical table. These tables and variables are named appropriately so that the end user will be able to utilize the data for further analysis. Please find the list of tables and names of the tables where the source data is captured and stored.

| **CRF number**  **(section\_id)** | **CRF page name**  **(section\_title)** | **Classification** |
| --- | --- | --- |
| 1 | History of Present Illness | Ayurvedic data |
| 2 | Review Of Systems |  |
| 3 | Physical Examination |  |
| 4 | Past / Family / Personal History/History of trauma/ injury | Ayurvedic data |
| 5 | Nurse Assessment |  |
| 6 | Gyn History |  |
| 7 | OBG History |  |
| 8 | Samprapti Ghatakas | Ayurvedic data |
| 9 | Rogi Pareeksha | Ayurvedic data |
| 10 | Session |  |
| 11 | Roga Vinischaya |  |
| 12 | Systemic Examination |  |
| 13 | Investigations |  |
| 14 | Complaint |  |
| 15 | IP Case Proforma |  |
| 16 | General Examination1 |  |
| 17 | Local Examination |  |
| 18 | Nidana |  |
| 19 | Dashavidha Pareeksha | Ayurvedic data |
| 20 | Nutitional Assessment |  |
| 21 | General Examination |  |
| 22 | Breathing Practices |  |
| 23 | Loosening Practices |  |
| 24 | Postures | Ayurvedic data |
| 25 | Kriyas |  |
| 26 | Pranayamas | Ayurvedic data |
| 27 | Mudras | Ayurvedic data |
| 28 | Bandhas |  |
| 29 | Relaxation Techniques |  |
| 30 | Meditation Techniques | Ayurvedic data |
| 31 | Netra Case Sheet |  |
| 32 | Vitals |  |
| 33 | Visual Acuity Test |  |
| 34 | Glass Power Prescription |  |
| 35 | Other Findings |  |
| 36 | Nephrology Case sheet |  |
| 37 | Personal History |  |
| 38 | Vihara |  |
| 39 | Wellness assesment of child |  |
| 40 | GROWTH & DEVELOPMENT ASSESSMENT |  |
| 41 | Dosha Assessment Questionnaire |  |
| 42 | Diet Recommendations |  |
| 43 | Operation Notes |  |
| 44 | Conduction Notes |  |
| 77 | IP - History of Present Illness | Ayurvedic data |
| 78 | IP - Gyn History |  |
| 79 | IP - Samprapti Ghatakas | Ayurvedic data |
| 80 | IP - Nidan Panchak | Ayurvedic data |
| 81 | IP – Session |  |
| 82 | IP - Roga Vinischaya |  |
| 83 | IP - Systemic Examination |  |
| 84 | IP – Investigations |  |
| 85 | IP – Complaint |  |
| 86 | IP - Local Examination |  |
| 87 | IP - Dashavidha Pareeksha |  |
| 88 | IP - Nutitional Assessment |  |
| 89 | IP - General Examination |  |
| 90 | Visit Breathing Practices |  |
| 91 | Visit Loosening Practices |  |
| 92 | Visit Postures |  |
| 93 | Visit Kriyas |  |
| 94 | Visit Pranayamas |  |
| 95 | Visit Mudras |  |
| 96 | Visit Bandhas |  |
| 97 | Visit Relaxation Techniques |  |
| 98 | Visit Meditation Techniques |  |
| 99 | Doctor Advice |  |
| 100 | Oral Cavity | Ayurvedic data |
| 101 | Ear |  |
| 102 | Nose |  |
| 103 | Complaints And Associated Complaints |  |
| 104 | History of Previous Illness |  |
| 105 | Medical History |  |
| 106 | Investigation. |  |
| 107 | Obstetrical History |  |
| 108 | Food Habit |  |
| 109 | Activity(Vihara) |  |
| 110 | Physical.Examination. |  |
| 111 | ASTA STHANA PARIKSHA | Ayurvedic data |
| 112 | DASHA VIDHA PARIKSHA | Ayurvedic data |
| 113 | Date |  |
| 114 | Treatment Plan |  |
| 115 | Final Diagnosis |  |
| 116 | Physiotherapy Treatment Plan |  |
| 117 | Physiotherapy Short term Goal |  |
| 118 | Physiotherapy Long Term Goal |  |
| 119 | Yoga Treatment Plan |  |
| 120 | Physiotherapy Assessment |  |
| 121 | Physiotherapy Outcome |  |
| 122 | ROGA VINISCHAYA |  |
| 123 | ROGA VINISCHAYA – IP |  |
| 124 | CCHPI |  |
| 125 | Health History: Do you have Or have you ever had any of the following? |  |
| 126 | CLINICAL EXAMINATION |  |

The rows in the table above marked in yellow color contain very little data (33 tables out of 66), so are not utilized for the analysis purpose. The tables and variables are classified into following sections to get an idea about what kind of data is collected:

1. Ayurvedic data
2. Background
3. Disease
4. Doctor's Notes
5. Food / Exercise
6. Hospital Visit
7. Lab report
8. Measurement
9. Treatment / Procedure

This data was analyzed to understand data collection pattern for patients. If there is any non-missing data present in a particular variable or a column then a pseudo value “Yes” is assigned, if the data is missing then a pseudo “Blank or No” value is assigned for the purpose of analysis. Tableau display is presented below as an illustration.



The analysis carried out shows that for majority of the patient and for majority of the visits, the disease data and medication (Treatment /Procedure) are entered and is not missing. Most of the other categories are not entered as consistently as they should have been. This lack of information should be addressed.\*

References to the analysis files:

|  |  |
| --- | --- |
| R program | 03\_typesOfassessment.R |
| Datafile | 03\_typesOfassessent.csv |
| Tableau vizname | 03\_typesOfassessment |
| Tableau sheetname | TypesOfassessments – StudyDay |

## Understanding variables from various CRF pages

The following analysis provides information about distinct number of patients present in individual table as well as unique values present for various variables.

1. As explained above, there are many CRF pages with very little number of patients.
2. There are many variables where captured data is in a “free text” format. These provide the doctors flexibility during data entry and the complete information gets captured.
3. This creates challenges in analysis. Same data value could be represented in different cases, minor spelling mistakes, human errors in data handling, etc. This causes lower data accuracy

E.g. Let us take a look at the following row in the table below:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| sec001\_var008\_Diabetes | 1064 | 4124 |  |  | Background |

1. sec001\_var008\_Diabetes: presents CRF page 1 “History of Present Illness” and variable number 8 “Diabetes”.
2. This variable has 1064 unique values entered by different doctors for different patients.
3. There is some entered data for 4124 distinct patients and
4. This variable is categorized as variable capturing data for category “Background”.

Another example:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| sec001\_var018\_Associated Complaint with Onset & Duration | 5102 | 4549 |  |  | Disease |

1. sec001\_var018\_Associated Complaint with Onset & Duration: presents CRF page 1 “History of Present Illness” and variable number 8 “Associated Complaint with Onset & Duration”.
2. This variable has 5102 different values entered by different doctors for different patients.
3. There is some entered data for 4549 distinct patients and
4. This variable is categorized as variable capturing data for category “Disease”.

This data provides the following areas of improvements:

1. Standardization of CRF pages for better data capture – there are some standards already available in healthcare industry, they could be implemented at the hospital.
   1. CDISC standards
   2. ISO standards
2. Implementation of the standard dictionaries to capture data uniformly and make analysis ready, some of these could be directly implemented; some could be modified for our requirements.
   1. LOINC standards
   2. NCI USA Code lists
   3. MedDRA dictionary
   4. ICD Codes
3. There are some variables present in more than 1 CRF page, this duplication should be removed.
4. After consulting experts in specific fields make some variables mandatory with appropriate values, pre-defined drop down lists.
5. Data quality as well as amount of data for Ayurvedic parameters should be improved to recreate patient information.

These steps should help in improving the data quality and data consistency.

| The CRF page + Variable name | Distinct values of the variable | Distinct number of patients | Data | Status | Data category |
| --- | --- | --- | --- | --- | --- |
| sec001\_var001\_Location | 7 | 6 |  |  | Measurement |
| sec001\_var002\_Quality | 2 | 1 |  |  | Measurement |
| sec001\_var003\_Duration | 3 | 2 |  |  | Measurement |
| sec001\_var004\_Context | 4 | 3 |  |  | Measurement |
| sec001\_var005\_Modifying Factors | 2 | 1 |  |  | Measurement |
| sec001\_var006\_Associated Signs & Symptoms | 3 | 2 |  |  | Disease |
| sec001\_var007\_Additional Complaint | 9 | 8 |  |  | Disease |
| sec001\_var008\_Diabetes | 1064 | 4124 |  |  | Background |
| sec001\_var009\_Hypertension | 967 | 3895 |  |  | Background |
| sec001\_var010\_Allergy | 189 | 587 |  |  | Background |
| sec001\_var011\_Renal Diseases | 39 | 79 |  |  | Background |
| sec001\_var012\_Liver Diseases | 13 | 53 |  |  | Background |
| sec001\_var013\_Food Allergy | 52 | 102 |  |  | Food / Exercise |
| sec001\_var014\_Food Intolerance | 13 | 45 |  |  | Food / Exercise |
| sec001\_var015\_Chief Complaint with Onset & Duration | 16488 | 11536 |  |  | Disease |
| sec001\_var016\_Upashaya | 250 | 585 |  |  | Ayurvedic data |
| sec001\_var017\_Anupashaya | 369 | 588 |  |  | Ayurvedic data |
| sec001\_var018\_Associated Complaint with Onset & Duration | 5102 | 4549 |  |  | Disease |
| sec002\_var001\_ENT | 3 | 2 | Little data | Not to be used | Measurement |
| sec002\_var002\_Respiratory | 3 | 2 | Little data | Not to be used | Measurement |
| sec002\_var003\_Abdominal Pain | 3 | 2 | Little data | Not to be used | Measurement |
| sec002\_var004\_Gastrointestinal | 4 | 3 | Little data | Not to be used | Measurement |
| sec002\_var005\_Urinary Frequency | 2 | 1 | Little data | Not to be used | Measurement |
| sec002\_var006\_Joint Pain | 10 | 10 | Little data | Not to be used | Measurement |
| sec002\_var007\_Joint Swelling | 5 | 5 | Little data | Not to be used | Measurement |
| sec002\_var008\_Muscle Pain | 4 | 3 | Little data | Not to be used | Measurement |
| sec002\_var009\_Musculoskeletal | 15 | 14 | Little data | Not to be used | Measurement |
| sec002\_var010\_Integumentary | 6 | 5 | Little data | Not to be used | Measurement |
| sec002\_var011\_Tremor | 2 | 1 | Little data | Not to be used | Measurement |
| sec002\_var012\_Neurological | 2 | 1 | Little data | Not to be used | Measurement |
| sec002\_var013\_Psychiatric | 2 | 1 | Little data | Not to be used | Measurement |
| sec003\_var001\_Eyes | 2 | 1 | Little data | Not to be used | Measurement |
| sec003\_var002\_Sinusitis | 2 | 1 | Little data | Not to be used | Measurement |
| sec003\_var003\_ENT | 3 | 2 | Little data | Not to be used | Measurement |
| sec003\_var004\_Respiratory | 3 | 2 | Little data | Not to be used | Measurement |
| sec003\_var005\_Abdominal Pain | 3 | 2 | Little data | Not to be used | Measurement |
| sec003\_var006\_Gastrointestinal | 4 | 3 | Little data | Not to be used | Measurement |
| sec003\_var007\_Arthralgia | 8 | 8 | Little data | Not to be used | Measurement |
| sec003\_var008\_Edema | 2 | 1 | Little data | Not to be used | Measurement |
| sec003\_var009\_Lumbago | 3 | 3 | Little data | Not to be used | Measurement |
| sec003\_var010\_Myalgia | 2 | 1 | Little data | Not to be used | Measurement |
| sec003\_var011\_Pain in the Limb | 4 | 3 | Little data | Not to be used | Measurement |
| sec003\_var012\_Stiffness | 3 | 2 | Little data | Not to be used | Measurement |
| sec003\_var013\_Swelling | 5 | 4 | Little data | Not to be used | Measurement |
| sec003\_var014\_Musculoskeletal | 17 | 16 | Little data | Not to be used | Measurement |
| sec003\_var015\_Integumentary | 6 | 5 | Little data | Not to be used | Measurement |
| sec003\_var016\_Tremor | 2 | 1 | Little data | Not to be used | Measurement |
| sec003\_var017\_Neurological | 4 | 3 | Little data | Not to be used | Measurement |
| sec003\_var018\_Psychiatric | 2 | 1 | Little data | Not to be used | Measurement |
| sec004\_var001\_Medical History | 8679 | 9472 |  |  | Background |
| sec004\_var002\_Family History | 1465 | 3270 |  |  | Background |
| sec004\_var003\_Diagnostic History | 4018 | 4247 |  |  | Background |
| sec004\_var004\_Surgical History | 3157 | 4796 |  |  | Background |
| sec004\_var005\_Psychological & Occupational History | 623 | 2035 |  |  | Background |
| sec004\_var006\_Ahara | 1961 | 8906 |  |  | Ayurvedic data |
| sec004\_var007\_Vihara | 364 | 2000 |  |  | Ayurvedic data |
| sec004\_var008\_Nidra | 940 | 8778 |  |  | Ayurvedic data |
| sec004\_var009\_Vyayama | 710 | 1718 |  |  | Ayurvedic data |
| sec004\_var010\_Vyavaya | 40 | 138 |  |  | Ayurvedic data |
| sec004\_var011\_Mala | 1750 | 9121 |  |  | Ayurvedic data |
| sec004\_var012\_Mutra | 1051 | 8302 |  |  | Ayurvedic data |
| sec004\_var013\_Madakari Dravya Abhyasa | 1041 | 1532 |  |  | Ayurvedic data |
| sec004\_var014\_Immunization History | 25 | 533 |  |  | Background |
| sec004\_var015\_Birth History | 48 | 617 |  |  | Background |
| sec004\_var016\_Growth and development History | 35 | 613 |  |  | Background |
| sec006\_var001\_Menarche (yrs) | 87 | 367 |  |  | Background |
| sec006\_var002\_Menopause (yrs) | 488 | 801 |  |  | Background |
| sec006\_var003\_MH | 749 | 961 |  |  | Measurement |
| sec006\_var004\_LMP | 989 | 717 |  |  | Measurement |
| sec006\_var005\_PMH | 143 | 99 |  |  | Measurement |
| sec006\_var006\_Colour | 29 | 151 |  |  | Measurement |
| sec006\_var007\_Consistency | 15 | 83 |  |  | Measurement |
| sec006\_var008\_Characteristics | 110 | 105 |  |  | Measurement |
| sec006\_var009\_Flow | 182 | 429 |  |  | Measurement |
| sec006\_var010\_Clots | 63 | 200 |  |  | Measurement |
| sec006\_var011\_Smell | 19 | 84 |  |  | Measurement |
| sec006\_var012\_Discharge | 44 | 62 |  |  | Measurement |
| sec006\_var013\_Pre Menstrual Symptoms | 53 | 54 |  |  | Measurement |
| sec006\_var014\_Menopausal Symptoms | 9 | 7 |  |  | Measurement |
| sec007\_var001\_Married | 110 | 138 |  |  | Background |
| sec007\_var002\_Single | 2 | 1 |  |  | Background |
| sec007\_var003\_Widow | 2 | 1 |  |  | Background |
| sec007\_var004\_FTND | 108 | 764 |  |  | Measurement |
| sec007\_var005\_Mode of Delivery | 45 | 47 |  |  | Background |
| sec007\_var006\_PTND | 4 | 6 |  |  | Background |
| sec007\_var007\_LSCS | 77 | 333 |  |  | Background |
| sec007\_var008\_Instrumental | 17 | 21 |  |  | Background |
| sec007\_var009\_Complications | 9 | 8 |  |  | Background |
| sec007\_var010\_LMP | 83 | 78 |  |  | Background |
| sec007\_var011\_POG | 39 | 15 |  |  | Background |
| sec007\_var012\_EDD | 18 | 14 |  |  | Background |
| sec007\_var013\_OH | 119 | 128 |  |  | Background |
| sec007\_var014\_G | 20 | 1145 |  |  | Background |
| sec007\_var015\_P | 19 | 1075 |  |  | Background |
| sec007\_var016\_A | 82 | 956 |  |  | Background |
| sec007\_var017\_L | 34 | 1094 |  |  | Background |
| sec007\_var018\_D | 19 | 639 |  |  | Background |
| sec007\_var019\_Antenatal/Foetal History | 3 | 2 |  |  | Background |
| sec008\_var001\_Rasa | 3 | 3 | Little data | Not to be used | Ayurvedic data |
| sec008\_var002\_Dooshya | 10 | 11 | Little data | Not to be used | Ayurvedic data |
| sec008\_var003\_Rakta | 3 | 3 | Little data | Not to be used | Ayurvedic data |
| sec008\_var004\_Mamsa | 3 | 2 | Little data | Not to be used | Ayurvedic data |
| sec008\_var005\_Asthi | 4 | 3 | Little data | Not to be used | Ayurvedic data |
| sec008\_var006\_Majja | 5 | 8 | Little data | Not to be used | Ayurvedic data |
| sec008\_var007\_Mala | 2 | 1 | Little data | Not to be used | Ayurvedic data |
| sec008\_var008\_Mutra | 2 | 1 | Little data | Not to be used | Ayurvedic data |
| sec008\_var009\_Stanya | 2 | 1 | Little data | Not to be used | Ayurvedic data |
| sec008\_var010\_Artava | 2 | 1 | Little data | Not to be used | Ayurvedic data |
| sec008\_var011\_Sira | 3 | 3 | Little data | Not to be used | Ayurvedic data |
| sec008\_var012\_Twacha | 4 | 3 | Little data | Not to be used | Ayurvedic data |
| sec008\_var013\_Snayu | 2 | 1 | Little data | Not to be used | Ayurvedic data |
| sec008\_var014\_Srotas | 6 | 8 | Little data | Not to be used | Ayurvedic data |
| sec008\_var015\_Raktavaha | 3 | 3 | Little data | Not to be used | Ayurvedic data |
| sec008\_var016\_Mamsavaha | 2 | 1 | Little data | Not to be used | Ayurvedic data |
| sec008\_var017\_Asthivaha | 3 | 2 | Little data | Not to be used | Ayurvedic data |
| sec008\_var018\_Majjavaha | 4 | 5 | Little data | Not to be used | Ayurvedic data |
| sec008\_var019\_Mutravaha | 2 | 1 | Little data | Not to be used | Ayurvedic data |
| sec008\_var020\_Manovaha | 6 | 5 | Little data | Not to be used | Ayurvedic data |
| sec008\_var021\_Ati pravrutti | 3 | 2 | Little data | Not to be used | Ayurvedic data |
| sec008\_var022\_Sangha | 3 | 2 | Little data | Not to be used | Ayurvedic data |
| sec008\_var023\_Vimarga gamana | 4 | 3 | Little data | Not to be used | Ayurvedic data |
| sec008\_var024\_Sira granthi | 3 | 3 | Little data | Not to be used | Ayurvedic data |
| sec009\_var001\_Nidana.... | 1088 | 2648 |  |  | Ayurvedic data |
| sec009\_var002\_Poorvaroopa | 521 | 1045 |  |  | Ayurvedic data |
| sec009\_var003\_Roopa | 1955 | 2693 |  |  | Ayurvedic data |
| sec009\_var004\_Ahara | 62 | 173 |  |  | Ayurvedic data |
| sec009\_var005\_Vihara | 48 | 150 |  |  | Ayurvedic data |
| sec009\_var006\_Vyasana | 12 | 17 |  |  | Ayurvedic data |
| sec009\_var007\_Manasika | 7 | 9 |  |  | Ayurvedic data |
| sec009\_var008\_Abhighata | 15 | 14 |  |  | Ayurvedic data |
| sec010\_var001\_Session Start Time | 3692 | 16073 |  |  | Hospital Visit |
| sec010\_var002\_Session End Time | 3460 | 15950 |  |  | Hospital Visit |
| sec010\_var003\_Screening Doctor | 769 | 15625 |  |  | Hospital Visit |
| sec011\_var001\_Allopathic Diagnosis | 4907 | 5880 |  |  | Disease |
| sec012\_var001\_Examination | 114 | 111 |  |  | Measurement |
| sec012\_var002\_Neurological | 961 | 849 |  |  | Measurement |
| sec012\_var003\_Ophthalmic | 27 | 26 |  |  | Measurement |
| sec012\_var004\_ENT | 142 | 135 |  |  | Measurement |
| sec012\_var005\_Cardiovascular | 108 | 650 |  |  | Measurement |
| sec012\_var006\_Respiratory | 541 | 1035 |  |  | Measurement |
| sec012\_var007\_Gastrointestinal | 749 | 909 |  |  | Measurement |
| sec012\_var008\_Urinary | 30 | 34 |  |  | Measurement |
| sec012\_var009\_Genital | 62 | 54 |  |  | Measurement |
| sec012\_var010\_Musculoskeletal | 6037 | 4843 |  |  | Measurement |
| sec012\_var011\_Integumentary | 286 | 253 |  |  | Measurement |
| sec012\_var012\_Endocrine | 16 | 15 |  |  | Measurement |
| sec012\_var013\_Psychiatric | 15 | 14 |  |  | Measurement |
| sec012\_var014\_Hemotological/Lymphatic | 146 | 138 |  |  | Measurement |
| sec012\_var015\_Allergic/Immunologic | 9 | 8 | Little data | Not to be used | Measurement |
| sec012\_var016\_Local Examination | 29 | 28 | Little data | Not to be used | Measurement |
| sec012\_var017\_All other systems | 22 | 25 | Little data | Not to be used | Measurement |
| sec013\_var001\_Investigation Reports | 6241 | 4246 |  |  | Lab report |
| sec014\_var001\_Complaint | 46658 | 16385 |  |  | Background |
| sec014\_var002\_Doctor's Notes | 4751 | 3064 |  |  | Doctor's Notes |
| sec014\_var003\_Source of History | 195 | 6502 |  |  | Background |
| sec017\_var001\_Examinationm,,,,, | 3891 | 3016 |  |  | Measurement |
| sec017\_var002\_VAS | 79 | 194 |  |  | Measurement |
| sec017\_var003\_Tenderness | 247 | 269 |  |  | Measurement |
| sec017\_var004\_Crepitation's | 142 | 255 |  |  | Measurement |
| sec017\_var005\_Measurement of the knee | 86 | 90 |  |  | Measurement |
| sec017\_var006\_Goniometric assessment | 160 | 132 |  |  | Measurement |
| sec017\_var007\_Examination | 865 | 728 |  |  | Measurement |
| sec019\_var001\_Rasa | 3 | 4 | Little data | Not to be used | Ayurvedic data |
| sec019\_var002\_Rakta | 3 | 4 | Little data | Not to be used | Ayurvedic data |
| sec019\_var003\_Mamsa | 3 | 4 | Little data | Not to be used | Ayurvedic data |
| sec019\_var004\_Meda | 3 | 4 | Little data | Not to be used | Ayurvedic data |
| sec019\_var005\_Asthi | 3 | 4 | Little data | Not to be used | Ayurvedic data |
| sec019\_var006\_Majja | 4 | 4 | Little data | Not to be used | Ayurvedic data |
| sec019\_var007\_Shukra | 3 | 2 | Little data | Not to be used | Ayurvedic data |
| sec019\_var008\_Satva | 2 | 1 | Little data | Not to be used | Ayurvedic data |
| sec020\_var001\_Normal | 4 | 4 | Little data | Not to be used | Measurement |
| sec020\_var002\_Poor | 2 | 1 | Little data | Not to be used | Measurement |
| sec020\_var003\_Yes | 6 | 6 | Little data | Not to be used | Measurement |
| sec020\_var004\_No | 2 | 1 | Little data | Not to be used | Measurement |
| sec020\_var005\_Yes | 6 | 5 | Little data | Not to be used | Measurement |
| sec020\_var006\_No | 2 | 1 | Little data | Not to be used | Measurement |
| sec020\_var007\_Junk Foods | 16 | 148 | Little data | Not to be used | Food / Exercise |
| sec020\_var008\_Untimely Food | 10 | 156 | Little data | Not to be used | Food / Exercise |
| sec020\_var009\_Excessive Food | 7 | 129 | Little data | Not to be used | Food / Exercise |
| sec020\_var010\_Yes | 6 | 5 | Little data | Not to be used | Food / Exercise |
| sec020\_var011\_No | 20 | 32 | Little data | Not to be used | Food / Exercise |
| sec020\_var012\_Yes | 48 | 74 | Little data | Not to be used | Food / Exercise |
| sec020\_var013\_No | 2 | 1 | Little data | Not to be used | Food / Exercise |
| sec020\_var014\_Yes | 111 | 188 | Little data | Not to be used | Food / Exercise |
| sec020\_var015\_No | 3 | 2 | Little data | Not to be used | Food / Exercise |
| sec020\_var016\_Yes | 106 | 163 | Little data | Not to be used | Food / Exercise |
| sec020\_var017\_No | 2 | 1 | Little data | Not to be used | Food / Exercise |
| sec020\_var018\_Consultant Dietic Restrictions | 149 | 248 | Little data | Not to be used | Food / Exercise |
| sec020\_var019\_General Dietic restrictions | 129 | 216 | Little data | Not to be used | Food / Exercise |
| sec021\_var001\_Appearance | 56 | 1078 |  |  | Background |
| sec021\_var002\_Body Built | 55 | 1124 |  |  | Background |
| sec021\_var003\_Body Strength | 33 | 1094 |  |  | Background |
| sec021\_var004\_Orientation | 58 | 1118 |  |  | Background |
| sec021\_var005\_Conciousness | 41 | 1018 |  |  | Background |
| sec021\_var006\_Appearance | 47 | 796 |  |  | Background |
| sec021\_var007\_Pallor | 22 | 904 |  |  | Background |
| sec021\_var008\_Jaundice | 10 | 880 |  |  | Background |
| sec021\_var009\_Odema | 99 | 878 |  |  | Background |
| sec021\_var010\_Lymphadenopathy | 19 | 644 |  |  | Background |
| sec021\_var011\_Nourishment | 48 | 655 |  |  | Background |
| sec021\_var012\_Posture | 51 | 494 |  |  | Background |
| sec021\_var013\_Mental State | 47 | 553 |  |  | Background |
| sec021\_var014\_Facies | 29 | 303 |  |  | Background |
| sec022\_var001\_Shashankasana breathing | 2 | 1 | Little data | Not to be used | Measurement |
| sec022\_var002\_Side leg raising | 2 | 1 | Little data | Not to be used | Measurement |
| sec022\_var003\_Straight leg raising | 2 | 1 | Little data | Not to be used | Measurement |
| sec022\_var004\_Naukasana breathing | 2 | 1 | Little data | Not to be used | Measurement |
| sec023\_var001\_Neck movement Ã¢Â€Â“ Forward/backward bending | 3 | 2 | Little data | Not to be used | Measurement |
| sec023\_var002\_Neck movement Ã¢Â€Â“ side bending | 2 | 1 | Little data | Not to be used | Measurement |
| sec023\_var003\_Neck movement Ã¢Â€Â“ Twisting | 2 | 1 | Little data | Not to be used | Measurement |
| sec023\_var004\_Neck movement Ã¢Â€Â“ Rotation | 2 | 1 | Little data | Not to be used | Measurement |
| sec023\_var005\_Shoulder rotation | 2 | 1 | Little data | Not to be used | Measurement |
| sec023\_var006\_Elbow movements/Rotation | 2 | 1 | Little data | Not to be used | Measurement |
| sec023\_var007\_Wrist movements/rotation | 2 | 1 | Little data | Not to be used | Measurement |
| sec023\_var008\_Finger joint loosening | 2 | 1 | Little data | Not to be used | Measurement |
| sec023\_var009\_Waist rotation | 2 | 1 | Little data | Not to be used | Measurement |
| sec023\_var010\_Forward/backward bending | 2 | 1 | Little data | Not to be used | Measurement |
| sec023\_var011\_Side bending | 2 | 1 | Little data | Not to be used | Measurement |
| sec023\_var012\_Twisting | 2 | 1 | Little data | Not to be used | Measurement |
| sec023\_var013\_Alternate toe touching | 2 | 1 | Little data | Not to be used | Measurement |
| sec023\_var014\_Drill walking | 2 | 1 | Little data | Not to be used | Measurement |
| sec023\_var015\_Knee bending | 5 | 6 | Little data | Not to be used | Measurement |
| sec023\_var016\_Ankle movement/rotation | 2 | 1 | Little data | Not to be used | Measurement |
| sec023\_var017\_Toe bending | 2 | 1 | Little data | Not to be used | Measurement |
| sec023\_var018\_Sit-ups | 2 | 1 | Little data | Not to be used | Measurement |
| sec024\_var001\_Utkatasana | 2 | 1 | Little data | Not to be used | Ayurvedic data |
| sec024\_var002\_Ardhakati-chakrasana | 2 | 1 | Little data | Not to be used | Ayurvedic data |
| sec024\_var003\_Ardha-chakrasana | 2 | 1 | Little data | Not to be used | Ayurvedic data |
| sec024\_var004\_Vrikshasana | 2 | 1 | Little data | Not to be used | Ayurvedic data |
| sec024\_var005\_Tadasana | 2 | 1 | Little data | Not to be used | Ayurvedic data |
| sec024\_var006\_Vajrasana | 2 | 1 | Little data | Not to be used | Ayurvedic data |
| sec024\_var007\_Paschimottanasana | 2 | 1 | Little data | Not to be used | Ayurvedic data |
| sec024\_var008\_Padmasana | 2 | 1 | Little data | Not to be used | Ayurvedic data |
| sec024\_var009\_Yogamudrsana | 2 | 1 | Little data | Not to be used | Ayurvedic data |
| sec024\_var010\_Vakrasana | 3 | 2 | Little data | Not to be used | Ayurvedic data |
| sec024\_var011\_Shashankasana | 2 | 1 | Little data | Not to be used | Ayurvedic data |
| sec024\_var012\_Bhujangasana | 2 | 1 | Little data | Not to be used | Ayurvedic data |
| sec024\_var013\_Shalabhasana | 2 | 1 | Little data | Not to be used | Ayurvedic data |
| sec024\_var014\_Naukasana | 2 | 1 | Little data | Not to be used | Ayurvedic data |
| sec024\_var015\_Shavasana | 2 | 1 | Little data | Not to be used | Ayurvedic data |
| sec026\_var001\_Yogic breathing | 4 | 3 | Little data | Not to be used | Ayurvedic data |
| sec026\_var002\_Suryaanuloma | 2 | 1 | Little data | Not to be used | Ayurvedic data |
| sec026\_var003\_Nadishodhana | 4 | 3 | Little data | Not to be used | Ayurvedic data |
| sec026\_var004\_Bhramari | 3 | 2 | Little data | Not to be used | Ayurvedic data |
| sec026\_var005\_Sadanta | 3 | 2 | Little data | Not to be used | Ayurvedic data |
| sec026\_var006\_Sheetali | 2 | 1 | Little data | Not to be used | Ayurvedic data |
| sec026\_var007\_Sheetkari | 2 | 1 | Little data | Not to be used | Ayurvedic data |
| sec027\_var001\_Jnana mudra | 2 | 1 | Little data | Not to be used | Ayurvedic data |
| sec030\_var001\_Nadanusandhana | 3 | 2 | Little data | Not to be used | Ayurvedic data |
| sec031\_var001\_Chief Complaint & Duration | 991 | 819 |  |  | Disease |
| sec031\_var002\_History Of Present Illness | 470 | 425 |  |  | Disease |
| sec031\_var003\_Surgical History | 81 | 92 |  |  | Background |
| sec031\_var004\_Bowel | 40 | 129 |  |  | Background |
| sec031\_var005\_Appetite | 14 | 70 |  |  | Food / Exercise |
| sec031\_var006\_Micturation | 13 | 55 |  |  | Background |
| sec031\_var007\_Sleep | 26 | 93 |  |  | Background |
| sec031\_var008\_Past History | 493 | 470 |  |  | Background |
| sec031\_var009\_Family History | 41 | 53 |  |  | Background |
| sec032\_var001\_Height in Cms | 31 | 28 |  |  | Measurement |
| sec032\_var002\_Weight in Kgs | 53 | 40 |  |  | Measurement |
| sec032\_var003\_BP | 40 | 38 |  |  | Measurement |
| sec032\_var004\_Pulse | 12 | 17 |  |  | Measurement |
| sec032\_var005\_Built | 11 | 21 |  |  | Measurement |
| sec032\_var006\_Temperature | 4 | 23 |  |  | Measurement |
| sec033\_var001\_OD | 132 | 790 | Eye data | Not to be used | Measurement |
| sec033\_var002\_OS | 113 | 779 | Eye data | Not to be used | Measurement |
| sec033\_var003\_OD | 8 | 16 | Eye data | Not to be used | Measurement |
| sec033\_var004\_OS | 7 | 14 | Eye data | Not to be used | Measurement |
| sec033\_var005\_OD | 131 | 336 | Eye data | Not to be used | Measurement |
| sec033\_var006\_OS | 118 | 333 | Eye data | Not to be used | Measurement |
| sec033\_var007\_OD | 47 | 582 | Eye data | Not to be used | Measurement |
| sec033\_var008\_OS | 44 | 582 | Eye data | Not to be used | Measurement |
| sec034\_var001\_Right | 34 | 77 | Eye data | Not to be used | Measurement |
| sec034\_var002\_Left | 35 | 79 | Eye data | Not to be used | Measurement |
| sec034\_var003\_Right | 20 | 72 | Eye data | Not to be used | Measurement |
| sec034\_var004\_Left | 24 | 78 | Eye data | Not to be used | Measurement |
| sec034\_var005\_Right | 53 | 72 | Eye data | Not to be used | Measurement |
| sec034\_var006\_Left | 58 | 78 | Eye data | Not to be used | Measurement |
| sec034\_var007\_Right | 21 | 55 | Eye data | Not to be used | Measurement |
| sec034\_var008\_Left | 17 | 57 | Eye data | Not to be used | Measurement |
| sec035\_var001\_Retinoscopy | 79 | 75 | Eye data | Not to be used | Measurement |
| sec035\_var002\_Acceptance | 7 | 6 | Eye data | Not to be used | Measurement |
| sec035\_var003\_ST(SCHIOTZ TONOMETRY) OD | 49 | 37 | Eye data | Not to be used | Measurement |
| sec035\_var004\_Findings | 894 | 730 | Eye data | Not to be used | Measurement |
| sec035\_var005\_Final Diagnosis | 538 | 791 | Eye data | Not to be used | Measurement |
| sec035\_var006\_Doctor's Signature | 182 | 254 | Eye data | Not to be used | Hospital Visit |
| sec036\_var001\_Main Complaints | 206 | 63 |  |  | Disease |
| sec036\_var002\_Associated Symptoms | 10 | 8 |  |  | Disease |
| sec036\_var003\_History Of Present Illness | 16 | 14 |  |  | Disease |
| sec036\_var004\_History of Past illness (Upadrava) | 31 | 27 |  |  | Background |
| sec036\_var005\_Family History | 4 | 6 |  |  | Background |
| sec037\_var001\_Potatoes | 5 | 4 | Little data | Not to be used | Food / Exercise |
| sec037\_var002\_Tomatoes | 6 | 5 | Little data | Not to be used | Food / Exercise |
| sec037\_var003\_Spinach | 4 | 4 | Little data | Not to be used | Food / Exercise |
| sec037\_var004\_Rice | 3 | 3 | Little data | Not to be used | Food / Exercise |
| sec037\_var005\_Wheat | 4 | 3 | Little data | Not to be used | Food / Exercise |
| sec037\_var006\_Ragi | 2 | 1 | Little data | Not to be used | Food / Exercise |
| sec037\_var007\_Green Gram | 2 | 1 | Little data | Not to be used | Food / Exercise |
| sec037\_var008\_Black Gram | 3 | 2 | Little data | Not to be used | Food / Exercise |
| sec037\_var009\_Chanaka Gram | 3 | 2 | Little data | Not to be used | Food / Exercise |
| sec037\_var010\_Aprouted | 2 | 1 | Little data | Not to be used | Food / Exercise |
| sec037\_var011\_FastFoods | 2 | 1 | Little data | Not to be used | Food / Exercise |
| sec037\_var012\_Chats | 3 | 2 | Little data | Not to be used | Food / Exercise |
| sec037\_var013\_Pizza | 2 | 1 | Little data | Not to be used | Food / Exercise |
| sec037\_var014\_Biscuits | 3 | 2 | Little data | Not to be used | Food / Exercise |
| sec037\_var015\_Cake/Pasteries | 3 | 2 | Little data | Not to be used | Food / Exercise |
| sec037\_var016\_Sweets | 5 | 4 | Little data | Not to be used | Food / Exercise |
| sec037\_var017\_Milk | 3 | 3 | Little data | Not to be used | Food / Exercise |
| sec037\_var018\_Curds | 5 | 4 | Little data | Not to be used | Food / Exercise |
| sec037\_var019\_Ghee | 3 | 2 | Little data | Not to be used | Food / Exercise |
| sec037\_var020\_Paneer | 3 | 2 | Little data | Not to be used | Food / Exercise |
| sec037\_var021\_Soft drinks | 3 | 2 | Little data | Not to be used | Food / Exercise |
| sec037\_var022\_Hot Drinks | 3 | 2 | Little data | Not to be used | Food / Exercise |
| sec037\_var023\_Milk Shakes | 2 | 1 | Little data | Not to be used | Food / Exercise |
| sec037\_var024\_Pickles | 4 | 3 | Little data | Not to be used | Food / Exercise |
| sec037\_var025\_Chutneys | 3 | 2 | Little data | Not to be used | Food / Exercise |
| sec037\_var026\_Chillies | 3 | 3 | Little data | Not to be used | Food / Exercise |
| sec037\_var027\_Garlic | 3 | 3 | Little data | Not to be used | Food / Exercise |
| sec037\_var028\_Ginger | 3 | 3 | Little data | Not to be used | Food / Exercise |
| sec037\_var029\_Refined Oil | 3 | 2 | Little data | Not to be used | Food / Exercise |
| sec037\_var030\_Non Refined Oil | 3 | 2 | Little data | Not to be used | Food / Exercise |
| sec037\_var031\_Cucumber | 3 | 2 | Little data | Not to be used | Food / Exercise |
| sec037\_var032\_Fruit Salads | 3 | 2 | Little data | Not to be used | Food / Exercise |
| sec037\_var033\_Carrot | 4 | 3 | Little data | Not to be used | Food / Exercise |
| sec037\_var034\_Onion | 4 | 3 | Little data | Not to be used | Food / Exercise |
| sec037\_var035\_Raddish | 2 | 1 | Little data | Not to be used | Food / Exercise |
| sec037\_var036\_Stale food intake frequency | 2 | 1 | Little data | Not to be used | Food / Exercise |
| sec037\_var037\_Water Intake frequency | 6 | 5 | Little data | Not to be used | Food / Exercise |
| sec037\_var038\_Totla Quantity in Lts | 11 | 10 | Little data | Not to be used | Food / Exercise |
| sec037\_var039\_Fasting Frequency | 3 | 2 | Little data | Not to be used | Food / Exercise |
| sec038\_var001\_Breakfast | 15 | 14 | Little data | Not to be used | Food / Exercise |
| sec038\_var002\_Lunch | 15 | 14 | Little data | Not to be used | Food / Exercise |
| sec038\_var003\_Dinner | 17 | 16 | Little data | Not to be used | Food / Exercise |
| sec038\_var004\_Timing Of work | 3 | 2 | Little data | Not to be used | Background |
| sec038\_var005\_Nature Of Work | 4 | 3 | Little data | Not to be used | Background |
| sec038\_var006\_Wake UpTime | 12 | 18 | Little data | Not to be used | Background |
| sec038\_var007\_Sleeping Time | 7 | 11 | Little data | Not to be used | Background |
| sec038\_var008\_Smell | 5 | 4 | Little data | Not to be used | Measurement |
| sec038\_var009\_Consistency(Well formed/hard/Liquid) | 4 | 6 | Little data | Not to be used | Measurement |
| sec038\_var010\_Frequency | 5 | 6 | Little data | Not to be used | Measurement |
| sec038\_var011\_Colour | 2 | 1 | Little data | Not to be used | Measurement |
| sec038\_var012\_Smell | 2 | 1 | Little data | Not to be used | Measurement |
| sec038\_var013\_Any Complaints | 2 | 1 | Little data | Not to be used | Background |
| sec038\_var014\_Alcohol | 2 | 1 | Little data | Not to be used | Background |
| sec038\_var015\_Pan | 2 | 1 | Little data | Not to be used | Background |
| sec038\_var016\_Others | 4 | 3 | Little data | Not to be used | Background |
| sec038\_var017\_Cycle | 2 | 1 | Little data | Not to be used | Background |
| sec038\_var018\_Psychological | 4 | 2 | Little data | Not to be used | Background |
| sec038\_var019\_Appearance | 2 | 1 | Little data | Not to be used | Background |
| sec038\_var020\_Body Weight | 2 | 1 | Little data | Not to be used | Measurement |
| sec038\_var021\_Pulse (Nadi) | 4 | 3 | Little data | Not to be used | Measurement |
| sec038\_var022\_Blood Pressure | 2 | 1 | Little data | Not to be used | Measurement |
| sec038\_var023\_Appearance | 2 | 3 | Little data | Not to be used | Measurement |
| sec038\_var024\_Body weight in kgs | 43 | 23 | Little data | Not to be used | Measurement |
| sec038\_var025\_Pulse (Nadi) | 3 | 2 | Little data | Not to be used | Measurement |
| sec038\_var026\_Blood Pressure | 22 | 20 | Little data | Not to be used | Measurement |
| sec044\_var001\_Notes | 2 | 1 | Little data | Not to be used | Measurement |
| sec077\_var001\_Chief Complaint with Onset & Duration | 1605 | 1360 |  |  | Disease |
| sec077\_var002\_Upashaya | 4 | 4 |  |  | Ayurvedic data |
| sec077\_var003\_Anupashaya | 6 | 5 |  |  | Ayurvedic data |
| sec077\_var004\_Associated Complaint with Onset & Duration | 343 | 325 |  |  | Disease |
| sec077\_var005\_Diabetes | 70 | 230 |  |  | Background |
| sec077\_var006\_Hypertension | 61 | 225 |  |  | Background |
| sec077\_var007\_Allergy | 8 | 44 |  |  | Background |
| sec077\_var008\_Renal Diseases | 5 | 19 |  |  | Background |
| sec077\_var009\_Liver Diseases | 3 | 9 |  |  | Background |
| sec077\_var010\_Food Allergy | 3 | 6 |  |  | Food / Exercise |
| sec077\_var011\_Food Intolerance | 2 | 1 |  |  | Food / Exercise |
| sec078\_var001\_Menarche (yrs) | 9 | 10 | Little data | Not to be used | Measurement |
| sec078\_var002\_Menopause (yrs) | 24 | 26 | Little data | Not to be used | Measurement |
| sec078\_var003\_MH | 29 | 37 | Little data | Not to be used | Measurement |
| sec078\_var004\_LMP | 26 | 25 | Little data | Not to be used | Measurement |
| sec078\_var005\_PMH | 3 | 2 | Little data | Not to be used | Measurement |
| sec078\_var006\_Colour | 4 | 9 | Little data | Not to be used | Measurement |
| sec078\_var007\_Consistency | 2 | 4 | Little data | Not to be used | Measurement |
| sec078\_var008\_Characteristics | 7 | 6 | Little data | Not to be used | Measurement |
| sec078\_var009\_Flow | 9 | 16 | Little data | Not to be used | Measurement |
| sec078\_var010\_Clots | 5 | 6 | Little data | Not to be used | Measurement |
| sec078\_var011\_Smell | 5 | 6 | Little data | Not to be used | Measurement |
| sec078\_var012\_Discharge | 3 | 2 | Little data | Not to be used | Measurement |
| sec078\_var013\_Pre Menstrual Symptoms | 2 | 1 | Little data | Not to be used | Measurement |
| sec078\_var014\_Menopausal Symptoms | 2 | 1 | Little data | Not to be used | Measurement |
| sec079\_var001\_Dooshya | 7 | 7 | Little data | Not to be used | Ayurvedic data |
| sec079\_var002\_Mala | 2 | 1 | Little data | Not to be used | Ayurvedic data |
| sec079\_var003\_Mutra | 2 | 1 | Little data | Not to be used | Ayurvedic data |
| sec079\_var004\_Srotas | 4 | 4 | Little data | Not to be used | Ayurvedic data |
| sec079\_var005\_Ati pravrutti | 2 | 1 | Little data | Not to be used | Ayurvedic data |
| sec080\_var001\_Nidana | 547 | 888 |  |  | Ayurvedic data |
| sec080\_var002\_Poorvaroopa | 242 | 635 |  |  | Ayurvedic data |
| sec080\_var003\_Roopa | 797 | 921 |  |  | Ayurvedic data |
| sec080\_var004\_Upashaya/Anupashaya | 62 | 74 |  |  | Ayurvedic data |
| sec081\_var001\_Screening Doctor | 174 | 1466 |  |  | Hospital Visit |
| sec081\_var002\_Session End Time | 704 | 1466 |  |  | Hospital Visit |
| sec081\_var003\_Session Start Time | 665 | 1466 |  |  | Hospital Visit |
| sec082\_var001\_Allopathic Diagnosis | 439 | 594 |  |  | Disease |
| sec083\_var001\_Examination | 19 | 18 |  |  | Measurement |
| sec083\_var002\_Neurological | 226 | 230 |  |  | Measurement |
| sec083\_var003\_Ophthalmic | 26 | 25 |  |  | Measurement |
| sec083\_var004\_ENT | 25 | 29 |  |  | Measurement |
| sec083\_var005\_Cardiovascular | 77 | 423 |  |  | Measurement |
| sec083\_var006\_Respiratory | 62 | 447 |  |  | Measurement |
| sec083\_var007\_Gastrointestinal | 116 | 221 |  |  | Measurement |
| sec083\_var008\_Urinary | 9 | 11 |  |  | Measurement |
| sec083\_var009\_Genital | 5 | 4 |  |  | Measurement |
| sec083\_var010\_Musculoskeletal | 784 | 697 |  |  | Measurement |
| sec083\_var011\_Integumentary | 31 | 27 |  |  | Measurement |
| sec083\_var012\_Endocrine | 5 | 5 |  |  | Measurement |
| sec083\_var013\_Psychiatric | 7 | 5 |  |  | Measurement |
| sec083\_var014\_Hemotological/Lymphatic | 14 | 12 |  |  | Measurement |
| sec083\_var015\_Allergic/Immunologic | 4 | 3 |  |  | Measurement |
| sec084\_var001\_Investigation Reports | 277 | 333 |  | Not be used | Lab report |
| sec085\_var001\_Complaint | 1665 | 1427 |  |  | Disease |
| sec085\_var002\_Doctor's Notes | 78 | 78 |  |  | Doctor's Notes |
| sec085\_var003\_Source of History | 41 | 636 |  |  | Background |
| sec086\_var001\_Examination | 642 | 588 |  |  | Measurement |
| sec088\_var001\_Yes | 8 | 10 | Little data | Not to be used | Measurement |
| sec088\_var002\_Yes | 6 | 5 | Little data | Not to be used | Measurement |
| sec088\_var003\_No | 8 | 9 | Little data | Not to be used | Measurement |
| sec088\_var004\_Yes | 28 | 57 | Little data | Not to be used | Measurement |
| sec088\_var005\_Yes | 89 | 179 | Little data | Not to be used | Measurement |
| sec088\_var006\_No | 2 | 1 | Little data | Not to be used | Measurement |
| sec088\_var007\_General Dietic restrictions | 118 | 321 | Little data | Not to be used | Food / Exercise |
| sec088\_var008\_Yes | 95 | 120 | Little data | Not to be used | Food / Exercise |
| sec088\_var009\_Consultant Dietic Restrictions | 130 | 305 | Little data | Not to be used | Food / Exercise |
| sec088\_var010\_Normal | 3 | 2 | Little data | Not to be used | Food / Exercise |
| sec088\_var011\_<50 % | 2 | 2 | Little data | Not to be used | Food / Exercise |
| sec088\_var012\_Yes | 4 | 3 | Little data | Not to be used | Food / Exercise |
| sec088\_var013\_Junk Foods | 2 | 11 | Little data | Not to be used | Food / Exercise |
| sec088\_var014\_Untimely Food | 4 | 13 | Little data | Not to be used | Food / Exercise |
| sec088\_var015\_Excessive Food | 3 | 12 | Little data | Not to be used | Food / Exercise |
| sec089\_var001\_Appearance | 114 | 1190 |  |  | Background |
| sec089\_var002\_Pallor | 25 | 1238 |  |  | Background |
| sec089\_var003\_Icterus | 15 | 1236 |  |  | Background |
| sec089\_var004\_Odema | 133 | 1228 |  |  | Background |
| sec089\_var005\_Lymphadenopathy | 14 | 964 |  |  | Background |
| sec089\_var006\_Nourishment | 59 | 930 |  |  | Background |
| sec089\_var007\_Posture | 58 | 672 |  |  | Background |
| sec089\_var008\_Mental State | 73 | 723 |  |  | Background |
| sec089\_var009\_Facies | 28 | 490 |  |  | Background |
| sec089\_var010\_Appearance | 147 | 1320 |  |  | Background |
| sec089\_var011\_Body Built | 65 | 1339 |  |  | Background |
| sec089\_var012\_Body Strength | 49 | 1322 |  |  | Background |
| sec089\_var013\_Orientation | 89 | 1346 |  |  | Background |
| sec089\_var014\_Conciousness | 64 | 1237 |  |  | Background |
| sec099\_var001\_Doctor Advice | 585 | 1335 |  |  | Doctor's Notes |
| sec100\_var001\_DANTA MOOLA | 3 | 2 | Little data | Not to be used | Ayurvedic data |
| sec100\_var002\_DANTA | 4 | 3 | Little data | Not to be used | Ayurvedic data |
| sec100\_var003\_JIHVA | 2 | 1 | Little data | Not to be used | Ayurvedic data |
| sec100\_var004\_EXAMINATIONATION | 4 | 3 | Little data | Not to be used | Ayurvedic data |
| sec100\_var005\_Talu | 2 | 1 | Little data | Not to be used | Ayurvedic data |
| sec100\_var006\_GALA | 20 | 20 | Little data | Not to be used | Ayurvedic data |
| sec100\_var007\_INVESTIGATIONS | 2 | 1 | Little data | Not to be used | Measurement |
| sec101\_var001\_EAM | 38 | 41 |  | Not to be used | Measurement |
| sec101\_var002\_TM | 65 | 61 |  | Not to be used | Measurement |
| sec101\_var003\_EXAMINATIONS | 18 | 17 |  | Not to be used | Measurement |
| sec102\_var001\_External Nose | 2 | 1 |  | Not to be used | Measurement |
| sec102\_var002\_Septum | 20 | 24 |  | Not to be used | Measurement |
| sec102\_var003\_Nasal Cavity | 30 | 35 |  | Not to be used | Measurement |
| sec102\_var004\_Investigations | 2 | 1 |  | Not to be used | Measurement |
| sec103\_var001\_Pain | 2 | 1 | Little data | Not to be used | Measurement |
| sec103\_var002\_HTN | 2 | 1 | Little data | Not to be used | Measurement |
| sec103\_var003\_Any others | 2 | 1 | Little data | Not to be used | Measurement |
| sec106\_var001\_Additional Data | 2 | 1 | Little data | Not to be used | Measurement |
| sec111\_var001\_Nadi | 2 | 1 | Little data | Not to be used | Ayurvedic data |
| sec111\_var002\_Jihwa | 2 | 1 | Little data | Not to be used | Ayurvedic data |
| sec111\_var003\_Mala | 2 | 1 | Little data | Not to be used | Ayurvedic data |
| sec111\_var004\_Mutra | 2 | 1 | Little data | Not to be used | Ayurvedic data |
| sec111\_var005\_Shabda | 2 | 1 | Little data | Not to be used | Ayurvedic data |
| sec111\_var006\_Sparsha | 2 | 1 | Little data | Not to be used | Ayurvedic data |
| sec111\_var007\_Drik | 2 | 1 | Little data | Not to be used | Ayurvedic data |
| sec111\_var008\_Akruthi | 2 | 1 | Little data | Not to be used | Ayurvedic data |
| sec112\_var001\_Prakriti | 2 | 1 | Little data | Not to be used | Ayurvedic data |
| sec112\_var002\_Sara | 2 | 1 | Little data | Not to be used | Ayurvedic data |
| sec112\_var003\_Samhanana | 2 | 1 | Little data | Not to be used | Ayurvedic data |
| sec112\_var004\_Pramana | 2 | 1 | Little data | Not to be used | Ayurvedic data |
| sec112\_var005\_Ahara shakti | 2 | 1 | Little data | Not to be used | Ayurvedic data |
| sec112\_var006\_Vyayama Shakti | 2 | 1 | Little data | Not to be used | Ayurvedic data |
| sec112\_var007\_Satmya | 2 | 1 | Little data | Not to be used | Ayurvedic data |
| sec112\_var008\_Satwa | 2 | 1 | Little data | Not to be used | Ayurvedic data |
| sec112\_var009\_Vaya | 2 | 1 | Little data | Not to be used | Ayurvedic data |
| sec114\_var001\_Treatment procedures | 2 | 1 | Little data | Not to be used | Treatment / Procedure |
| sec115\_var001\_Final Diagnosis | 2 | 1 | Little data | Not to be used | Disease |
| sec116\_var001\_Physiotherapy Treatment Plan | 5 | 4 | Little data | Not to be used | Treatment / Procedure |
| sec119\_var001\_ | 13 | 13 | Little data | Not to be used | Measurement |
| sec120\_var001\_Assesment | 3 | 2 | Little data | Not to be used | Measurement |
| sec122\_var001\_Allopathic Diagnosis | 1279 | 2617 |  |  | Disease |
| sec123\_var001\_Allopathic Diagnosis | 281 | 410 |  |  | Disease |
| sec124\_var001\_Chief Complaints | 55 | 108 |  |  | Disease |
| sec124\_var002\_History & presenting illness | 50 | 45 |  |  | Background |
| sec126\_var001\_Stains | 4 | 37 | Dental data | Not to be used | Measurement |
| sec126\_var002\_Calculus | 5 | 72 | Dental data | Not to be used | Measurement |
| sec126\_var003\_Attrition | 6 | 6 | Dental data | Not to be used | Measurement |
| sec126\_var004\_Abrasion | 7 | 7 | Dental data | Not to be used | Measurement |
| sec126\_var005\_Grade I | 6 | 5 | Dental data | Not to be used | Measurement |
| sec126\_var006\_Grade II | 8 | 7 | Dental data | Not to be used | Measurement |
| sec126\_var007\_Grade III | 5 | 4 | Dental data | Not to be used | Measurement |
| sec126\_var008\_Class I | 2 | 1 | Dental data | Not to be used | Measurement |
| sec126\_var009\_Present | 8 | 8 | Dental data | Not to be used | Measurement |
| sec126\_var010\_Present | 2 | 1 | Dental data | Not to be used | Measurement |
| sec126\_var011\_Present | 19 | 23 | Dental data | Not to be used | Measurement |
| sec126\_var012\_Absent | 2 | 1 | Dental data | Not to be used | Measurement |
| sec126\_var013\_Attached Gingiva | 2 | 1 | Dental data | Not to be used | Measurement |
| sec126\_var014\_Mucosal Lesion | 2 | 1 | Dental data | Not to be used | Measurement |
| sec126\_var015\_Ulcer | 2 | 1 | Dental data | Not to be used | Measurement |
| sec126\_var016\_Swelling | 2 | 1 | Dental data | Not to be used | Measurement |
| sec126\_var017\_Others | 17 | 17 | Dental data | Not to be used | Measurement |
| sec126\_var018\_Provisional Diagnosis | 84 | 105 | Dental data | Not to be used | Disease |
| sec126\_var019\_Differential Diagnosis | 3 | 2 | Dental data | Not to be used | Disease |
| sec126\_var020\_IOPAR | 20 | 23 | Dental data | Not to be used | Measurement |
| sec126\_var021\_OPG | 3 | 2 | Dental data | Not to be used | Measurement |
| sec126\_var022\_Others | 2 | 1 | Dental data | Not to be used | Measurement |
| sec126\_var023\_Final Diagnosis | 81 | 102 | Dental data | Not to be used | Disease |
| sec126\_var024\_Treatment Planned | 80 | 100 | Dental data | Not to be used | Treatment / Procedure |
| sec126\_var025\_Drugs Prescribed | 2 | 1 | Dental data | Not to be used | Treatment / Procedure |

## Base dataset “01adsl\_met\_rmsd” analysis for RMSD and Metabolic patients

Explanation related to 01adsl\_met\_rmsd.rds data. This is a very important dataset with key patient information stored in it. Section 3 of protocol has the schematic diagram and the flow of steps for creating this dataset. This section outlines all the variables and explanation for them.

|  |  |  |
| --- | --- | --- |
| Variable name | Description | Derivation |
| mr\_no | Unique Patient ID | Source variable, no derivation needed  E.g. MR000001, MR040237, etc. |
| patient\_gender | Patient gender | Source variable, no derivation needed  E.g. M, F |
| patient\_id | Visit ID | Source variable, no derivation needed, the hospital database captures unique visit ID for each visit. |
| city\_name | City name | Source variable, no derivation needed |
| state\_name | State name | Source variable, no derivation needed |
| country\_name | Country name | Source variable, no derivation needed |
| dateofbirth | Date of birth | Source variable, no derivation needed, for some patients this is missing |
| newdt0 | Date of visit to hospital | Date of visit to hospital in numeric format  All the InPatient visits, OutPatient visits and Service related visits are combined from source datasets into dataset, unique visit and date combinations are created. |
| newdt | Date of visit to hospital | Character version of newdt0 |
| vis | Visit | 1. Based on all the InPatient visits, OutPatient visits and Service related visits unique visit numbers are created. 2. Visit numbers are numeric values from 1 to n, based on current version of data; a patient has maximum number 323 visits. |
| all\_vis | All visits | This variable contains maximum number of for each patient. all\_vis = max(vis) grouped by each mr\_no |
| all\_ip | All IP visits | This variable contains maximum number of for each patient for IP type of visits. all\_vis = max(vis) grouped by each mr\_no and visit type is IP. |
| all\_op | All OP visits | This variable contains maximum number of for each patient for OP type of visits. all\_vis = max(vis) grouped by each mr\_no and visit type is OP. |
| studyday | Study day | studyday = 1 when the visit minimum visit or first visit for a patient, else studyday is calculated as newdt0 – min(newdt0) + 1.  Studyday is never missing and never less than 0 for the dataset created. |
| age | Age of patient at that visit | If date of birth is non-missing for a patient, then age is calculated as round( (anydate(newdt) - anydate(dateofbirth) + 1)/365.25, digits = 0 ) |
| baseage | Age of patient at the first visit | Age at vis = 1 for each patient is stored as base age |
| death\_date | Date of death | Source variable, no derivation needed |
| cstdt | Min Start date | cstdt = min(newdt) |
| cendt | End date | cendt = max(newdt) |
| cdur | Total duration in days | cdur = max(newdt) - min(newdt) + 1 |
| stdt\_IP | Start date of IP visits | Minimum visit date for IP visits for each patient |
| endt\_IP | End date of IP visits | Maximum visit date for IP visits for each patient |
| dur\_IP | Duration of IP visits | dur\_IP = endt\_IP – stdt\_IP + 1 |
| stdt\_OP | Start date of OP visits | Minimum visit date for OP visits for each patient |
| endt\_OP | End date of OP visits | Maximum visit date for OP visits for each patient |
| dur\_OP | Duration of OP visits | dur\_OP = endt\_OP – stdt\_OP + 1 |
| serstdt | Service Start date | Minimum visit date for Service visits for each patient |
| serendt | Service End date | Maximum visit date for Service visits for each patient |
| Code | Code | Source variable, no derivation needed, ACD code |
| description | Description | Source variable, no derivation needed, description |
| Type | Type of visit | This variable identifies a visit either as IP or OP based on visit classification |
| diag\_type | Diagnosis type | Source variable, no derivation needed:  Primary or Secondary |
| year | Year | Year part of the newdt variable |
| season | Indian seasons | Derivation of Indian seasons based on the date variable for each visit:  # Add Indian rutus as new variables  # <https://www.drikpanchang.com/seasons/season-tropical-timings.html?geoname-id=1277333&year=2010>  01 Vasant Rutu  02 Grishma Rutu  03 Varsha Rutu  04 Sharad Rutu  05 Hemant Rutu  06 Shishir Rutu |
| C, N, P, U, X, Y | Values related to Services offered to patients | Source variable, no derivation needed:  C- Cancelled  U - Condn. Unnecessary  Y - Conducted  N - Not Conducted  P - Partially Conducted |
| presc\_type |  | Source variable, no derivation needed |
| medicine\_name | Medicine name | Source variable, no derivation needed  Prescribed medicine names follow a certain predefined naming convention. Medicine name + Quantity + Producer’s name are the details recorded for each prescribed medicine. |
| item\_name | Source value of medicine name | Source variable, no derivation needed |
| quantity | Quantity of prescribed medicine | Source variable, no derivation needed |
| med\_route | Route of administration of prescribed medicine | Source variable, no derivation needed |
| generic\_code |  | Source variable, no derivation needed |
| remarks | Notes provided by doctors for medicines | Source variable, no derivation needed |
| frequency | Frequency of prescribed medicine | Source variable, no derivation needed |
| duration | Duration of prescribed medicine | Source variable, no derivation needed |
| duration\_units | Unit for duration of prescribed medicine | Source variable, no derivation needed |
| Coded\_med | Only name of medicine | Derived from medicine\_name |
| Company | Name of the company producing the drug | Derived from medicine\_name |
| Quantity | Quantity of prescribed medicine | Derived from medicine\_name |
| Unit | Unit of prescribed medicine | Derived from medicine\_name |
| Type\_med | Type of medicine | Derived based on medicine\_name. Classified into different kinds of medicines, e.g.  Ghritam  Kashayam  Asavam  Aristham  Bhasma  Abhyanga  Cream  Rasayanam  Tablet / Gulika / Vati  … |
| cat\_id |  |  |
| distype | Disease type | Disease type as OTHER, RMSD, Metabolic   1. If a disease code is present in Metabolic list then the value is Metabolic 2. If a disease code is present in RMSD list then the value is RMSD 3. Any other disease is classified as OTHER |
| Metabolic | Metabolic | If a patient has reported any Metabolic disease at least once then that patient is given value Metabolic = 1, else Metabolic =0 |
| RMSD | RMSD | If a patient has reported any RMSD disease at least once then that patient is given value Metabolic = 1, else Metabolic =0 |
| combine | Metabolic  RMSD  Both | 1. If a patient is classified only as Metabolic diseased patient then combine = 1, 2. If a patient is classified only as RMSD diseased patient then combine = 2, 3. If a patient is classified as Metabolic as well as RMSD diseased patient then combine = 99 |
| Minday Metabolic | First day on which reported metabolic disease | First day on which any metabolic disease has been reported by a patient. |
| Minday RMSD | First day on which reported RMSD disease | First day on which any RMSD disease has been reported by a patient. |

Additional details about the derivations:

1. Unique patient ID is assigned to individual patient. Each visit to the hospital is also uniquely captured. A visit is classified into 2 types (1) in-patient visit where a patient is hospitalized for certain duration, (2) out-patient visit where a patient visits hospital, meets a designated doctor and goes back home. The Unique Patient ID and visit number are used as “key variables” to join information from various tables.
2. Disease conditions are coded using ACD dictionary. This dictionary was developed at C-DAC Pune and covers approximately 4500 disease conditions. At the time of analysis, the database contained approximately 900 disease conditions.
3. There are a few records where the Coded disease value is missing, it will be coded as “\*\* Not yet coded”
4. Information for the diseases and medicines from different tables are merged into 1 large table based on Patient ID (mr\_no) + Visit ID (Patient ID), this provides a side by side view of Disease conditions and prescribed medicines for the same.

References to the analysis files:

|  |  |
| --- | --- |
| SQL program to extract data from the source data | 100\_adsl\_sqlpart.sql  Login using the Cygwin terminal (the following command will prompt for password):  psql -h 54.244.12.255 -p 5432 -d iaim -U iaim\_ro  Postgress DB details:  Hostname: 54.244.12.255  port: 5432  user: iaim\_ro  password: a1b2c3 |
| R program | 100\_adsl.R |
| Datafile(s) | 01adsl\_met\_rmsd.rds  01adsl\_met\_rmsd.csv |

## Demographics analysis using the derived dataset

This section provides insights into patient level data created above. Full analysis is stored in another HTML file. The analysis is split into 7 different sections as follows.

1. Frequency counts to understand patient population
   1. Disease category

Patients are classified into 2 disease groupings, namely metabolic and RMSD diseases. There are 10 diseases contributing to metabolic and 106 diseases contributing to RMSD group.

* 1. Disease category by gender

There are 1343 females and 1771 males having metabolic diseases. There are 7180 females and 5778 males having RMSD diseases. There are more numbers females than males for RMSD diseases.

* 1. Number of metabolic patients

There are 4447 patients with metabolic disease.

* 1. Number of RMSD patients

There are 14292 patients with RMSD diseases. There are 1333 patients with both metabolic and RMSD diseases.

1. Summary statistics of age at baseline and subsequent visits
   1. Metabolic: Summary statistics of baseline age in years

For females Mean (SD) is observed as 46.5 (14.51) years, for males, it is 49.4 (13.96) years.

* 1. RMSD: Summary statistics of baseline age in years

For females Mean (SD) is observed as 48.8 (14.70) years, for males, it is 47.7 (15.88) years.

* 1. Metabolic: Summary statistics of age in years, by visit

The mean and median age for female patients go on increasing from 46 to 57, similarly for males it is 49 to 52.

* 1. RMSD: Summary statistics of age in years, by visit

The mean and median age for female patients go on increasing from 48 to 57, similarly for males it is 47.7 to 52.

1. Analysis related to number of visits and duration
   1. Metabolic: Summary statistics in days and visits

* Total duration of visits to hospital for females Mean (SD) is 265.2 (448.15) days, median (range) is 34 (1-2506) days, for males Mean (SD) is 272.1 (472.95), median (range) is 30 (1-2506) days.
* Total number of IP visits to hospital for females Mean (SD) is 6.3 (5.82) visits, median (range) is 5 (1-39) visits, for males Mean (SD) is 6.9 (5.04), median (range) is 5 (1-60) visits.
* Total number of OP visits to hospital for females Mean (SD) is 5.3 (8.86) visits, median (range) is 2 (1-230) visits, for males Mean (SD) is 5.4 (12.13), median (range) is 2 (1-318) visits.
  1. RMSD: Summary statistics in days and visits
* Total duration of visits to hospital for females Mean (SD) is 234.0 (431.44) days, median (range) is 21 (1-2528) days, for males Mean (SD) is 222.3 (441.60), median (range) is 10 (1-2530) days.
* Total number of IP visits to hospital for females Mean (SD) is 7.0 (5.49) visits, median (range) is 6 (1-86) visits, for males Mean (SD) is 7.5 (7.02), median (range) is 6 (1-83) visits.
* Total number of OP visits to hospital for females Mean (SD) is 4.8 (8.96) visits, median (range) is 2 (1-274) visits, for males Mean (SD) is 4.3 (9.47), median (range) is 2 (1-318) visits.
  1. Diseases: Summary statistics in days, by gender

This section provides summary statistics by gender for each disease.

1. Cumulative analysis: In this analysis patients are counted multiple times as per available data for each time period. Following time points are considered for analysis: Day 1, >=1 month, >=2 months, >=3 months, >=6 months, >=1 year, >=2 years, >=3 years, >=4 years and >=5 years. These provide clinical and operational insights into disease manifestations. A patient visiting for more than 5 years is counted in all categories. If a patient has discontinued in the 4th month then that patient is counted in Day 1, >=1 month, >=2 months, >=3 months categories.
   1. Cumulative display of patients by duration

* Total 17406 patients visit hospital on day 1. Out of these 8725 (50%) continue hospital visits after 1 month, 7018 (40%) continue visits after 2 months, 6173 (35%) continue visits after 3 months, 4785 (27%) continue visits after 6 months, 3446 (19%) continue visits after 1 year. 2020 (11%) have visits beyond 2 years, 1168 (6%) have visits beyond 3 years, 579 (3%) have visits beyond 4 years and 256 (1.5%) have visits beyond 5 years.
  1. Cumulative display of patients by duration and gender
* Similar patterns for both RMSD and metabolic diseases by gender are observed. Some diseases are cured only after 1 visit. For some diseases, approximately 5 visits are sufficient, for some diseases more than 5 visits spanning more than 30 days, 60 days, 90 days, etc. are needed. Additional analysis is carried out to explore the data.
  1. Cumulative display of patients by Code and duration
* Analysis for each disease is carried out. The drop-out pattern for each of the diseases is consistent with overall duration analysis.

1. Non-overlapping analysis: this analysis provides information for different time points in mutually exclusive manner. An individual patient is counted only once for each duration period.
   1. Total patients present across different time points
   2. Summary statistics of total duration across different time points
   3. Summary statistics of total visits across different time points
   4. Summary statistics of total visits across different time points for each disease
   5. Total duration across non overlapping time periods
   6. Metabolic: total duration by gender across non overlapping time periods
   7. RMSD: total duration across non overlapping time periods
   8. Metabolic: total duration for by gender across non overlapping time periods
   9. Metabolic: total duration for each disease across non overlapping time periods
   10. RMSD: total duration for overall by gender non overlapping time periods
   11. RMSD: total duration for each disease across non overlapping time periods
2. No-overlapping time period, frequency counts
   1. Frequency counts for Total number of patients with treatment and diseases
3. Diseases present in each non-overlapping duration: If a disease is present at least in a time period once then denote it by Yes.

* This table does not provide the quantum of patients reporting diseases across time points, but only provides binary representation of presence or absence of a disease.
* This analysis shows, frequency of a disease getting reported across different time periods. If a disease is presented in all the time point categories then it means that the disease is reported consistently. Speculative interpretation could be “patients are getting some benefit”.
* Some diseases which are reported first time only in say after 4th month, or 1st year, etc. could be “additional co-morbities” developed in due course of primary disease. Other interpretation could be that these could be side effects of prescribed treatments.

References to the analysis files:

|  |  |
| --- | --- |
| R program | 100\_adsl\_analysis.RMD   * 07\_cumulative\_duration.R * 07\_cumulative\_dur\_byCode.R * 07\_cumulative\_dur\_byCode\_Part02.R * 08\_nonoverlap.R |
| Datafile | 01adsl\_met\_rmsd.rds |
| KnitR output | 100\_adsl\_analysis.HTML |
| Tableau vizname | 01SQL\_Dis\_Med\_Ser |
| Tableau sheetname | 1. RMSD\_Met\_patients:    * Frequency table by gender and high level disease classification, there are more number of RMSD patients compared to the Metabolic, Metabolic and RMSD patients.    * There is more number of female RMSD patients compared to males.    * There are similar number of males and females in Metabolic disease categories 2. Visit\_Duration:    * Boxplot is plotted for Total duration of hospital visits is calculated as the maximum date of hospital visit - minimum date of hospital visit + 1 in days for each patient, by gender and disease group |

Interpretation:

1. There is more number of RMSD disease patients compared to metabolic disease patients.
2. For metabolic disease group Males and females at baseline have similar age characteristics.
3. For RMSD disease group median age of females is more than median age of male patients.
4. Approximately 50% of patients come only for 1 visit.
5. As number of visits increase, the median age for both males and females continue increasing, elder patients are seen continuing for more number of visits.
6. Maximum duration to hospital is almost 2500+ days; median number of days is approximately 30+ days.
7. Maximum number of IP visits is 39 and 60 (female and male), maximum number of OP visits is 230 and 318 (female and male).

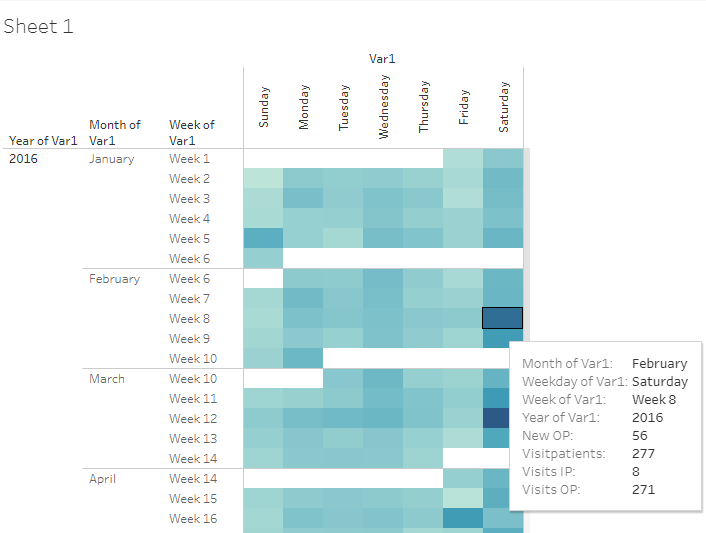
## Visit pattern summary

The following analysis provides information about visit patterns from year 2011 to 2016.

* Unique combinations of individual visits for each patient are created for each day for each year.
* Columns in the display are: (1) Year, (2) Month, (3) Week of month, and (4) Days of a week from Sunday to Saturday.
* Each of the resulting cell is colored in shades of blue from light blue to dark blue based on the frequency count of number of patients
* Each cell has additional information included in the tooltip feature for the following summaries:
  + New Out Patients added on that day
  + Total number of patients visiting on that day
  + Total number of Inpatient visits on that day
  + Total number of Outpatient visits on that day

Interpretation:

* The number of patients visiting hospital on weekdays is less than the number of patients visiting on weekends. This information would help in employing staff across different Line Functions to adequately cover services for patients.
* If the hospital conducts special events then the number of patients goes up.
* Inpatients are considerably less than Outpatients which is quite understanble.



Reference files:

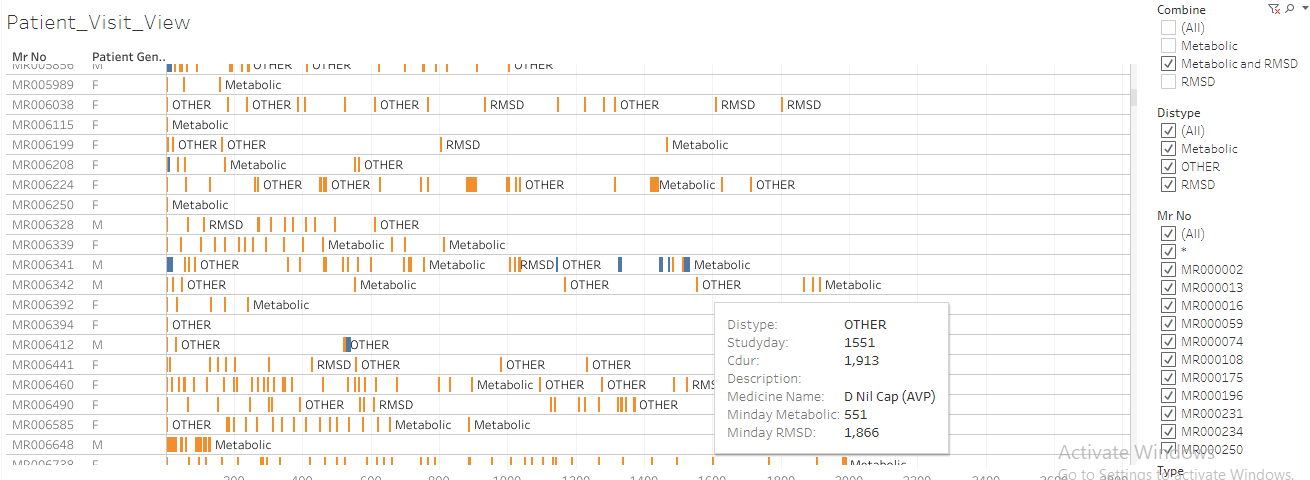
|  |  |
| --- | --- |
| Tableau viz | 04\_calendar\_view |
| Tableau sheetname | Sheet 1 |

## Patient visit view

There are 2 analysis views created for individual patient data. These show the longitudinal nature of data.

Columns displayed in the first view are follows: Patient ID (mr\_no), gender, study day

1. The Inpatient visits are displayed in blur color and Outpatient visits are displayed in Orange color.
2. The tooltip contains information about the following data points not displayed on the page:
   1. Studyday: Study day
   2. Cdur: Total duration of hospital visits.
   3. Description: Disease description variable accompanying ACD codes.
   4. Medicine Name: Medicine provided at that visit.
   5. Minday Metabolic: First day on which any metabolic disease has been reported by patient.
   6. Minday RMSD: First day on which any RMSD disease has been reported by patient.

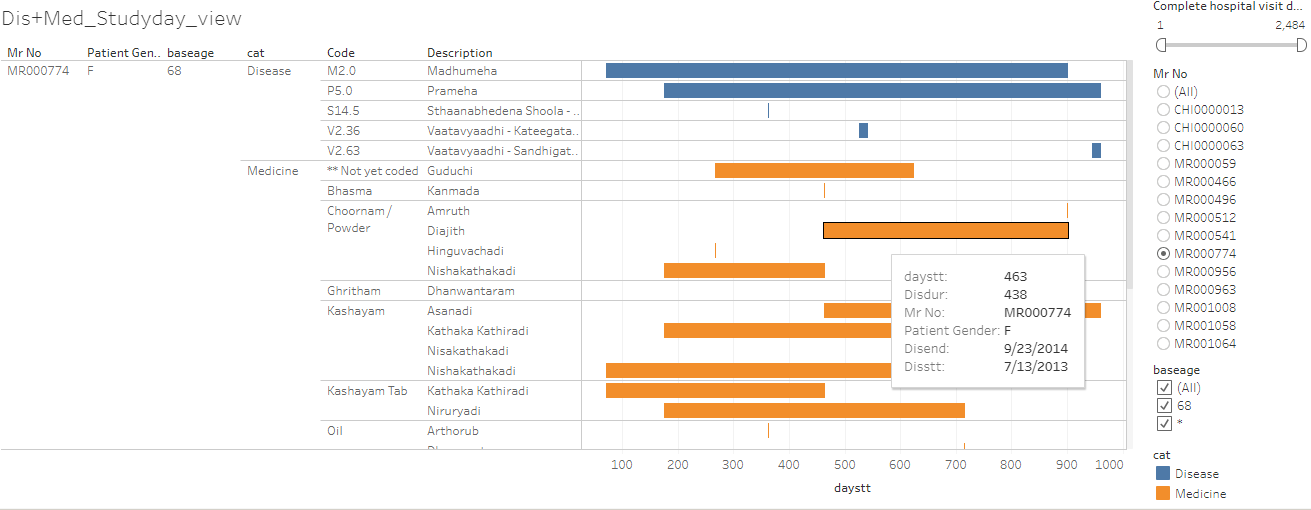


Reference files:

|  |  |
| --- | --- |
| Tableau viz | 01SQL\_Dis\_Med\_Ser |
| Tableau sheetname | Patient\_Visit\_View |

Columns displayed in the second view are follows: Patient ID (mr\_no), gender, base age, category, Code, description, study day

1. The Diseases are displayed in blue colored bars and treatments prescribed are marked in orange colored bars.
2. Bars are created as followed: Duration between minimum and maximum reported date for a disease as well as prescribed treatment is calculated, this duration is displayed on the visualization. This calculation needs improvements (algorithm is getting developed to derive individual episodes of diseases as well as individual episodes of treatment assignment)
3. The tooltip contains information about the following data points not displayed on the page:
   1. Daystt: Start of event in days (disease as well as treatment)
   2. Disdur: Duration of event in days (disease as well as treatment)
   3. Disstt: Start date of event
   4. Diend: End date of event



Reference files:

|  |  |
| --- | --- |
| R program | 01\_Primary\_Gridhrasee.R, 01\_Primary\_madhumeha.R |
| Datafile | Primary\_gridhrasee.csv, Primary\_madhumeha.csv |
| Tableau viz | 01\_Primary\_Gridhrasee, 01\_Primary\_madhumeha |
| Tableau sheetname | Dis+Med\_Studyday\_view, Dis+Med\_Studyday\_view |

Interpretation:

1. White spaces between the bars represent days between 2 consecutive visits.
2. Duration bars displayed one below the other provides an easy visualization of co-morbidities as well as co-prescription of medicines.
3. For RMSD disease group, there are a lot more visits. The difference between consecutive visits is smaller than metabolic disease group.
4. In the 2nd view, medicines are categorized into types: Bhasma, Ghritam, Kashayam, Oil, Choornam, etc. This classification helps in understanding treatment principles followed by the doctor while treating a disease.
5. These 2 views should provide huge information at one glance to the treating doctor. These 2 views could be used as an additional helping aid while talking with patient F2F or over the phone.

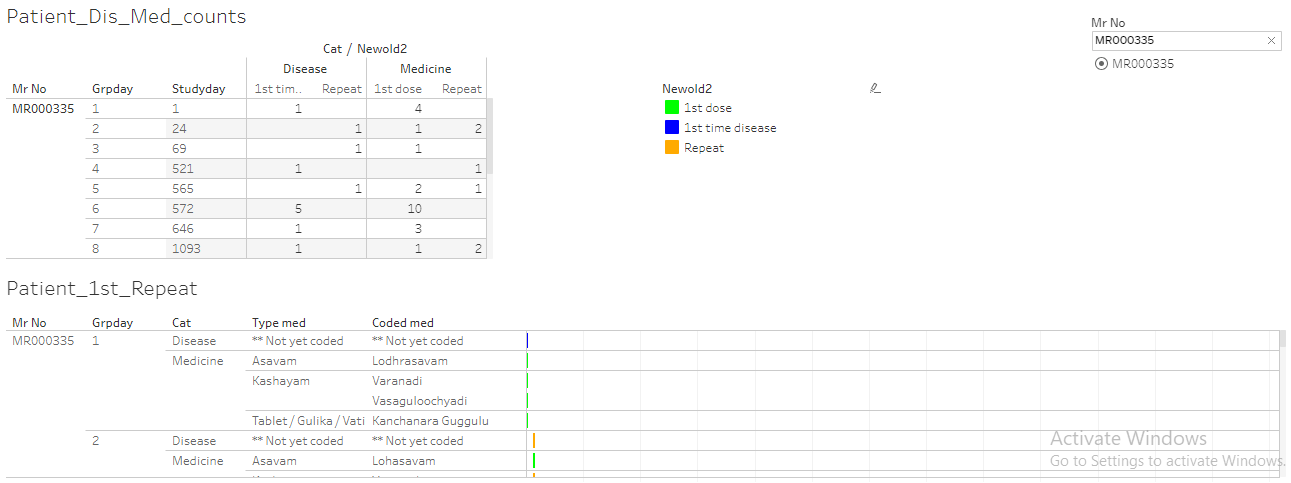
## Disease and treatment view, listing and summary

There are 3 analysis views created for individual patient data.

1st part of the analysis:

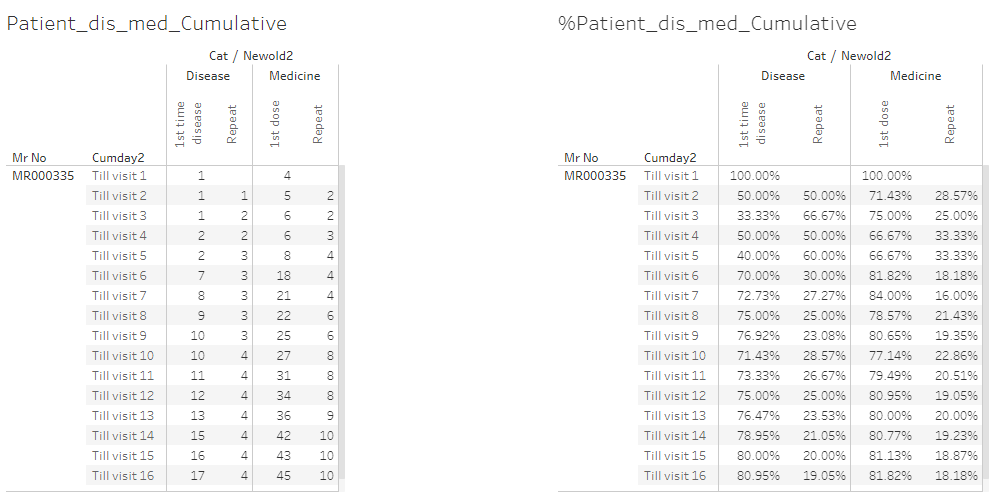
Patients are treated as they come to hospital. This visual provides a patient level view of number of diseases reported for the first time and then repeated, similarly treatment prescribed for the first time vs. a repeat of treatment.

1. When a disease is reported very first time then that is considered “1st time disease reported”, any subsequent repetition is considered as “Repeat”.
2. When a treatment is prescribed very first time then that is considered “1st time treatment prescribed”, any subsequent repetition is considered as “Repeat”.
3. These 2 calculations are repeated through the data for each patient.



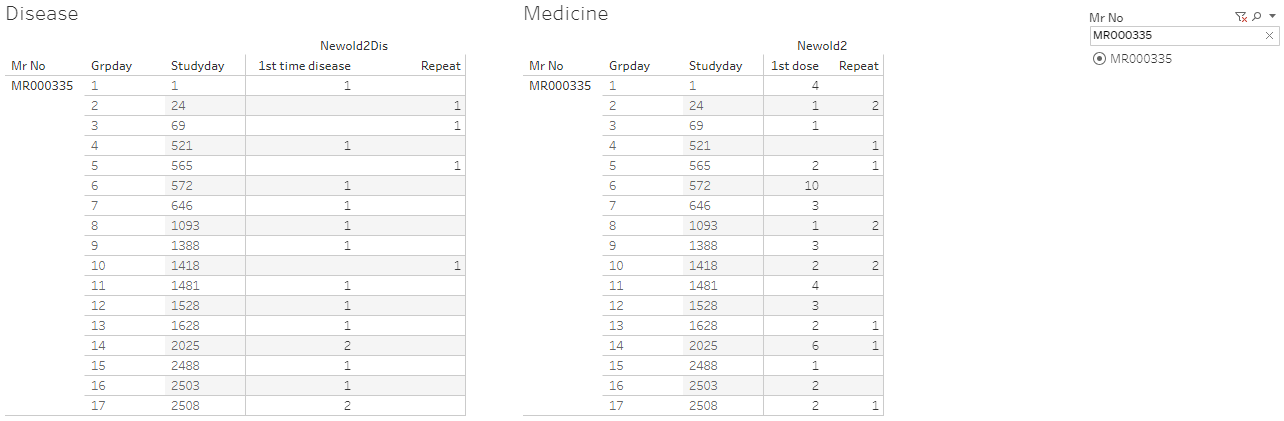
2nd part of the analysis:

This is a cumulative view for an individual patient. This provides a summary of what would have happened to a patient till a certain visit number. There are 2 tables created, first with absolute numbers and second with percentages.



3rd part of analysis: This is another version of display of diseases and treatments for individual patients “non-overlapping or non-cumulative” version.

1. Each line is a patient visit. 1st disease, Repeat disease, 1st treatment and Repeat treatment columns are displayed.
2. Studyday column shows the visit day.



Reference files:

|  |  |
| --- | --- |
| R program | 080\_medicine\_repeat\_prop.R  080\_medicine\_repeat\_prop\_addnl\_cal.R |
| Datafile | 080\_medicine\_repeat\_prop.csv,  080\_medicine\_repeat\_prop\_cumulative.csv  080\_medicine\_dis\_repeat\_prop\_cumulative.csv |
| Tableau viz | 080\_medicine\_dis\_repeat\_prop  080\_medicine\_dis\_repeat\_prop\_cumulative |
| Tableau sheetname | Dashboard 1 |

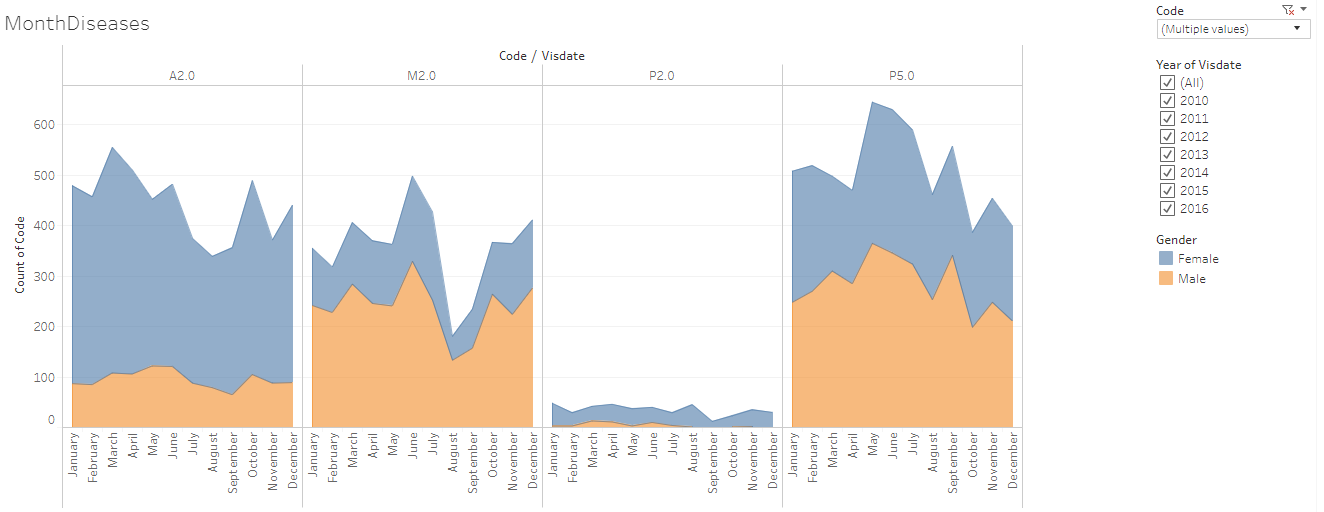
Interpretation:

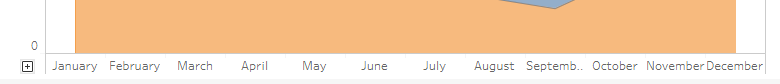
1. When a new disease is reported, usually a new treatment or treatments are reported, if there is only a new treatment added then it could indicate, the earlier treatment may not have worked, or it explains the treatment regimen.
2. If only new diseases are added and no new treatment is added then the same treatment could work for multiple diseases.
3. The above example shows for patient MR000335,
   1. There are 17 visits
   2. There are 17 distinct diseases reported and 45 distinct treatments, services prescribed.
   3. 4 out of 17 diseases are repeated and 10 out of 45 treatments have been repeated.
   4. Based on the 3rd view, at visit 6 on day 572, there is only 1 new disease reported and 10 new treatments are added. At visit 14 on day 2025, there are 2 new diseases reported and 6 new treatments added.
4. These visualizations allow the treating doctor insights into newer diseases getting reported as well as what newer treatments have been prescribed at what time points.

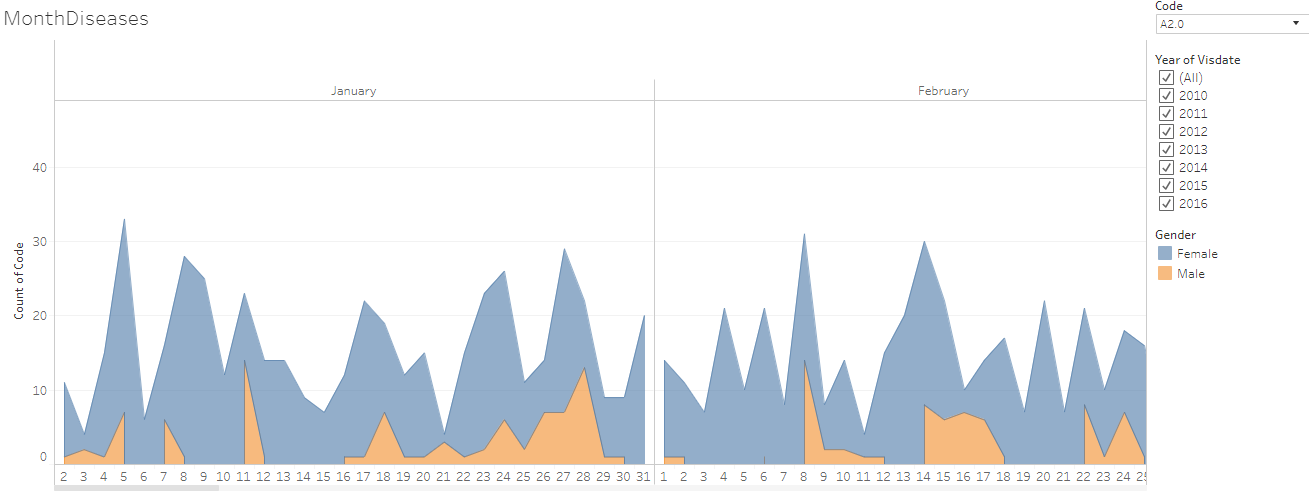
## Disease view by seasonal variation

The following analysis provides frequency count of patients for each disease by month by gender.

1. Unique combinations of patients, diseases by date and gender are created.
2. Frequency counts are displayed.
3. Counts of females are displayed in blur color and counts for males are displayed in orange color.
4. This visual opens for each day, by clicking on “+” sign on the x-axis, showing the operational as well as scientific usefulness.







Interpretation:

1. This provides information about 800+ diseases in very short space.
2. Disease patterns are interesting due to following reasons:
   1. Some diseases are reported more than a few other ones, it clearly gets shown easily.
   2. Diseases vary seasonally.
   3. Diseases are experienced differently by genders and it gets shown easily by looking at the distributions.
3. This view is very useful for both operational excellence as well as clinical judgment.

Reference files:

|  |  |
| --- | --- |
| Tableau viz | IndividualPatientCalendar |
| Tableau sheetname | MonthDiseases |

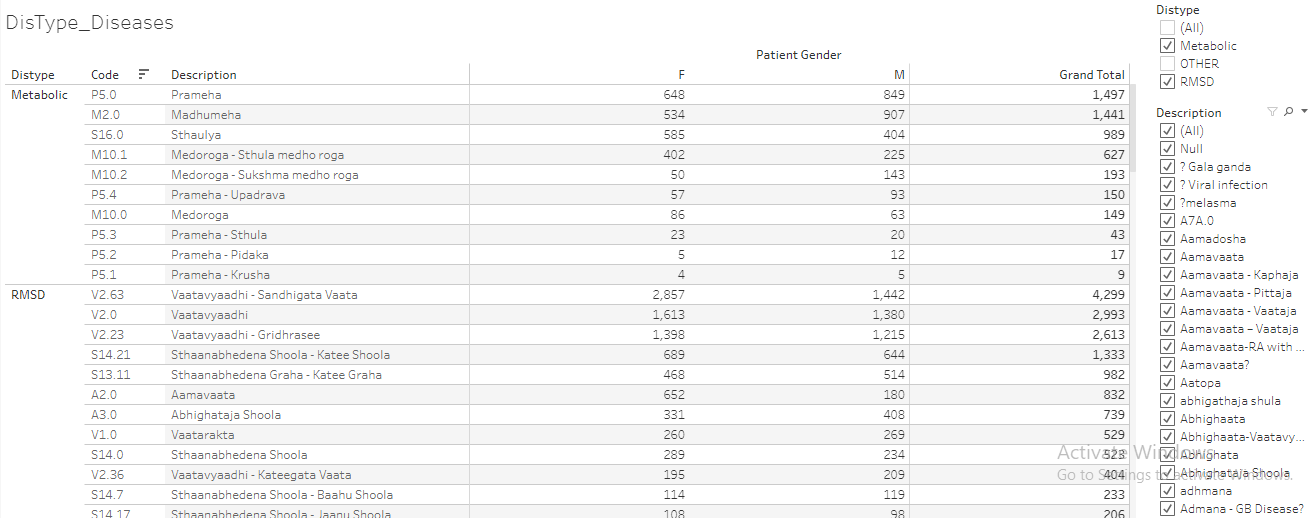
Reference files for 2nd analysis carried out similar in nature:

|  |  |
| --- | --- |
| Datafile | 01adsl\_met\_rmsd.rds |
| Tableau vizname | 01SQL\_Dis\_Med\_Ser |
| Tableau sheetname | Slopegraph\_disPatients, Slopegraph\_disVisit |

## Rate of occurrence for diseases for metabolic and RMSD

After understanding the data and some operational side of it, let us understand the rate of occurrence for various diseases reported. The most frequently reported diseases have been sorted in ascending order.

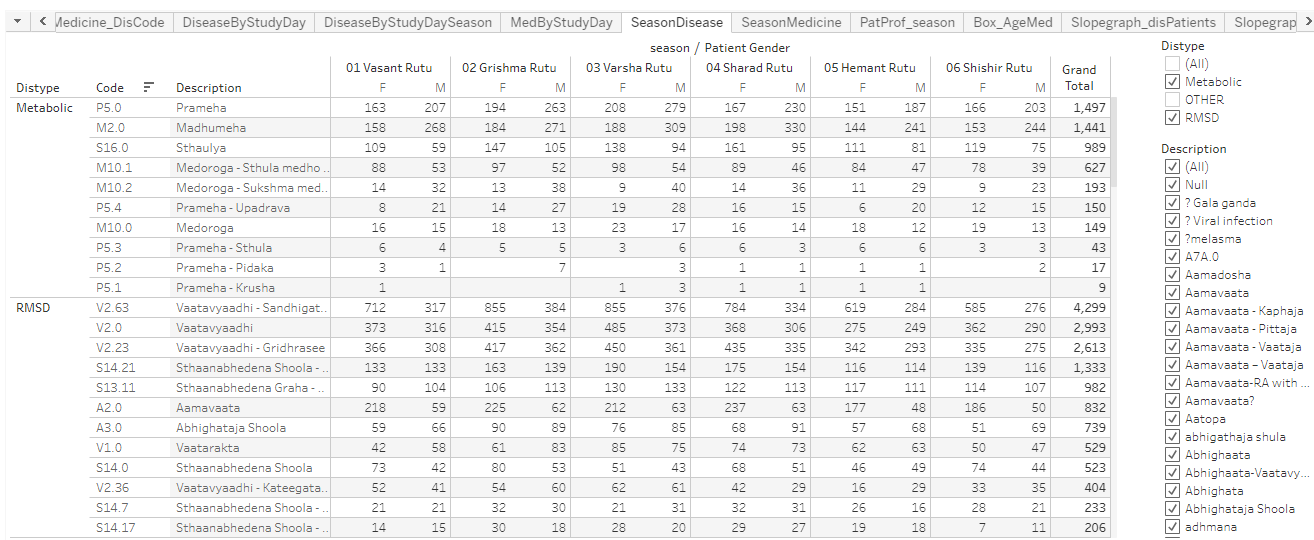
1. Metabolic disease group has 10 diseases and RMSD disease group has 100+ diseases.
2. For Metabolic disease group the top 3 diseases are:
   1. Prameha
   2. Madhumeha
   3. Sthaulya
3. For RMSD disease group the top 5 diseases are:
   1. Vaatavyaadhi – Sandhigata Vaata
   2. Vaatavyaadhi
   3. Vaatavyaadhi – Gridhrasee
   4. Sthaanabhedana Shoola – Katee Shoola
   5. Sthaanabhedana Graha – Katee Graha



Reference files:

|  |  |
| --- | --- |
| Datafile | 01adsl\_met\_rmsd.rds |
| Tableau vizname | 01SQL\_Dis\_Med\_Ser |
| Tableau sheetname | DisType\_Diseases |

The analysis was carried out for disease group by gender and Indian seasons.



Reference files:

|  |  |
| --- | --- |
| Datafile | 01adsl\_met\_rmsd.rds |
| Tableau vizname | 01SQL\_Dis\_Med\_Ser |
| Tableau sheetname | SeasonDisease |

There are many analysis created using to get additional insights into the data.

Interpretation:

1. Prameha and Madhumeha are reported more by males than females.
2. There are more female patients with disease condition Sthaulya.
3. In general, RMSD diseases are reported by more number of females than males.
4. For RMSD disease group, 51 out of 100+ disease are reported by <= 10 patients.

## Medicine prescription by day

There are numerous medicines prescribed. These medicines are classified into following broad categories:

1. Abhyanga
2. Aristham
3. Arka
4. Asavam
5. Avagha
6. Bhasma / Bhasma Cap / Bhasma Tab
7. Dhara
8. Ghritam and variations of Ghritam
9. Kashayam and variations
10. Kshar
11. Lehyam
12. Oil
13. Pichu
14. Rasayanam

Etc.

Source variable for treatment will be classified into the following categories. This should allow recreation of treatment protocol as per ayurvedic principles.



Interpretation:

1. Arka, Avagha are prescribed to very few patients.
2. Bloddletting has been advised to a few patients.
3. Kashayam has been

Reference files:

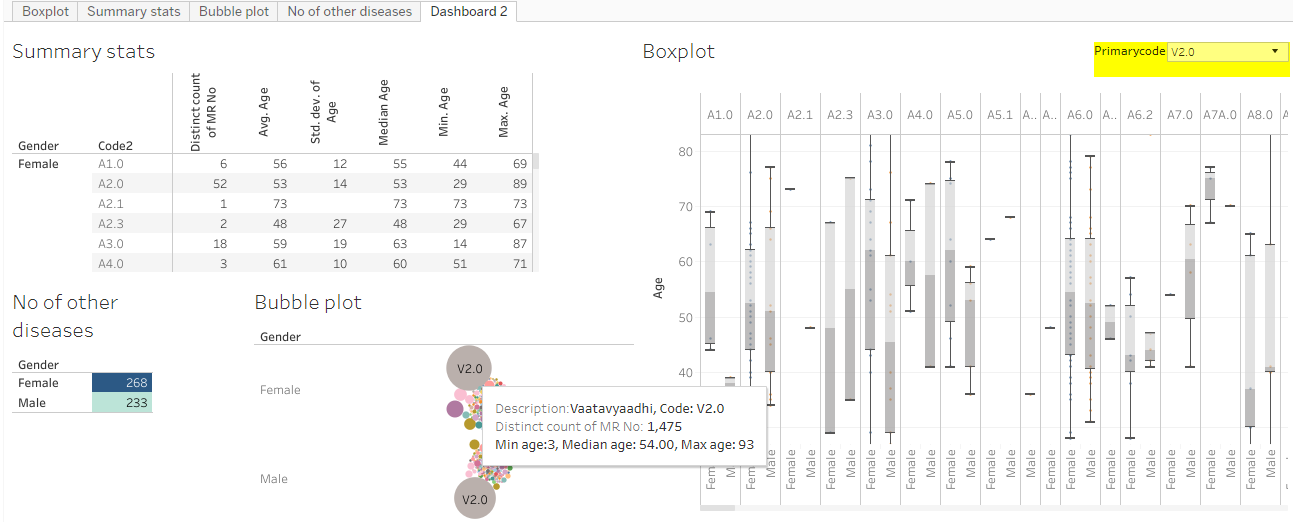
|  |  |
| --- | --- |
| Datafile | 01adsl\_met\_rmsd.rds |
| Tableau vizname | 01SQL\_Dis\_Med\_Ser |
| Tableau sheetname | MedicineByDay |

## Co-morbidity analysis

Patients report multiple diseases through their visits to the hospital. There are known as well as unknown disease combinations present due to biological linkages. 3 different analysis provide insights into co-morbidities observed through the existing data.

Algorithm for 1st analysis:

1. Create unique combinations of Patient ID, gender and reported disease at any given time point.
2. Subsequently create a dataset having combination of 2 diseases for individual patient. E.g. if a patient has reported 5 unique diseases then all the combinations of these 5 diseases will be created.
3. The resulting data will have the following structure: Patient ID, Primary disease, Secondary disease, gender.
4. Frequency count of distinct patients will be calculated for each Primary disease, Secondary disease combination and gender.
5. Using this data following analysis is carried out:
   1. Summary statistics of age group for each secondary disease by gender.
   2. Boxplot of age group for each secondary disease by gender.
   3. Bubble plot for each disease, bubble size is determined by the count of unique patient ID.
   4. For a primary disease how many other unique diseases are reported is calculated by gender.
   5. Tooltip on the bubble plot provides information about count of distinct number of patients, and summary statistics for age group.
6. The dashboard is controlled by a “PrimaryCode” or a reference disease. The corresponding data is displayed on the page.
   1. The bubble plot displays the number of distinct patients having the primary disease.
   2. Other bubbles display the diseases reported by this subset of patients at any point in time (these could be clinically related or unrelated, could have occurred before or after the occurrence of reference disease).
   3. The tooltip shows min, median and max age, distinct counts of patients.
   4. A small table on the left side shows number of other diseases experienced.



Algorithm for 2nd view: all the steps are same as 1st analysis + addition of monthly variation.

Same calculations for 1st algorithm are followed to create co-morbidities, in addition time factor of month has been added to get insights into seasonal variation.



Algorithm for 3rd analysis: steps are similar to the 1st analysis + chronology of diseases is maintained. How is the trajectory of the diseases unfolds is depicted here. The visual display is created in a form of collapsible tree. A brief flow chart of the analysis is as follows:

1. Diseases experienced by each patient are sorted by date and only 1st instance of a disease is retained.
2. For each disease trajectory the frequency counts are created and are displayed as a collapsible tree.
3. This tree shows progression of diseases as experienced by patients in the database.
4. This tree shows approximately 12,500 lines of data in very short space.
5. Some diseases are experienced more by males or by females. Some diseases are only reported by one of the genders.
6. Some diseases have many more branches than a few others.
7. The tree has filled blue dots which open up additional branches, white filled blue dots are the end of the branch, (N=xx) at each of the branches display number of patients reporting that disease trajectory.
8. Some of the disease trajectories have very few numbers of patients. Some of the trajectories may be clinically meaningful and some may not be meaningful.

Technical details behind the flowchart:

1. Disease trajectories are created using R programming. Final output stored in Json file.
2. Json file is used the input to the D3js Java programming.
3. Index.html file is hosted on the Github page to create the interactive page <https://coursephd.github.io>

Initial view of the tree



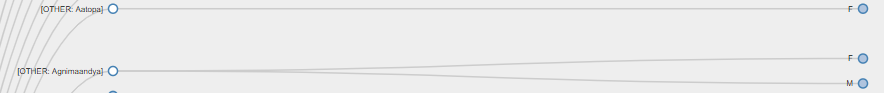
Example of Vaatavyadhi -- Gridhrasee



After clicking on F, the tree opens up



An example of a disease experienced only by one gender



Interpretation:

1. This display provides a comprehensive view of the disease clusters. Comorbidities are easily identified, some of them are clinically relevant, and some of them are not.
2. Bubble size provides comparative view of number of patients reporting a specific disease. The age group distribution for each gender is available. Some diseases are reported more by males or by females, easy to spot on the graph.
3. Box named “Number of other diseases” provides a contextual display about number of co-morbidities. Some diseases have higher number of co-morbidities, some have lower number. Variations are seen amongst gender as well.
4. This analysis does not take into account the before or after nature of time points, so this does not provide insights into the causal relationships between diseases.
5. 2nd analysis provides views on the seasonal variations of diseases as well as seasonal co-morbidities.

Reference files:

|  |  |
| --- | --- |
| R program | diagnosis\_primary.R, diagnosis\_primary\_month.R |
| Tableau viz | Primary\_disease\_and\_all\_other\_diseases , PrimDis\_otherDis\_ByMonth |
| Tableau sheetname | Dashboard 2, Dashboard 1 |
| Collapsible tree | <https://coursephd.github.io> |

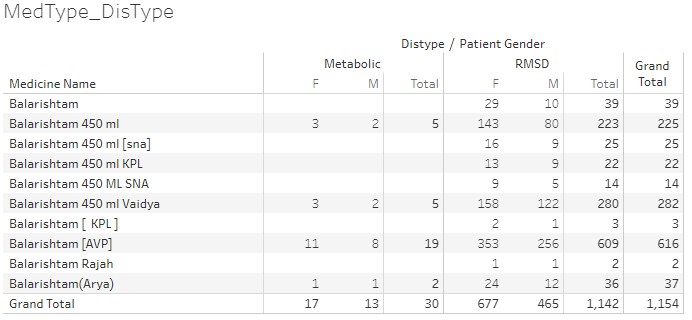
## Treatment and disease combinations

The Patient Report form or Case Report form captures diseases reported on a particular visit along with treatments and services prescribed to a patient. Due to the nature of the CRF page, multiple diseases and treatments are captured on the same visit. This creates many to many relationships and dilutes one to one relation. Even though this challenge exists, the data at a summary level provides good view on treatment and disease relationship.

Medicine and disease group rate of occurrences are calculated as well as medicine and individual disease rate of occurrences are calculated.

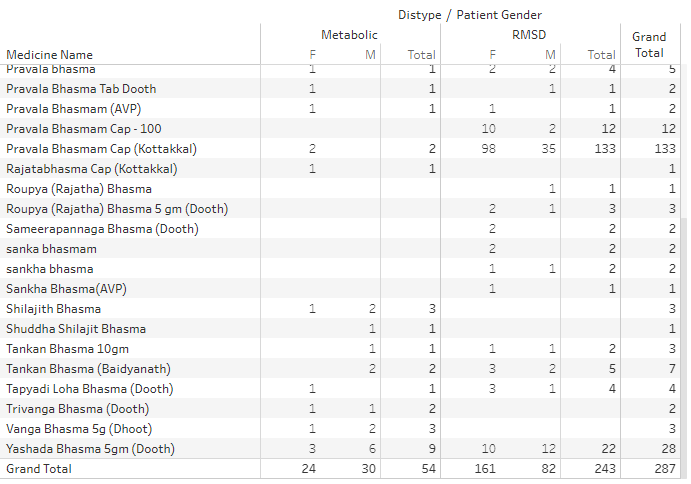
E.g. Use Balaristham as a case:

1. Balaristham is prescribed to the following number of patients.
2. The source variable captures the quantity + unit + company name are presented in the same variable, which does not allow for numerically correct calculations.
3. Coded variable is created to get around this challenge.
4. The medicine is prescribed for RMSD group. It is not used so much for Metabolic group.



2nd example of bhasma:

1. Approximately 287 patients out of 17406, 1.5% of patients are prescribed bhasmas for various diseases.
2. Traditionally bhasmas of any kind are prescribed in very limited quantity and same is reflected in observed data.
3. Naming convention and spelling correctness need to be considered while capturing data in future.



Reference files:

|  |  |
| --- | --- |
| Datafile | 01adsl\_met\_rmsd.rds |
| Tableau vizname | 01SQL\_Dis\_Med\_Ser |
| Tableau sheetname | MedType\_DisType  Medicine\_DisCode  MedByStudyDay  SeasonMedicine  Box\_AgeMed |

## ICD coding of diseases

National morbidity codes by CCRAS under guidance of Ministry of AYUSH

## ISO coding for background work history

## Dataset with each disease considered as a reference disease having day 1

This data is generated from every day medical practice at the hospital. Hence the diseases are reported almost at random. The following analysis uses 1st occurrence of any disease as day 1 at an individual patient basis. Using this as reference day “before period” and “after period” is derived. “Before period” provides significant amount of “baseline data”, “after period” provides specific insights into what would happen after the reference disease.

Algorithm to create the underlying data for analysis:

1. Each of the 106 diseases (10 Metabolic and 96 RMSD) is considered as a reference disease.
2. Day 1 is calculated as the reference day 1 for individual patient for each disease.
3. Other diseases for the same patient are positioned either before or after compared to this reference disease.
4. Duration w.r.to this reference day is calculated before and after day 1. This calculation provides the background view as well as future view.
5. This referencing allows for more informative background disease as well as background medicine information. The duration is split into the following time points:

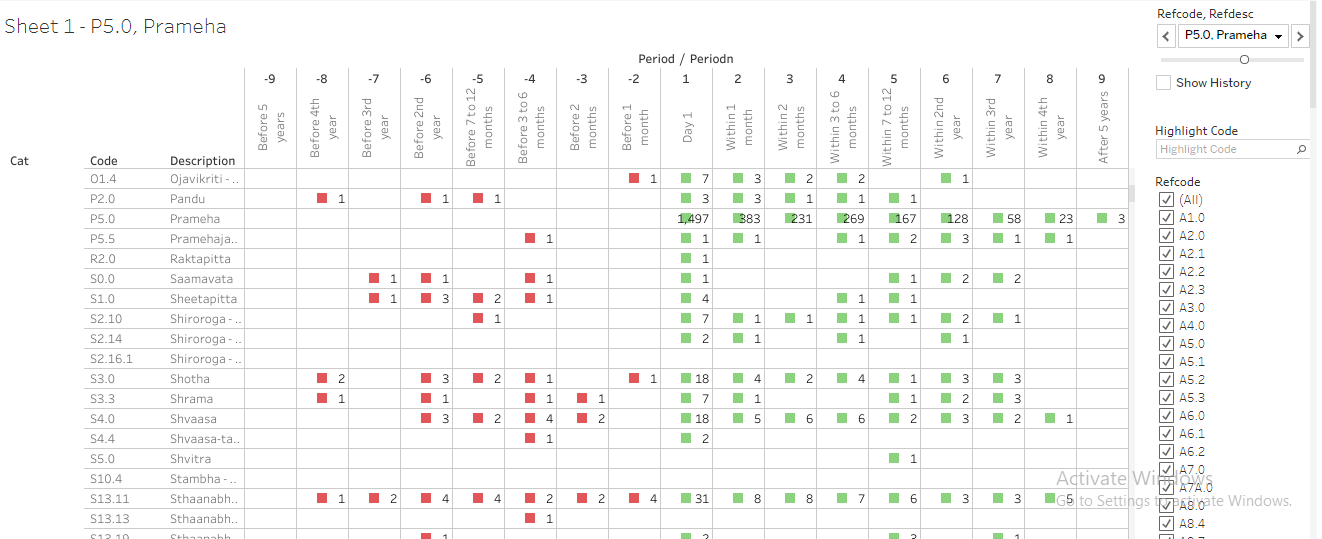
| **Before** | **After** |
| --- | --- |
| Day 1 as reference |  |
| Before 1 month | Within 1 month |
| Before 2 months | Within 2 months |
| Before 3 to 6 months | Within 3 to 6 months |
| Before 7 to 12 months | Within 7 to 12 months |
| Before 2nd year | Within 2nd year |
| Before 3rd year | Within 3rd year |
| Before 4th year | Within 4th year |
| Before 5 year | Within 5 year |

Details about the analysis file:

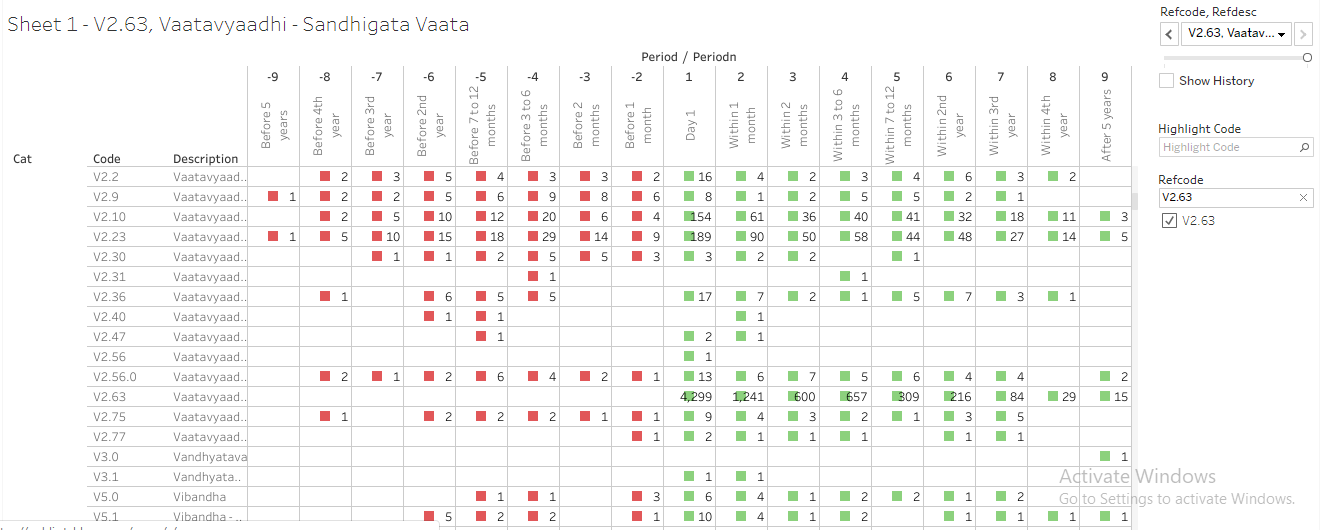
1. 1 sheet for each reference disease is created.
2. Frequency count of diseases and prescribed medicines is displayed.
3. “Before period” counts are displayed in red colour and “After period” counts are displayed in Green colour. This analysis provides good insights into the causal relationships.

E.g. use Prameha as an example:

1. Prameha has been reported by 1497 patients. Out of these 383 patients visit hospital within 1st month, 231, 269, 167, 128, etc are in the following time points.
2. Other lines in the table provide details about diseases reported by these 1497 patients.
3. Bottom section of the table provides information about the treatment details for these patients.



Another example of Vaatavyadhi – Gridhrasee, 4299 patients have reported at least once.



Reference files:

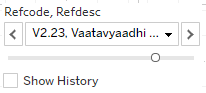
|  |  |
| --- | --- |
| R program | 085\_dis\_1st\_time\_refCal\_NodesEdges.R |
| Datafile | 085\_dis\_1st\_time\_refCal\_NodesEdges.csv  085\_dis\_1st\_time\_refCal\_NodesEdges.rds |
| Tableau vizname | 085\_dis\_1st\_time\_refCal\_NodesEdges |
| Tableau sheetname | Sheet 1- <Disease code>, <Disease name> |

## Circular disease and treatment view

This is 2nd analysis carried out on the data prepared earlier.

Details about the display:

1. For each reference disease 1 page is created. Each page is controlled by a combination of “Reference disease + disease”, “Reference disease + medicine”

Reference disease window:,

Reference disease or medicine window: 

1. Tables displayed in the top part of the display:
   1. There are 9 columns created for each time point.

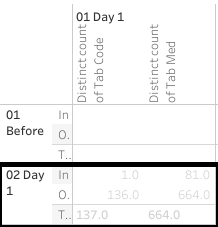


* 1. 2 columns are displayed in each time point to display “count of distinct number of diseases” and “count of distinct number of medicines”.

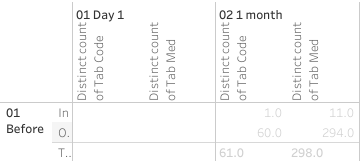
Count of distinct number of diseases: 

Count of distinct number of medicines: 

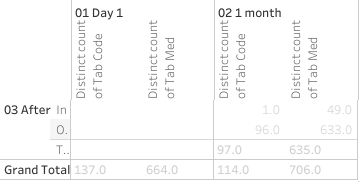
* 1. There are 3 rows for “Before period”, “Day 1” and “After period” with 2 lines in each period.
  2. Day 1 cell shows the start day of reference disease “V2.23: Vaatavyadhi – Gridhrasee”,
     1. This example shows 137 total number of distinct diseases reported and 664 total number of distinct medicines prescribed on day 1 for this combination of reference disease “V2.23: Vaatavyadhi – Gridhrasee” and disease “A6.0: Amlapitta”.
     2. The first line in the Day 1 cell shows, 1 disease – which is “A6.0: Amlapitta” and 81 distinct medicines prescribed. These 81 different treatments could have been prescribed for “A6.0: Amlapitta”.



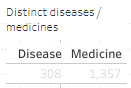
* 1. Cells in the “Before period” line provide the following information:
     1. This example shows 1 month before “V2.23: Vaatavyadhi – Gridhrasee”, there were 61 distinct diseases and 298 distinct medicines reported.
     2. The first line in the cell shows, 1 disease – which is “A6.0: Amlapitta” and 11 distinct medicines prescribed. These 11 different treatments could have been prescribed for “A6.0: Amlapitta”.



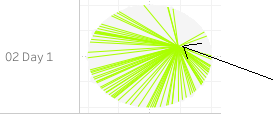
* 1. Cells in the “After period” line provide the following information:
     1. This example shows 1 month before “V2.23: Vaatavyadhi – Gridhrasee”, there were 96 distinct diseases and 633 distinct medicines reported.
     2. The first line in the cell shows, 1 disease – which is “A6.0: Amlapitta” and 49 distinct medicines prescribed. These 49 different treatments could have been prescribed for “A6.0: Amlapitta”.

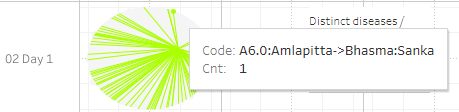


1. The bottom section follows the same structure as the top section. The following table provides distinct number of diseases reported and distinct number of medicines prescribed for this particular combination. There are 308 diseases and 1357 medicines reported for this combination of reference disease “V2.23: Vaatavyadhi – Gridhrasee” and disease “A6.0: Amlapitta”.



1. Explanation about the circular view:
   1. The starting point marks the position of the other disease in this case, “A6.0: Amlapitta”,
   2. The green colored spokes going from point of origin are different treatments prescribed.
   3. These are showing 664 distinct medicines prescribed on day 1.



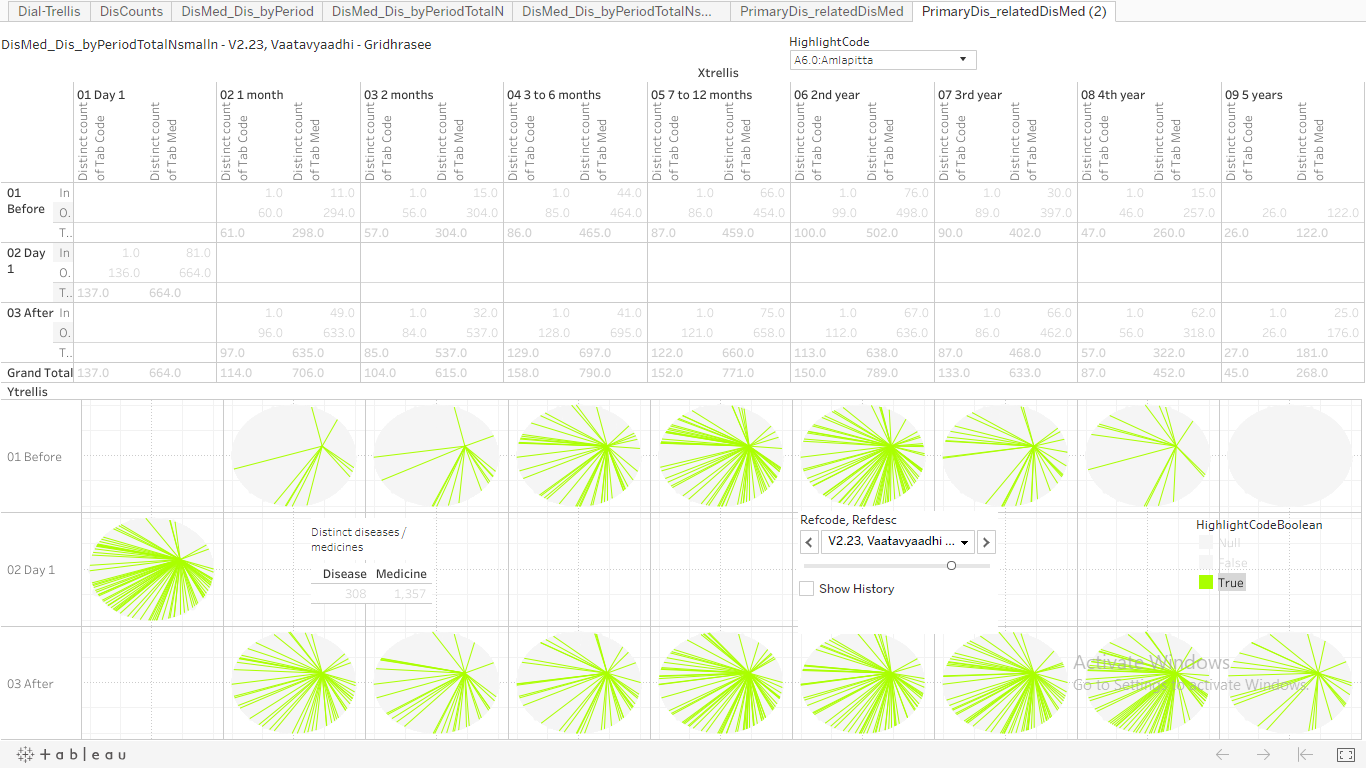
* 1. Hovering tooltip provides details about the disease, treatment name and count of number of patients: 

1. The inner circle displays the diseases.
2. The outer circle displays the treatments.

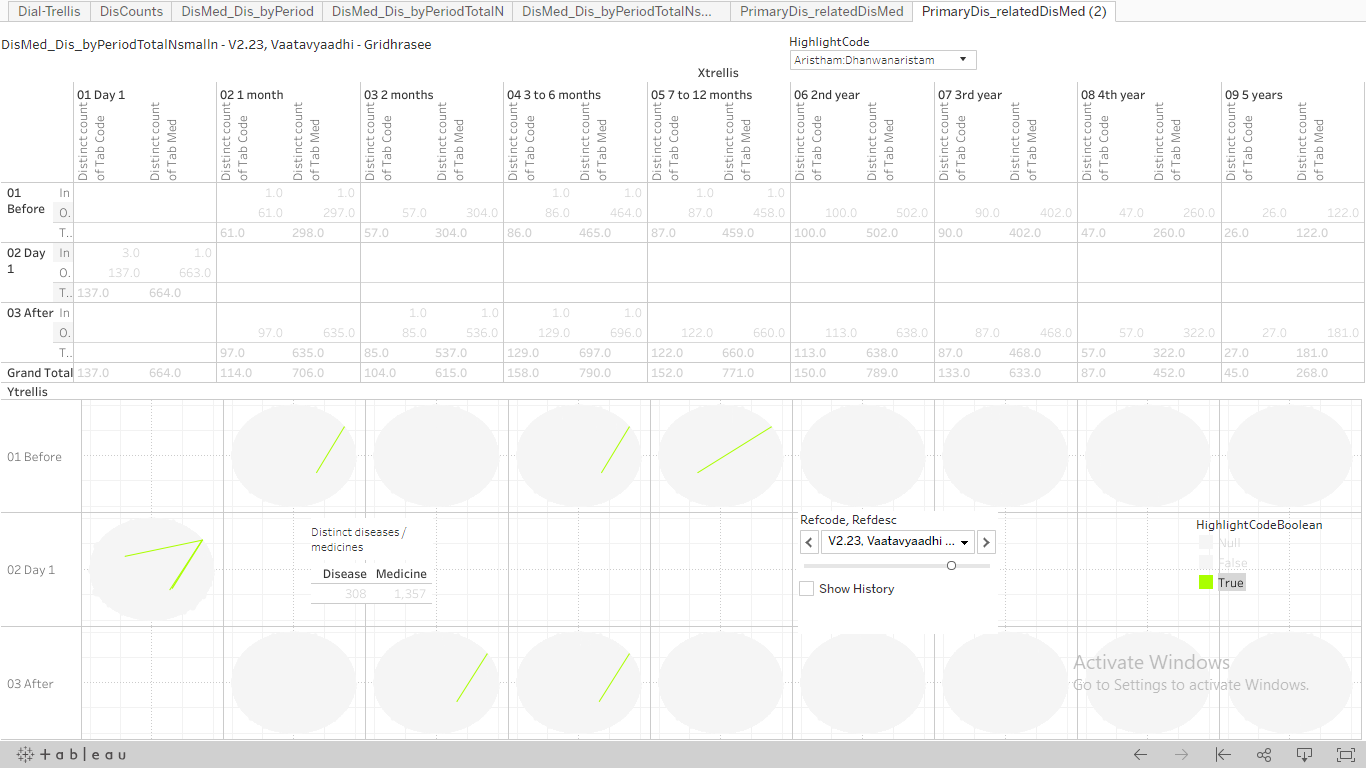
Circular view of disease and medicine view allows the following comparisons:

1. Relationship between diseases and treatments across different time points.
2. If a disease is experienced in different time windows then would the treatment options look different or would they look similar.
3. Occurrence of diseases and proximity -- do the diseases precede and / or succeed each other, etc.

E.g. Amavaata, what all diseases were experienced and treatments given before the 1st occurrence of disease and after the 1st occurrence of disease. How far or how close were these events are given in terms of within 1 month, within 2 months, within 3 to 6 months, 1 year, 2year etc. on both sides.



Example view of the combination of a treatment “Dhanwanaristham” and reference disease “V2.23: Vaatavyadhi – Gridhrasee”. Very few Green colored lines show that this treatment may not be a heavily used treatment against this specific disease condition.



## Before and after disease and treatment java view

This is 3rd analysis carried out on the data prepared earlier.