

**Summer Training at
Cairan India, Barmer
(April 3 to June 2, 2017)**

**Study on the Health Outcomes of RO Plants and Mobile Health Van
Services in Villages of Barmer & Jalore Districts, Provided by Cairn
India**

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2016-2018**


Institute of Health Management Research
**The IIHMR University, Jaipur
2017**

CERTIFICATE

This is to certify that **Dr. PRADEEP KAMERA** of **MBA Hospital and Health Management** from The IIHMR University, Jaipur has undergone internship training at **Cairn India, Barmer** from **3rd April to 2nd June 2017**.

The Candidate himself completed the project assign to him during summer training. His approach to the project was sincere and proactive. This summer training is in partial fulfillment of the course requirement recommended for the award of MBA in Hospital and Health Management

I wish him all success in all his future endeavors.



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केयर्न फाउंडेशन

Date: 11th July 2017

TO WHOM IT MAY CONCERN

This is to certify that Dr. Pradeep Kamera student of Masters in Business Administration (Health and Hospital Management) batch 2016-2018 of Indian Institute of Health Management and Research (IIHMR) University, Jaipur, Rajasthan has successfully completed his summer training with Cairn Foundation from 3rd April 2017 to 2nd June 2017.

This project was undertaken by him in the division of: Corporate Social Responsibility - "Impact of safe drinking water and mobile health vans (MHVs) on the health of rural Barmer"

During this period of internship his performance was found to be hardworking, punctual and inquisitive.

We wish him all the success in the future.

Thanking You,

*Shashwat
Kulshreshtha*

Shashwat Kulshreshtha
Member Secretary
Cairn Foundation

Acknowledgement

A successful project can never be prepared by the single effort or by the person to whom project is assigned, but it also demands the help and guardianship of some conversant person who helps in the undersigned actively or passively in the completion of successful project.

First, I would like to thank ALMIGHTY GOD, for providing me all the platforms to work upon.

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Experience in a public health environment is an important part of my course and this I have achieved from one of the esteemed organization, Cairn India, Barmer, Rajasthan. These two months of training has added a valuable and knowledgeable exposure in the development of my career and achievement of my objectives, for which I am highly grateful to the organization.

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Acronyms

E & P – Exploration and production

BOEPD – Barrel of Oil Equivalent per day

CSR – Corporate Social Responsibility

PHED – Public Health Engineering Department

BPO - Business Process Outsourcing

CCOE – cairn Center of Excellence

RSLDC – Rajasthan Skills and Livelihood Development Corporation

MOU's - memorandum of understanding

IIIT – Indian Institute of Information Technology

SHS – Solar Home System

NGO - Non-governmental organization

KW - kilowatt

SHG – Self Help Group

RO – Reverse Osmosis

TDS – Total Dissolved Salts

PPT – Parts Per Thousand

PPM – Parts Per Million

MHV – Mobile Health Van

RMP – Registered Medical Practitioner

About the organization

Background

Cairn India is one of the largest independent oil and gas exploration and production company (**E & P**) in India with a market capitalization of 11 Billion US \$ the company was rated as the fastest growing energy company in the world(CAIRN).

Vision: - "To be a best-in-class E&P Company with a balanced portfolio delivering value through superior business performance and partnerships"

Values: - Cairn India's vision is built on the foundation of our core values of pioneering spirit, teamwork, respect, and ownership. These are embodied in the way we conduct our business and engage with our stakeholders. (1)

Introduction

It is the largest private independent E & P company in India with a production of 211,671 BOEPD (Barrel of Oil Equivalent Per Day). Cairn India produces approximately 30% of India domestic crude oil helping the country to save over 4,81,000 million rupees from foreign exchange in the name of oil and gas importing.

Cairn India had started 4 basins with many discoveries from those which 38 are in Rajasthan. Mangala, Bhagyam & Aishwariya are the major fields discovered in Rajasthan with an approximate production of 1 billion barrels. It has a portfolio of 7 blocks 1 in Rajasthan, 1 in west coast, 4 in east coast & 1 in south Africa. (1)

CSR (Corporate Social Responsibility) act

"Companies Act 2013" has introduced several new provisions which change the face of Indian corporate business. One of such new anticipations are Corporate Social Responsibility (CSR). The concept of CSR rests on the idea of give and take. Companies take resources in the form of raw materials, human resources etc. from the society. By performing CSR activities, the companies are giving something back to the society. Ministry of Corporate Affairs had notified Section 135 and Schedule VII of the Companies Act as well as the provisions of the Companies (Corporate Social Responsibility Policy) Rules, 2014 (CRS Rules) which has come into effect from 1 April 2014. Section 135 of the Companies Act provides the upper limit for applicability of the CSR to a Company i.e.

- A) Net worth of the company should be Rs 500 crore or more.
- B) Turnover of the company should be Rs 1000 crore or more.
- C) Net profit of the company should be Rs 5 crore or more.

Further as per the CSR Rules, the provisions of CSR are not only applicable to Indian companies, but also applicable to branch and project offices of a foreign company in India. (2)

Under **section 135** Cairn India has started CSR activities in the year 2014 with.

CSR (Corporate Social Responsibilities) of Cairn India

3 core values guide CSR activity

- 1) Interest of the stakeholders are to be protected
- 2) Engagement of the local communities proactively
- 3) Inclusive Development ⁽³⁾

To achieve 2 interlinked objectives

- a) Socio-economic status of the community should be improved measurably
- b) Engagement with local communities continues to develop relationship and mutual trust with communities

CSR activity of Cairn India can be broadly classified in to 5 terms with the goal to increase complete socio-economic indicators of Cairn India's operational area.

- a) **Health care promotion, availability of safe drinking water & sanitation.**
- b) **Work augmentation by means of skill development and training programs.**
- c) **Financial augmentation by means of agricultural and other livelihood openings.**
- d) **Indorsing sports and education.**
- e) **Guaranteeing ecological nature.** ⁽³⁾

Promoting health care, sanitation & safe drinking water available.

Preventive health care: -

Cairn India is conveying Mobile Health Van administrations for the populace in country region in its territory of operation to give access to preventive social insurance. Political educational programs is executed through local government and NGO accomplices under National Rural Health Mission. This is a five-year program in organization with local government and Nongovernmental Organization accomplices to better social insurance administrations. This program tries to reduce Under five death rates, maternal death rate, control of common illnesses and better essential medicinal services get to.

Portable Health Van (MHV) administrations are tried to give essential restorative administrations at the entryway venture of the group. Ten versatile wellbeing vans are utilized to serve the goal in 2 regional area of Rajasthan and Gujarat, some in broad daylight private association display, they are covering 144 towns in Rajasthan and 115 in Gujarat. From the previous year MHVs had served more than 3,00,000 populaces in 9 areas of Rajasthan and Gujarat.

To upgrade human services offices through Barmer area, Cairn India is supporting District Hospital, by giving sanitation offices and therapeutic gear bolster. They have likewise made an OPD focus with expert specialists in Barmer bordering regions. ⁽³⁾ ⁽⁴⁾ ⁽⁵⁾

Sanitation & Safe drinking water: -

Delivering access to sanitation services to rural households in company with local Panchayat. Cairn India has constructed four thousand family toilets in organization with Government of Rajasthan in 6 Gram Panchayats in Sindhri and Baitu Blocks of Barmer locale. In the venture, the Cairn India would be building a sum of 25,000 family unit toilets in 3 Gram Panchayats and whole Baitu square. Under Swachh Bharat Swachh Vidyalaya development, Cairn India had built 188 school toilets in government schools in Barmer and Jalore areas.

In organization with Gram Panchayats, Cairn India is giving safe drinking water through group run RO plants. 34 such RO plants in Rajasthan, 10 in Gujarat and 14 in Andhra Pradesh gives safe drinking water to the group. Cairn India has techniques to begin 330 safe drinking water units in Barmer, touching over 800 towns. Dissemination through transportation Vehicles to build reach and openness.

A safe drinking water program is being implemented in Rajasthan, Gujarat & Andhra Pradesh (**“Jeevan Amrit”**). This was achieved by a door-to-door step water distribution program (**“Jal Rath”**). “Jal Rath” are running by local entrepreneurs. 13 “Jal Rath” have been setup so far. In addition to that, they have started launching the process of establishing 330 additional water purification plants across the Barmer district in association with the Public Health Engineering Department (PHED) & Government of Rajasthan. This program will be spread around 800 villages and will serve more than a million people in the district. It is one of the largest such initiatives in the country and is expected to result in several additional benefits such as direct and indirect local employment generation. (3) (4) (5)

Employment augmentation through training and skill development programs.

Woman and Child Development

Cairn India had provided combined education for children and women skill development through setting up of Anganwadis in Barmer and other areas. These will provide an integrated solution covering mother and child healthcare, skill development, other health services etc. Some women were also trained on masonry skills and created an opportunity to participate in the construction of toilets under the “Swachh Bharat Abhiyan”. Two training centers were established in Barmer and Baitu, which will train women in tailoring and stitching. (3) (4) (5)

Youth Development

Nearby youth were prepared through various employment situated courses through Cairn Enterprise Center, Barmer and in a few satellite focuses in Barmer and Sanchore and so forth. Repairing of cell phones, welding, stone work, electrical repairing, trainings in BPO are being proceeded. Aggregate of 1,470 adolescents have been prepared, out of which more

than 1,350 have been put. Projects are likewise started to show English-talking and PC aptitudes to differentially-abled grown-ups. This preparation qualifies them for occupations at the rustic BPO focus in Barmer (likewise financed by Cairn India).

Cairn Center of Excellence (CCOE), is a propelled preparing focus, at Jodhpur, Rajasthan. The office comprises of the craftsmanship labs to direct courses in sun based, wind, propelled welding, retail, and car repair. It additionally gives progress professional ability trainings on different modern exchanges. The inside means to prepare and utilize more than 3,000 country adolescents in the up and coming years. Work connected professional abilities preparing with plan to prepare and utilize more than 4000 young people in the country ranges. (3) (4) (5)

Income augmentation through agricultural and other livelihood opportunities.

Meant to expand group economical and business salary through water gathering and enhanced practices in horticulture, domesticated animals and create advertise linkages. It is required to expand pay of more than 20,000 ranchers in Cairn's operational region. Program will be executed through NGO accomplices.

The venture concentrates on improving job openings through preparing and limit working of agriculturists. Setting up of exhibition ranches, advancement of agri-business visionaries, dairy improvement, and market linkages for agriculturists. In north Barmer "Pilot Project on Cumin Cluster Development" was started connecting cumin agriculturist straightforwardly to acquisition office; NABARD upheld Watershed arranging and group shramdan work begun to set up Community Naadi as a feature of the regular asset administration extend alongside two bio-gas plants. 18 hectares of brushing land has been created; and ~10 lakh cubic meters of water being reaped throughout the year.

Cultivation and agribusiness program incorporates 3,788 ranchers by enhancing administration of water utilizing trickle water system hones and expanding soil dampness maintenance utilizing "khadins". "Khadins" are particular water collecting structures and 289 such structures were manufactured so far with other 144 under development. These intercessions have enabled ranchers to work on multicropping and develop money harvests, for example, vegetables and mushrooms. This venture has seen rancher earnings ascend in the brief span time frame that it has been dynamic.

Dairy helpful program has been creating 9,500 every day achieving 2,398 family units. (3) (4) (5)

Promoting education and sports.

School adoption program contribute to provide supplementary teachers to 37 Government schools with an evidence in increased academic performance. Cairn India has signed a MoU with the Rajasthan Skills and Livelihood Development Corporation (RSLDC) and has trained more than 600 individuals under this program. The Center has also received support from the Ministry of New and Renewable Energy's 'Suryamitra' program. Organization have also entered MoUs with IIIT (Kota) and the Malaviya National Institute of Technology (Jaipur). 300 students have completed the training and some have received job offers from companies such as Suzlon, Vodafone, Amazon, PepperTap, Samsung, Minda, Hero Group, and the State Bank of India.

To give commonsense figuring out how to understudies, the Company presented portable science vans and advanced learning in 50 rustic government schools of Gujarat. The versatile science vans visit schools showing logical investigations along these lines essentially instructing science to understudies. Grants were given to financially underestimated commendable understudies of class X and XII. They have additionally Providing framework bolster for building up IIIT at Kota, Rajasthan.

Advancement of games like Hockey and supporting improvement of games and empowering youth cooperation. (3) (4) (5)

Ensuring sustainable environment.

Cairn India had set up Solar smaller scale network and giving Solar Home Systems (SHS) to individuals from the group to enhance the personal satisfaction of the individuals who did not approach a power association. Increment green belt scope in the neighborhoods Company's operation for condition maintainability. The program will be done in organization with nearby panchayat, NGO accomplice and the woods division.

This Company had actualized group run 27 KW smaller scale network sunlight based plant to give family unit power to 600 group individuals in Village Meghwalon Ki Dhani, Barmer. The plant is overseen and keep running by the group. 500 sun powered home frameworks given to group. (3) (4) (5)

Rural Development Projects by Cairn India

Started people group require based tasks that enhance personal satisfaction in rustic zones by setting up quality instruction and wellbeing offices. It likewise gave access to power to family units in remote provincial regions through sun powered based undertakings in organization with Government and Small people group require based tasks in rustic territories to advance neighborhood group improvement.

The tasks are embraced for the advancement of provincial zones where the Company is operational. These undertakings incorporate building up the green cover, enabling ladies through SHG arrangement, advancing society and provincial games. These tasks are of littler

scale in view of group needs. These likewise contain some little scale foundation ventures which are mutually chosen with group through the group interface programs.

To enhance the school foundation offices, the Company gave require based framework support to country government schools. (3) (4) (5)

A study on the health outcomes of RO plants and Mobile Health Van services provided by CAIRN India in villages of Barmer & Jalore districts of Rajasthan.

Introduction

Barmer district is in western parts of Rajasthan forming a part of Thar Desert. Barmer has 8 blocks Baetu, Balotra, Barmer, Chohtan, Dhorimanna, Siwana, Sheo, Sindhari with 2460 revenue villages (6). Barmer is the third largest district by area in Rajasthan and fifth largest district in India, occupying an area of 28,378 sq.km, with a population of 2,603,751. It has a density of 92 people for sq.km with a decadal growth rate of 35.52%. According to 2011 census 93.2 % of population are in rural areas and the remaining 6.98 % are in urban areas. (6)ⁱ

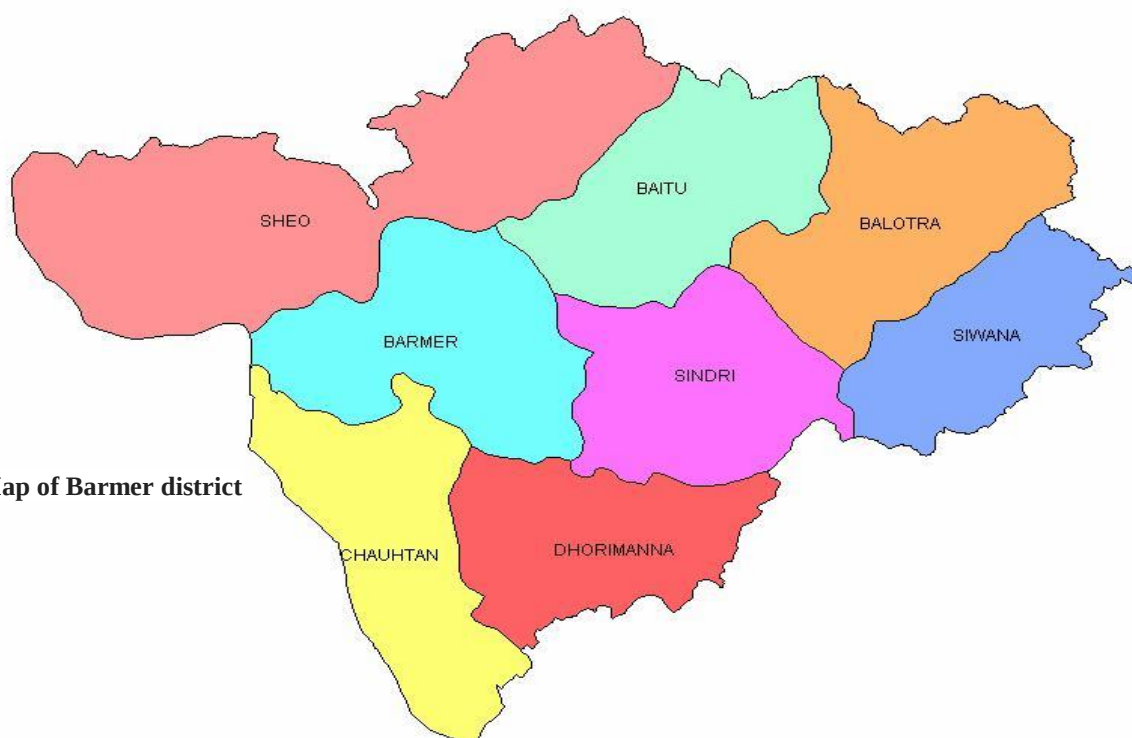


Fig:1 Map of Barmer district

GROUND WATER INFORMATION BARMER DISTRICT, CENTRAL GROUND WATER BOARD,
MINISTRY OF WATER RESOURCES, GOVERNMENT OF INDIA, 2013.

http://www.cgwb.gov.in/District_Profile/Rajasthan/Barmer.pdf

Average rainfall of Barmer district is 281.8 mm with high variation in temperatures during summers and winters (6). The depth of ground water level pre-monsoon is 4.90 to 70.95 ml and post-monsoon is 4.00 to 71.50 ml. Deeper water levels were recorded in Barmer, Chohtan, Dhorimanna, Sheo and Sindhari blocks (52.99 to 71.50).

Jalore district is in western parts of Rajasthan covering a geographical area of 10,640sq. km with a population of 1,828,730. The district is part of Jodhpur Division. Jalore, Ahore, Bhinmal, Sanchore, Raniwara, Sayala, Bagora with 820 villages.

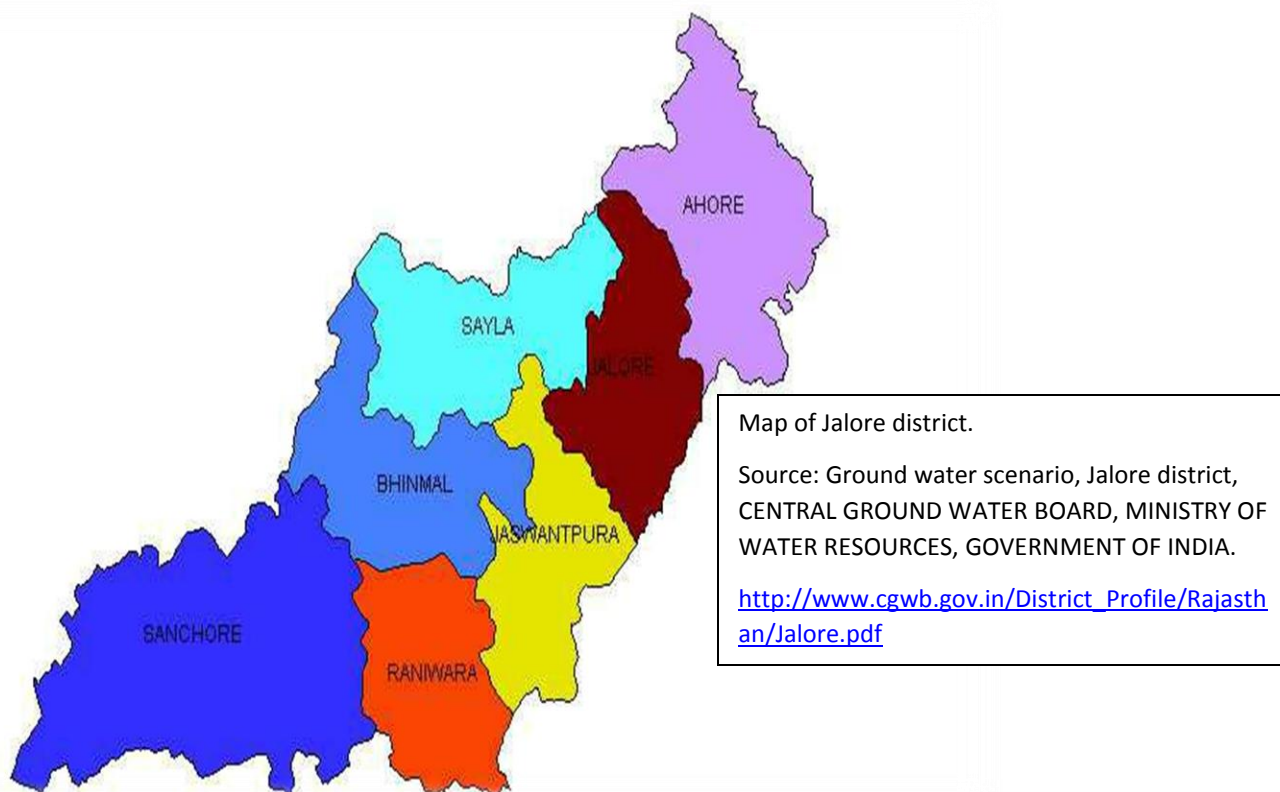


Fig: 2 Map of Jalore District

Average annual rainfall is 445.5mm the district experiences either mild or normal drought once in two years. Severe type of drought has been recorded at Ahore block. Most severe type of drought has been recorded at Bhinmal, Sanchore & Jaswantpura blocks. Jalore district is often called “**Delta of West Rajasthan**” and all the principal rivers of western Rajasthan flow through this district. The principal means of irrigation in the district are wells/tube wells, though canals irrigate some areas. Groundwater is the main source of irrigation and is utilized through dug wells & tube wells. Canal irrigates only a small area. Important irrigation projects are Narmada canal project, Bandhi sandhara irrigation project, Bhetala irrigation project, Dantwara irrigation project, Dhumada mata bund and Gudanal II irrigation project.

Depth of the water level in pre-monsoon period varies from 5m to 50m & in the post monsoon time it varies from 2m to 50m i.e. water levels have been found to range widely from less than 3m to more than 50m bgl. Water level is shallower in eastern parts of the district. In general, depth to water level varies from 2m to 10m in Jaswantpura tehsil and between 10m to 20m in the eastern parts of the district. In rest of the district post-monsoon water level ranges from 20m to more than 40m. Access to health care and equitable distribution of the health services are the basic requirements for achieving millennium developmental goals. Many areas in this district even in well-developed areas lack basic health care infrastructure limiting the access to health services.

Literature Review; -

Quality of ground water

Quality of ground water in shallow aquifer varies widely from saline water to fresh water which are close to the hilly tract. ⁽⁶⁾

Hard rock formation covers major part of the district such as Malani rhyolite and granite and Jalore & Siwana granites of Post Delhi. These have poor water yielding capacity. ⁽⁶⁾ Also, such areas suffer from water quality problem and in some of the areas ground water is highly saline. The district being a part of arid zone has mineralized ground water with wide variation in salinity of ground water. Salinity varies from 500µs/cm to 17000 µs/cm. Villages located in such areas have the basic problem of drinking water requirement and the situation becomes very critical in summers and in drought years. ⁽⁸⁾ In Barmer water quality and scarcity are a challenge. The most densely populated arid region in the world, much of the state is especially water scarce and drought prone. The title “**Marwar Region**” translates to “**Land of Death**”, a derivative of the harsh, water-strained area’s history. ⁽⁹⁾

“Water in the desert belt of Rajasthan has been giving not life but sickness - in the form of fluorosis, a crippling disease that spares no one. And with no help coming from the Government, many young children seem destined to a maimed future” a research done by **Ramesh Meanon** December 2013 says ***Water may give life but in 6,000 villages of Rajasthan water is also giving sickness.*** The villages were nicknamed as BANKA PATTI (Bent strip) ⁽¹⁰⁾.

Due to the scarcity of water and deprived quality of water in the desert belts of Barmer and Jalore, people are effected by various water borne disease like fluorosis & arthritis which made them live in pain and decreased quality of life ⁽¹⁰⁾.

Salinity is the measure of Total Salts Dissolved (TDS) in water and is measured in PPT (parts per thousand) 1 PPT = 1000 PPM (parts per million) ⁽¹¹⁾. TDS contains inorganic and some amounts of organic salts which are dissolved in water. The main constituents are usually calcium, magnesium, sodium and potassium, carbonate, bicarbonate, chloride, sulphate & nitrate. If anyone of these salts increase more than the permissible level the water is not

useful for drinking. It may taste bitter, salty, or metallic and may have unpleasant odors, high TDS water is less thirst quenching, high TDS interferes with the taste of foods and beverages, and makes them less desirable to consume. Some of the individual mineral salts that make up TDS pose a variety of health hazards. The most problematic are Nitrates, Sodium, Sulfates, Barium, Cadmium, Copper, and Fluoride. (12)

According to the Bureau of Indian Standards, the ideal TDS concentration for drinking water should be below 300mg/L. The maximum permissible limit of TDS in drinking water is 600mg/L. Due to unavailability of good sources of drinking water, most of the people must drink water high TDS concentration (13). Drinking water sources in Barmer district are not safe and the TDS levels are exceeding the permissible levels most commonly fluoride, chloride, nitrates & iron. The table below shows the range of salts in water in Barmer district and the permissible levels.

Table 1: TDS range in drinking water (13) (11)

TDS level (mg/l)	Rating
Less than 300	Excellent
300-600	Good
600-900	Fair
900-1200	Poor
Above 1200	Unacceptable

1. Source: Background document for development of WHO Guidelines for Drinking-water Quality, Total dissolved solids in Drinking-water. http://www.who.int/water_sanitation_health/dwq/chemicals/tds.pdf

Chemical Constitutes	Range	Permissible level
Chloride	50 to 5503 ppm	250mg/l
Fluoride	traces to 3.08 mg/l	0.7 to 1.2mg/l
Nitrates	traces to 892 ppm	10ppm
Iron	zero to 4.8mg/l	0.3 mg/l

Table 2: Ground water scenario in Barmer District (TDS levels)

Source: GROUND WATER INFORMATION BARMER DISTRICT, CENTRAL GROUND WATER BOARD, MINISTRY OF WATER RESOURCES, GOVERNMENT OF INDIA, 2013.
http://www.cgwb.gov.in/District_Profile/Rajasthan/Barmer.pdf (6)

Table 3: Ground water scenario in Jalore District (TDS levels)

Chemical Constituents	Range	Permissible level
PH	7.3 to 8.5	7
Chloride	99 to 1633ppm	250 ppm
Calcium	16 to 92ppm	200ppm
Magnesium	9 to 120ppm	100ppm
Iron	0.05 to 0.66mg/l	1mg/l
No3 (Nitrates)	15 to 155ppm	10ppm
Fluoride	0.09 to 2.40mg/l	1.5ppm

1. **Source:** Ground water scenario, Jalore district, CENTRAL GROUND WATER BOARD, MINISTRY OF WATER RESOURCES, GOVERNMENT OF INDIA.
http://www.cgwb.gov.in/District_Profile/Rajasthan/Jalore.pdf

It has been established that when the concentration of fluoride exceeds 1.5 mg/l, it gives a mottled brown discoloration to chalky white teeth, the disease is known as dental Fluorosis. In later stages the teeth become black, gets pitted and eventually get chipped off. In Nagaur district results of epidemiological survey carried out in the district reveals that 16,411 people are afflicted with dental fluorosis. It has also been observed that males are more prone to dental fluorosis as compared to females. Prolonged ingestion of fluoride causes chronic effect in bones leading to skeletal fluorosis. Because of such disease stiffness of joints, backbone and calcification of ligaments takes place. Results of epidemiological studies indicates that in Didwana and jayal block of Nagaur district, Kalyanpura village of Rani block of Pali district, Raniwara, Sayla block of Jalore district and Barmer areas, maximum cases of skeletal fluorosis have been seen (Singh *et al.*, 1993). (14)

A study was conducted in Gujarat in Bharuch and the study revealed that the beneficiaries opined that after the introduction of R.O. system, incidences of stone in gall-bladder, stomach pain and skin-disease have reduced. As per the observation of Community Health Care Centre, Hansot, the incidences of waterborne diseases have reduced by 30-35% (15)

Cairn India has taken an initiative to improve the quality of life of the community with various programs one of them is safe drinking water program known as “**Jeevan Amrit Project**” (4) which is providing safe drinking water to Barmer and Jalore districts of Rajasthan. Cairn India had established 34 RO plants in these districts with a filtering capacity of 1000lit/1hr to 3000lit/1hr and to reach the underserved areas. (4)

Cairn India has taken an initiative through providing Mobile Health Vans (**MHV**) for the rural population of Rajasthan. Giving Mobile Health Van administrations to the country populace in Cairn's territory of operation to give access to preventive medicinal services.

Program is actualized through NGO accomplices and nearby government under National Rural Health Mission. It is a five-year program in association with neighborhood government and NGO accomplices to enhance medicinal services administrations. This program principle objective is to decrease tyke and maternal death rates and control of pervasive sicknesses and enhance essential social insurance get to.

Mobile Health Vans (MHVs) are pointed to provide basic medical services at the door step of the community. 10 mobile health vans are used to serve the objective in districts of Rajasthan & Gujarat, including some in public private partnership mode covering 144 villages in Rajasthan and 115 in Gujarat. Over the year, the MHVs have conducted more than 3 lacs population across 9 districts of Rajasthan and Gujarat. (4)

Problem Statement; -

Though safe drinking water and mobile health van services are available for the people these resources are not been fully utilized by the people, instead they are using alternative sources of drinking water like preserved rain water, canal water, tube wells etc.

Research Question; -

- **What is the impact of safe drinking water on the health of people in Cairn India operational area?**
- **What is the impact of MHV (Mobile Health Van) on health of rural population in Cairn India operational area?**

Objectives of the study; -

- To evaluate the health outcome of “**Jeevan Amrit Project**” on safe drinking water implemented through Cairn India in its operational area.
- To understand the factors which affect the utilization of RO water and MHV provided by Cairn India.
- To provide recommendations for the improvement of the schemes.

Methodology; -

Study area – The study area is in operational area of Cairn India (Barmer & Jalore district). Cairn India had established 34 RO plants & 6 MHV in villages of Barmer & Jalore districts. Our study area will be those villages where RO plants are established for more than 2 years and MHV is also serving.

Study Respondents; - Families residing in the villages, who are consuming RO/other sources of drinking water & a single member from each household was be interviewed. Our respondents were adult Men and Women. (18 and above)

Non-User – A non-user is a person who is not consuming RO water and is not free from any diseases.

User – A user is a person who is consuming RO water and is free from diseases.

Sampling; - Stratified Random Sampling.

From all the 34 villages where RO plants are established we had selected a stratum of villages which contains RO plants which had completed at least 2 years and in the same village where MHV is serving. In the second step, we had selected randomly households from these selected villages.

Table 4: Sample

Total Sample size; - 204

Villages	Non-users	Users	Total
Adel	15	14	29
Badkha	15	15	30
Bhakar pur	15	11	26
Bhimda	15	15	30
Malvada	15	15	30
Pratappura	15	15	30
Virol chotti	15	14	29
Total HH	105	99	204

Methods of data collection; -

Primary; -

Population – All the villages of Barmer & Jalore district where RO plants are establishing.

Sampling frame – 34 RO plants in location.

Primary Sampling unit – All the villages which had completed 2 years & in the same village where MHV is also serving.

Sample size – 30 HH from each village

Secondary; -

MHV – Previous 3 (2013 – 2016) years reporting formats which contains waterborne diseases data, with age, sex & type of disease which they got treated for.

Tools of data collection – A structured schedule is made to collect the data from households of the village through qualitative and quantitative questions.

Data Collection; -

Initially a pilot will be done by us for one day in 2 villages.

Time line; -

Time line; -

Activities/Days	1	2	3	4	5	6	7	8	9	10	11	12
Sampling Listing Mapping												
Piolet study												
Primary data collection through structure schedule for RO & MHV												
Secondary data collection from Wockhardt, Helpage India, Dhara sansthan												
Preliminary data analysis and cleaning of data												
Meeting with officials of Cairn India												

Table 6: Actual time line

Activity/ Date	15/5/17	16/5/17	17/5/17	18/5/17	19/5/17	20/5/17	21/5/17	22/5/17	23/5/17	24/5/17
	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Monday	Tuesday	Wednesday
Primary data collection for RO plants & MHV	Pratap pura & Virol Chotti	Pratap pura & Malvada			Bhimda	Adel	Badkha	Pratap pura & Virol Chotti	Malvada & Bhakar pura	
Secondary data collection from NGO's			Helpage India & Dhara Sansthan (Barmer)							Dhara Sansthan & Wockhardt (Barmer)
Meeting with Cairn India officials				Barmer						Barmer

FINDINGS

Demographics; - The study includes data collected from 204 units in 7 villages of Barmer and Jalore districts in each village User & Non-user groups were selected with age ranging from 18 to 74 years old. 99 respondents in the study belong to user group (***According to our study a user is a person who is consuming RO water and is free from diseases***) were as 205 respondents belong to non-user group (***According to our study a non-user is a person who is not consuming RO water and is not free from any diseases***). A total of 204 sample units contains 89 Males & 10 Females in the RO user's group and 95 Males and 10 females in the RO-Non-users group.

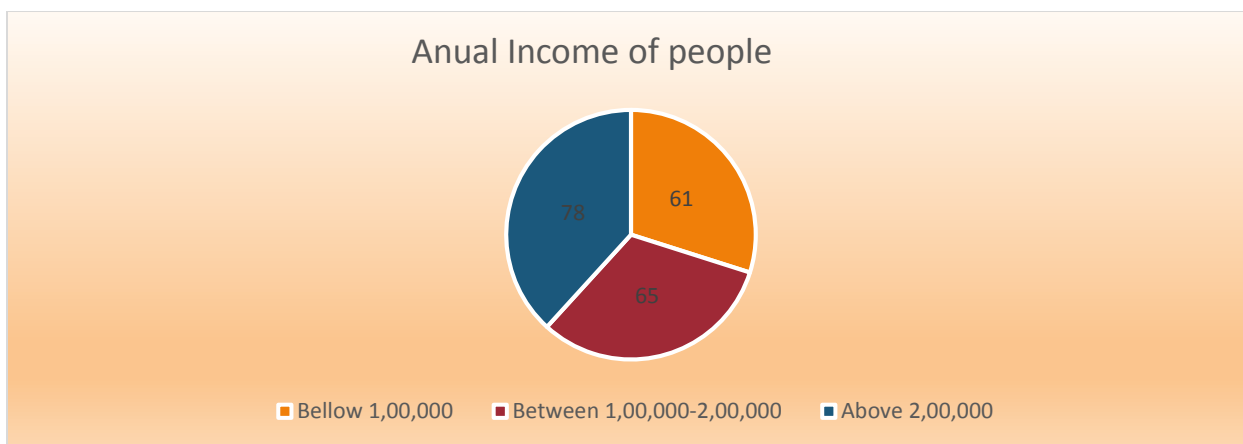


Fig3: Annual income of respondents

Drinking water sources: - Rain Water Harvesting, Tube Well's, Wells, PHED, River waters & Reverse Osmosis water are the main drinking water sources available in these villages.

Idea of safest source of drinking water; - Ranking of RO water by Users & Non-users

Table 7: Ranking of RO water by users & non-users

	Did not rank	Rank 1	Rank 2	Total
RO user	0	99	0	99
RO Non-user	20	71	14	105
				204

99 RO users considered RO water as safest source of drinking water among all the sources, were as 71 non-RO users considered RO water as safest among all the sources, 14 non-users ranked it as **second safest** source of drinking water & the remaining 20 did not rank RO water as safest source.

Ranking of RWH by Users & Non-users

Table 8: Ranking of Rain Water harvesting by RO users & non-users

	Did not rank	Rank 1	Rank 2	Total
RO user	90	0	9	99

RO Non-user	74	18	13	105
				204

Out of **99** RO users only 9 considered Rain Water Harvesting as the second safest drinking water source were as 90 did not rank it. 18 non-RO users considered RWH as safest source among all the available sources & 13 as the second safest source, were as 74 did not rank it.

Ranking of River/Stream/Tube well/Well's by Users & Non-Users

Table 9: Ranking of River/Stream/Tube well/Well's by RO Users & Non-Users

	Did not rank	Rank 1	Rank 2	Rank 3	Total
RO user	97	0	2	0	99
RO Non-user	79	8	16	2	105
					204

Only 2 respondents considered River/Stream/Tube well/Well's as the second safest source of drinking water among all were as 97 RO users did not rank it. Out of 105 Non-RO Users 8 considered River/Stream/Tube well/Well's as the safest drinking water source among all, 16 considered as the second safest drinking water source & 2 considered it as the tertiary source of drinking water.

Ranking of PHED by Users & Non-users

Table 10: Ranking of PHED by Users & Non-users

	Did not rank	Rank 1	Rank 2	Total
RO user	99	0	0	99
RO Non-user	85	8	12	105
				204

None of the RO users considered PHED as the safest source of drinking water. 8 Non-RO-Users considered PHED as the safest source among all the sources, 12 considered PHED as the second safest source & 85 did not rank it.

Water availability throughout the year among all available drinking water sources

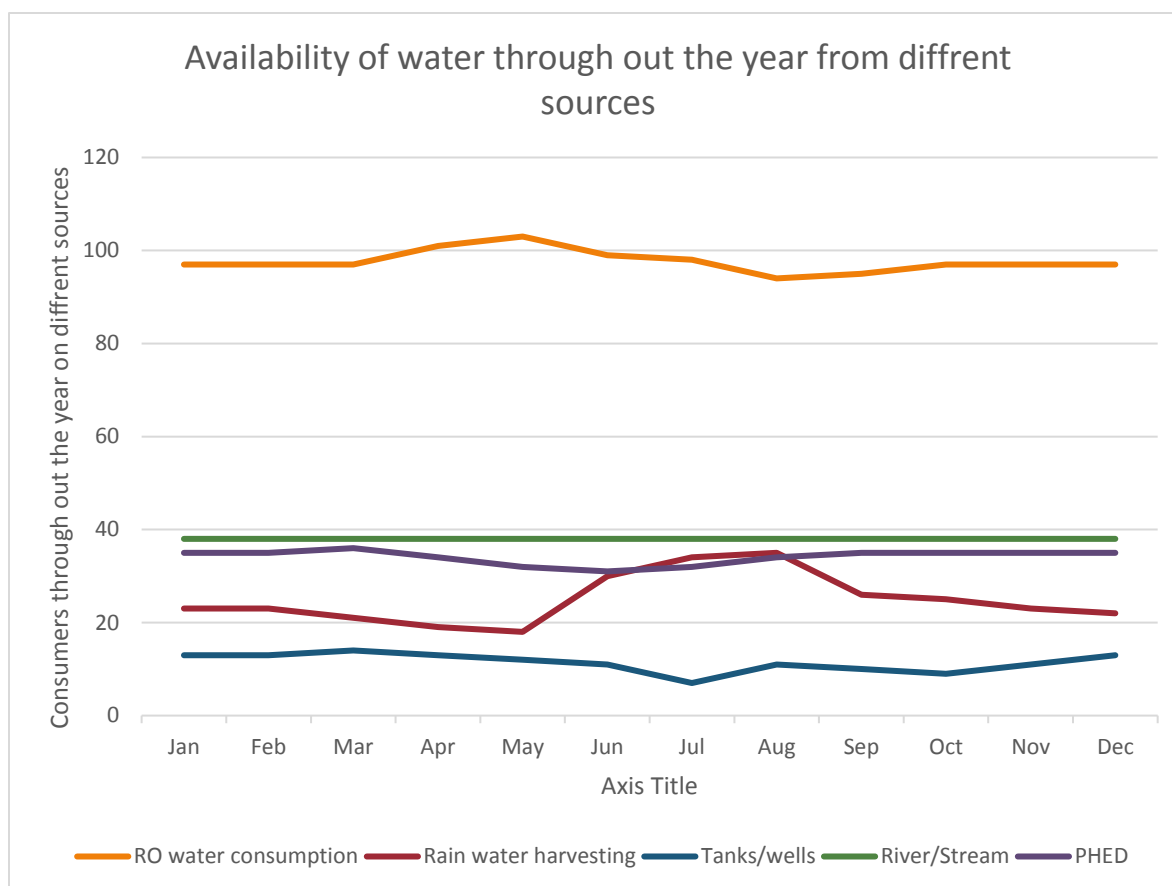


Fig 4: Water availability throughout the year

RO water consumption increases and reaches to the highest level in the months of April and May at the same time RHW consumption decreases and reaches the lowest level and it increases gradually in the month of June, July & August. Due to the depleted resources of RWH some of the consumers shift them towards RO water which ultimately increases the consumption of RO water in April & May. Tanks/Wells water consumption are highly fluctuating and do not show any pattern in the consumption & the reaming sources like River/Stream and PHED water consumption throughout the year is constant.

Distance covered to get drinking water from various sources

Table 11: Distance to get drinking water

	Within 5Kms	Between 5-10Kms	
RO user	97	2	99
RO Non-user	105	0	105
Total	202	2	204

98 % of RO users travel within 5kms and the remaining 2% travel 5-10kms to get their drinking water were as 100% of Non-RO-Users travel with in 5kms.

Expenditure on Drinking Water

Table 12: Monthly expenditure on drinking water

	Zero	Below 100	Between 100-300	Between 300-500	Above 500	
RO user	0	1	55	14	29	99
RO Non-user	102	2	0	0	1	105
Total	102	3	55	14	30	204

55.5% of RO users spend between 100-300/- per month, 14.14% of RO users spend between 300-500/- per month & 29.29% of RO user spend above 500/- on drinking water per month. Were as 97.14% of non-RO-users spend NIL on drinking water.

Expenditure vs Annual income

Table 13: comparison between Monthly expenditure, Annual income & RO-user and non-user

Annual income/Monthly expenditure		Zero	Below 100	Between 100-300	Between 300-500	Above 500	
Below 1,00,000	RO user	0		9	3	1	13
	RO Non-user	48		0	0	0	48
	Total	48		9	3	1	61
Between 1,00,000-2,00,000	RO user	0	0	19	2	12	33
	RO Non-user	30	1	0	0	1	32
	Total	30	1	19	2	13	65

Above 2,00,000	RO user	0	1	27	9	16	53
	RO Non- user	24	1	0	0	0	25
	Total	24	2	27	9	16	78
Total	RO user	0	1	55	14	29	99
	RO Non- user	102	2	0	0	1	105
	Total	102	3	55	14	30	204

There are 61 respondents in below 1,00,000 annual income group in which 48 respondents are non-RO users and there spending on drinking water is zero & out of the remaining 13 respondents 9 are spending between 100-300 rupees, 3 are spending between 300-500 rupees, only one is spending above 500 rupees.

65 respondents fall in income group between 1,00,000-2,00,000 rupees out of which 33 RO users and 32 are non-RO users. Out of the 33 respondents 19 spend in between 100-300 rupees, 2 of them spend between 300-500 rupees, 12 of them spend above 500 rupees on drinking water. Out of 32 non-RO users 30 spend zero, 1 spend below 100 rupees & 1 spend above 500 rupees on drinking water.

78 respondents fall in income above 2,00,000 rupees out of which 53 are RO user and 25 are non-RO users. Out of 53 RO users 1 respondent spends below 100 rupees, 27 respondents spend between 100-300 rupees, 9 spend between 300-500 rupees, and remaining 16 are spending above 500 rupees on drinking water. Out of 25 non-RO users 24 spend zero, 1 spend below 100 rupees on drinking water.

Health problems in last 3 months in RO-users & Non-RO-users

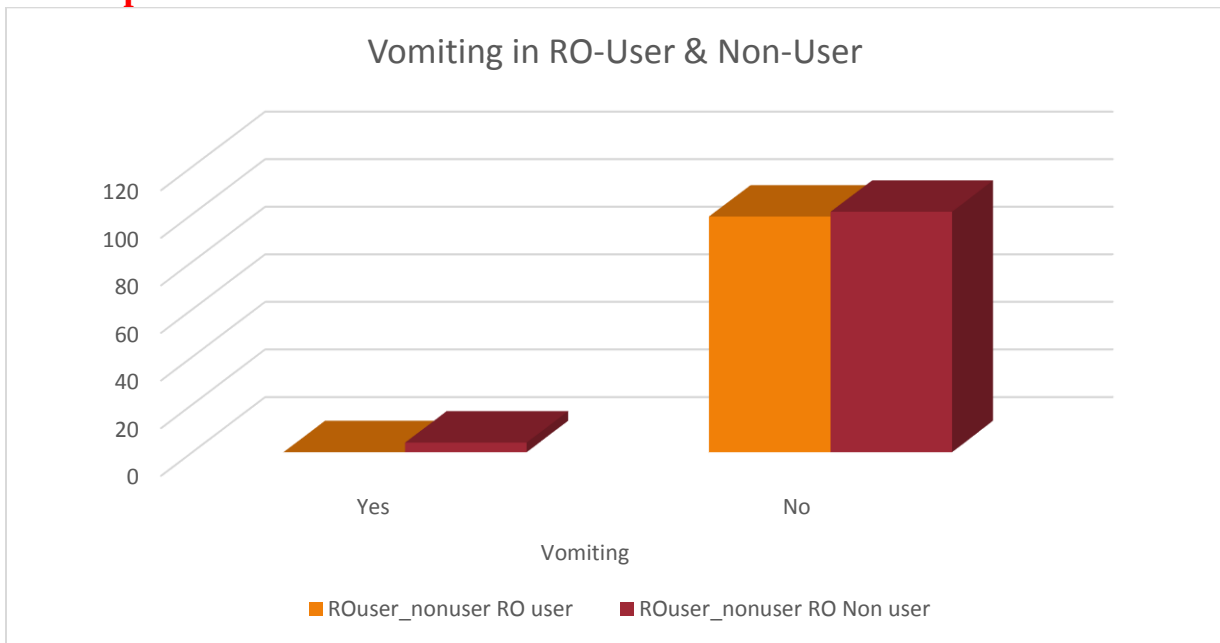


Fig 5: Vomiting's in RO-user & non-users

In last 3 months, no RO users suffered from vomiting were as 4 Non-RO users reported vomiting.

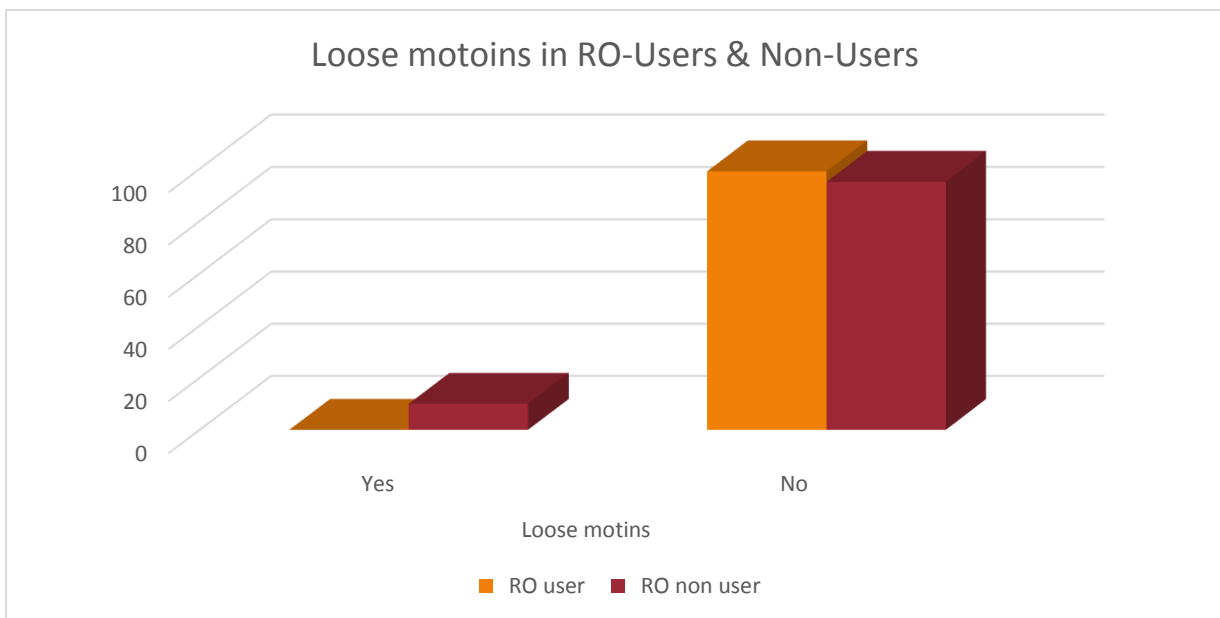


Fig 6: Loose motions in user and non-users

In last 3 months, no RO users suffered from loose motions were as 10 Non-RO users reported loose motions.

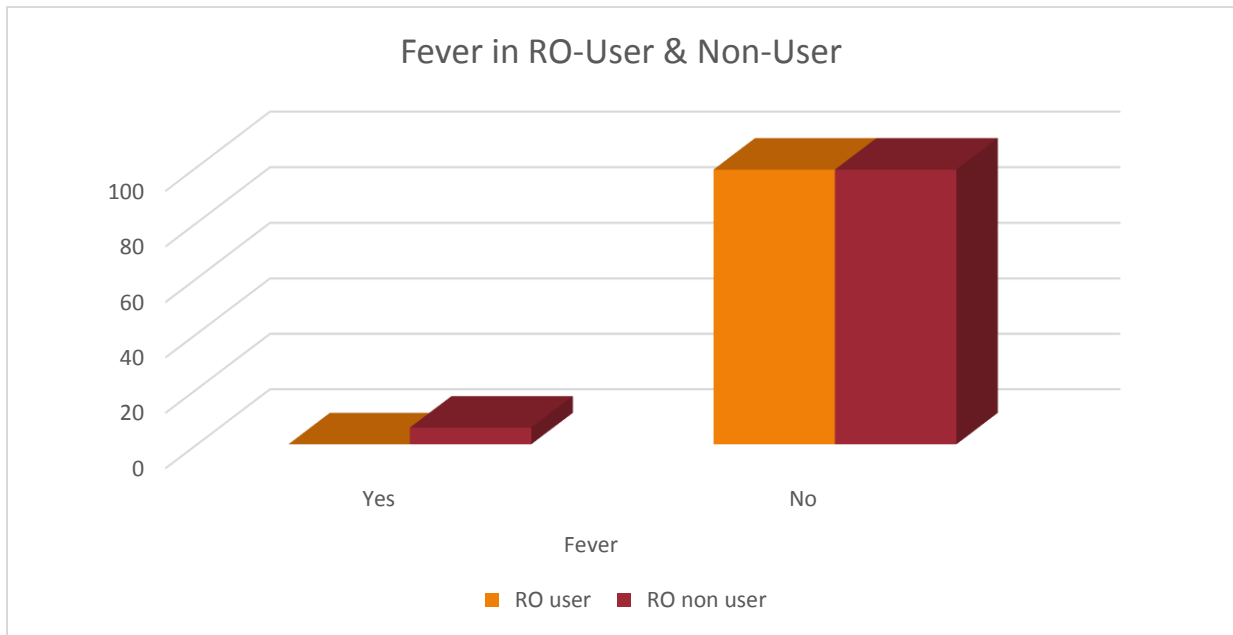


Fig 7: Fever in users and non-users

In last 3 months, no RO users suffered from fever were as 6 non-RO-users reported fever.

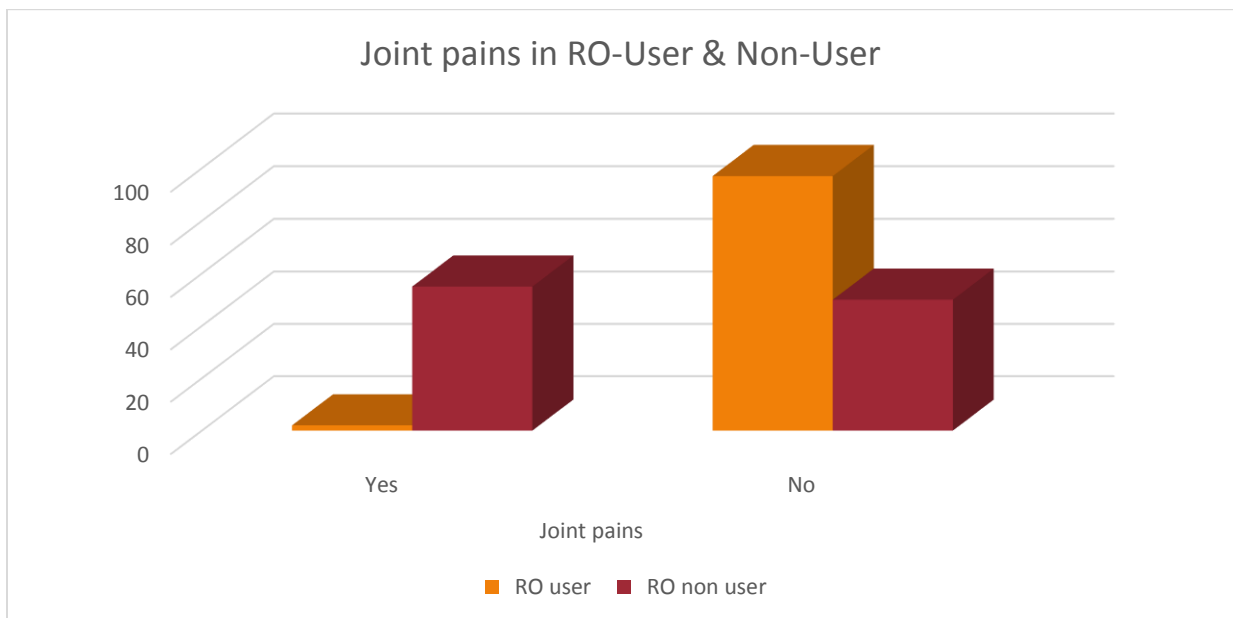


Fig 8: Joint pains in users and non-users

In last 3 months 2 RO users suffered from joint pains were as 55 non-RO-users reported joint pains.

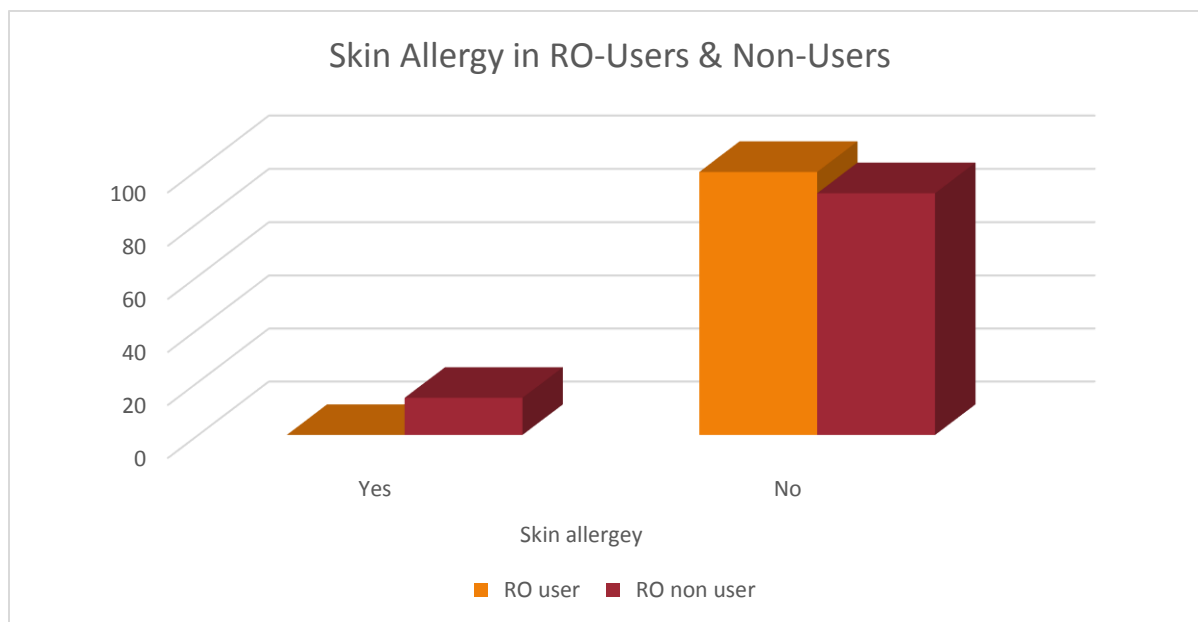


Fig 9: Skin allergy in users & non-users

In last 3 months 0 RO users suffered from skin allergy were as 14 non-RO users reported skin allergy.

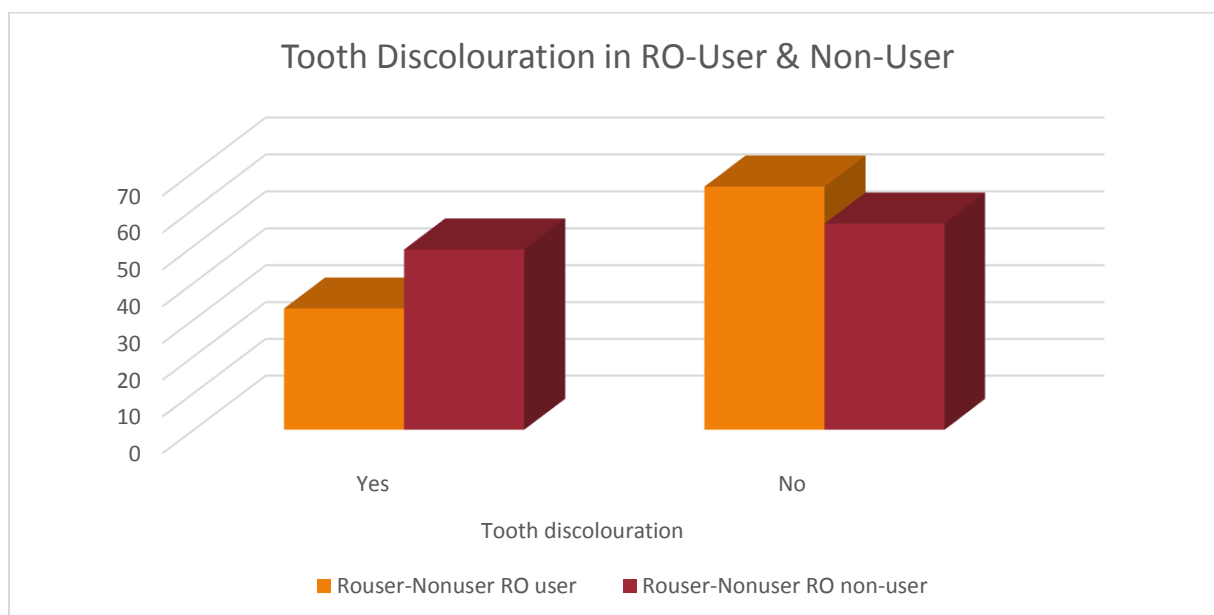


Fig 10: Tooth discoloration in users & non-users

In last 3 months 33 RO users suffered from tooth discoloration were as 49 non-RO users reported tooth discoloration.

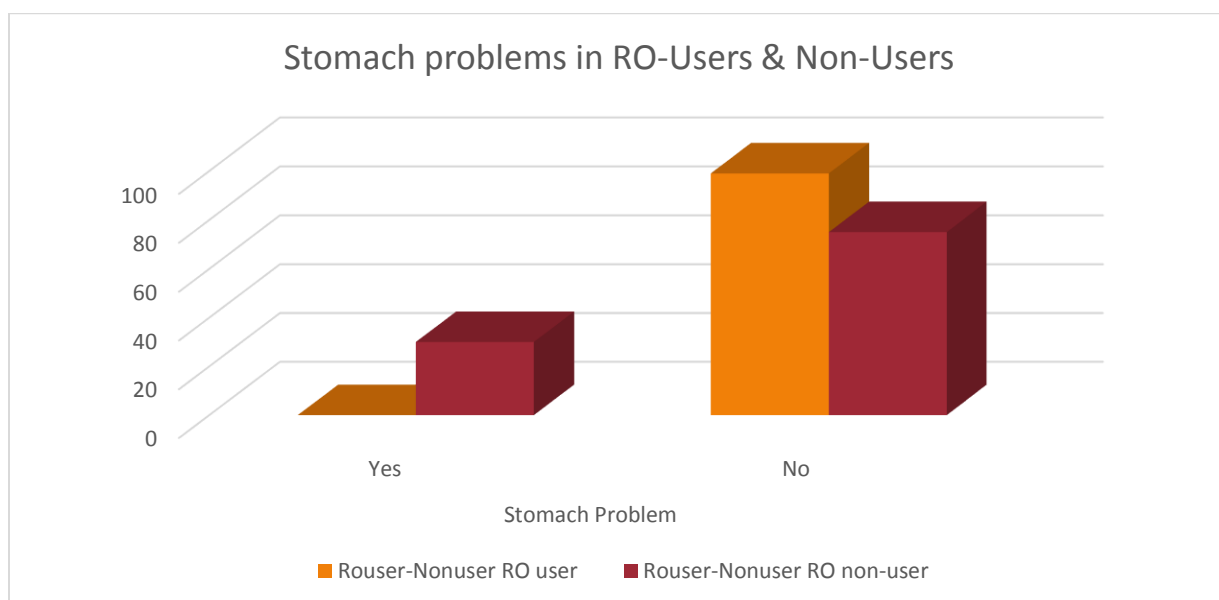


Fig 11: Stomach problems in users & non-users

In last 3 months 0 RO users suffered from stomach related problems were as 30 non-RO users reported stomach related problems.

Mobile Health Van

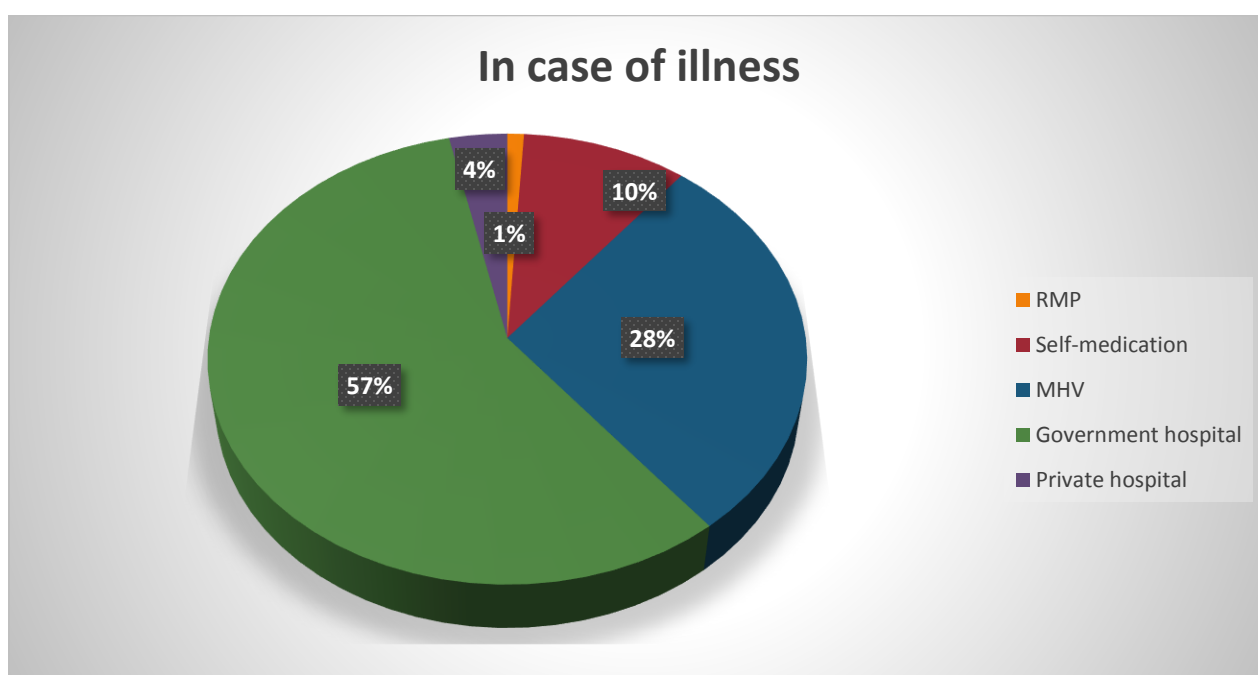
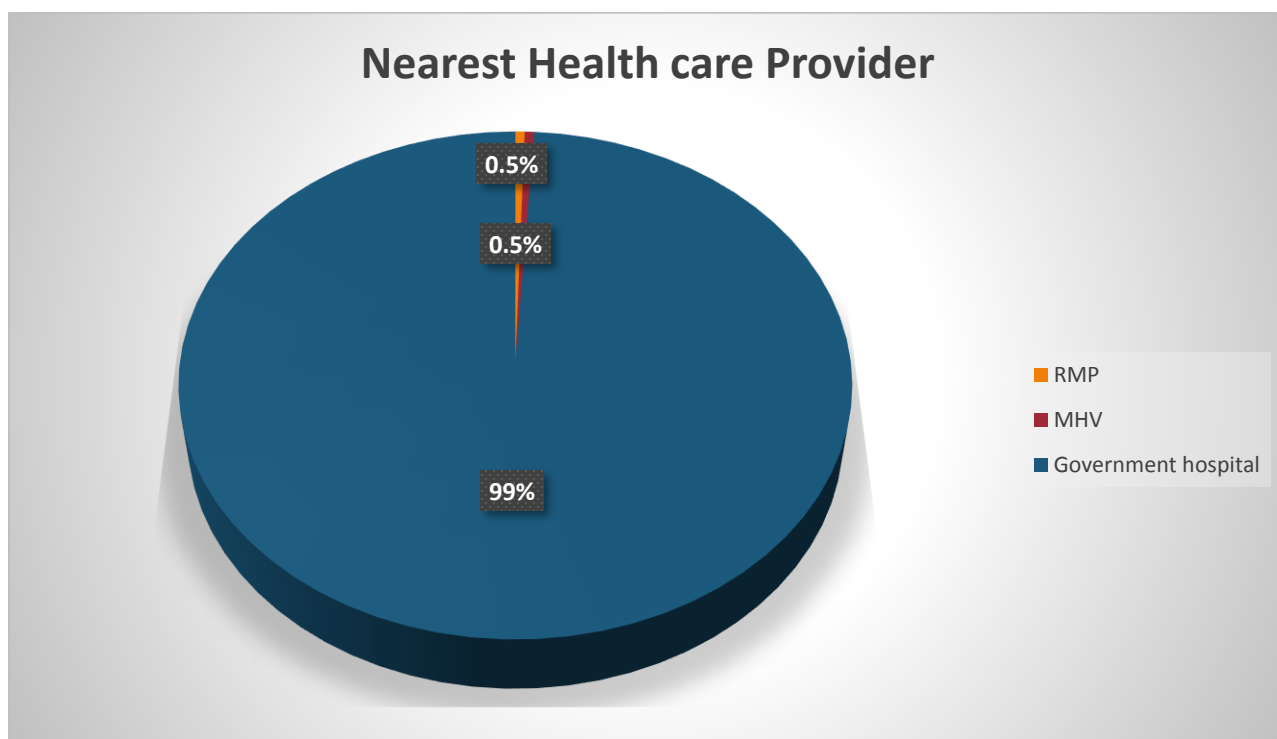


Fig 12: People visit in case of illness

Out of 204, 1% Visit RMP, 10% Self-medicate themselves, 28% visit MHV, 57% visit Government hospitals, 28% visit Private hospital in case of illness.

**Fig 13: Nearest hospital**

Out of 204, 1 said RMP is the nearest health care provider, 1 said MHV is the nearest health care provider, 202 said Government hospital is the nearest health care provider.

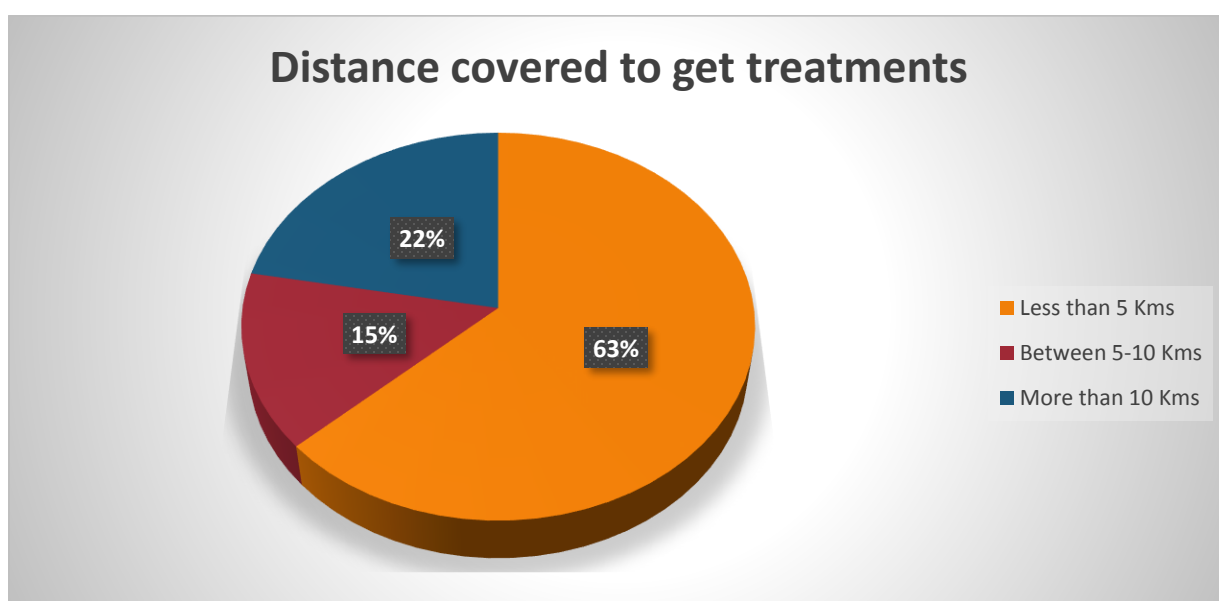
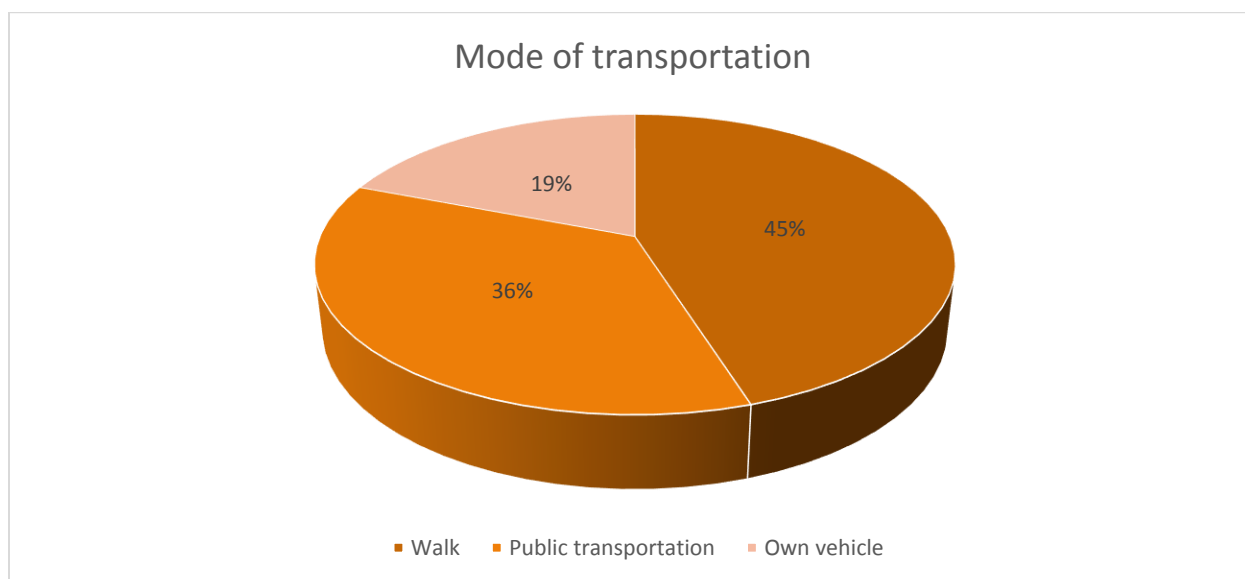


Fig 14: Distance covered to get treated

Out of 204, for 63% of people the nearest health care provider is less than 5 Kms far, 15% said its between 5-10 kms & 22% said it is more than 10 kms.

**Fig 15: Mode of transportation**

45% people visit the nearest health care provider by walking, 36% by public transportation & 18% by own vehicle.

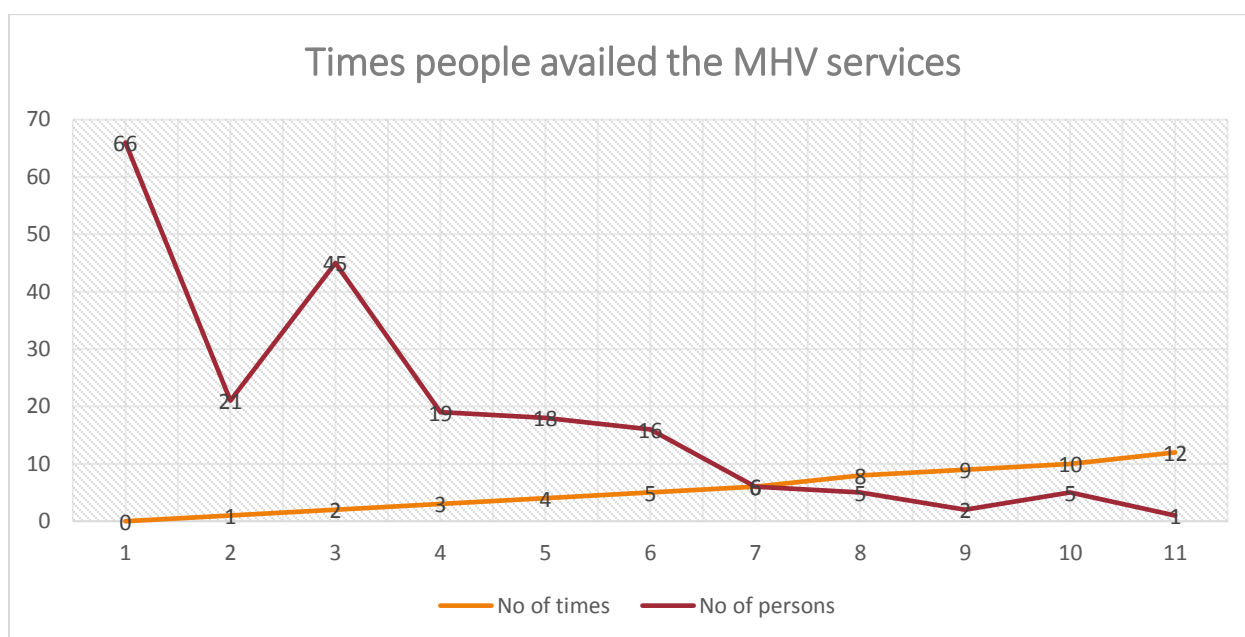
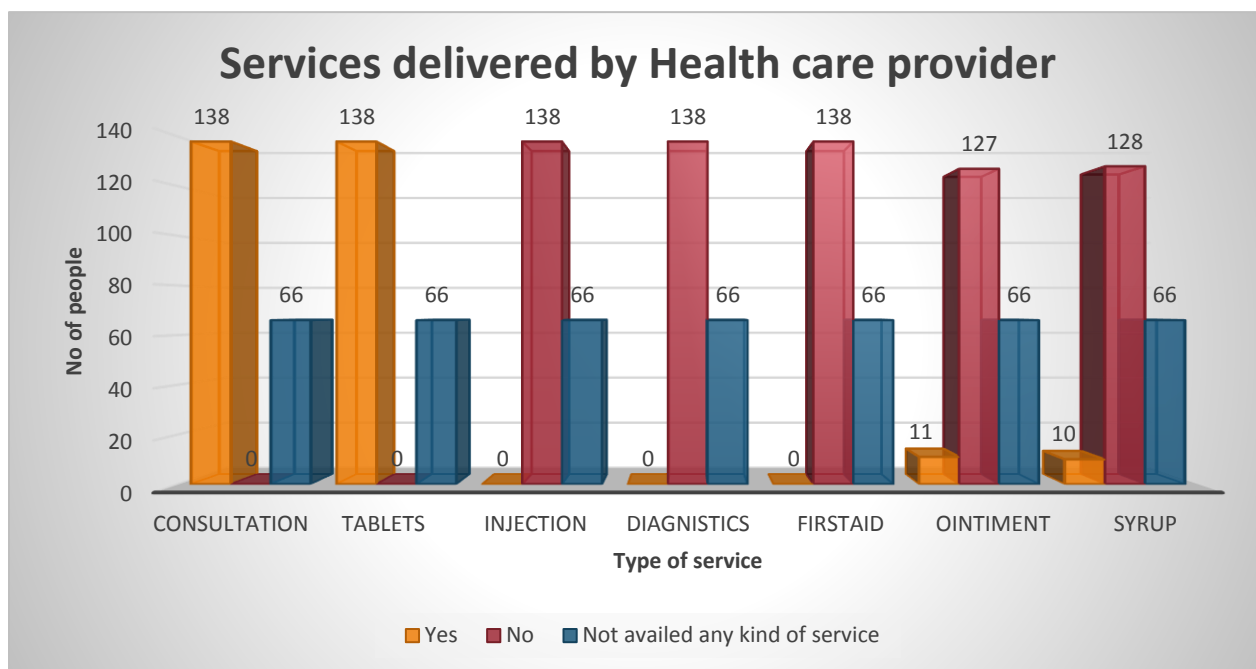


Fig 16: No of times visited MHV

Out of 204 66 people did not avail MHV services.

**Fig 17: Services offered by MHV**

The care provider is not providing the basic health services like injections, diagnostics & first aid.

People's note; -

The ground water in these districts are very hard (Khara Pani) to drink with Total Dissolved Salts (TDS) ranging from 2000-3000 ppm forcing all the villagers to drink this water, which is forcing them in to deadly diseases like fluorosis which makes them to be on bed in later stages of life. Most of the people who were drinking hard water were usually suffering from disease like Joint pain in different part of body usually called as Osteoarthritis, Discoloration of permanent tooth known as Dental fluorosis, bending in the long bones resulting in temporary to permanent deformity in their body termed as Skeletal fluorosis, often people felt difficulty in urination showing urolithiasis. Increased TDS also increases stomach related problems like Gastritis, Indigestion & heaviness of stomach and diarrhea in some cases.

In our study 99 respondents who were consuming RO water on regular basis felt themselves the improvement in health conditions. Almost all the people who were consuming RO water told us that they got relief in joint pains specially on knee and cervical joint's. People also felt that RO water increased digestion of food there by decreasing heaviness in stomach and increasing appetite. Some people also confessed that the difficulty during micturition also

decreased & RO water is also decreasing thirst and helping people to in take more drinking water ultimately helping them to fight against deadly diseases causing from unsafe water and improving the quality of life.

Conversation with some RO users; -



Fig 18: RO user Jabbar Giri

Jabbar Giri is a resident of Virol Chotti village in Jalore. He is a dairy operator and a famer with a large family of 30 member and all are consuming RO water for more than 2 years. Before consuming RO water, they used to drink water from well in his home which resulted in different diseases in family like joint pains, gastric problem in adults and diarrhea in children which made him and his family to visit a hospital very frequently. Later he started using RO water and the scenario is change now, all member of family is free from diseases mainly Joint pains and stomach relate problems ultimately, he is now not spending much money on hospitals due to improvement in health conditions.



Fig 19: RO user Rama Ram

Rama ram is a PHED operator in Badkha village in Barmer district. He used to drink PHED water from long time which resulted in Knee Joint pain for which he had visited many hospitals for the treatment. On the advice of his relative he started drinking RO water which is located near to his home from past 2 years and now he told that he got relief in the joint pains and he don't feel any more to visit a hospital for his joint pain. He also says the water is free from fluoride, good to taste, cold which ultimately saves your money. He also advises people of that village to drink RO water.

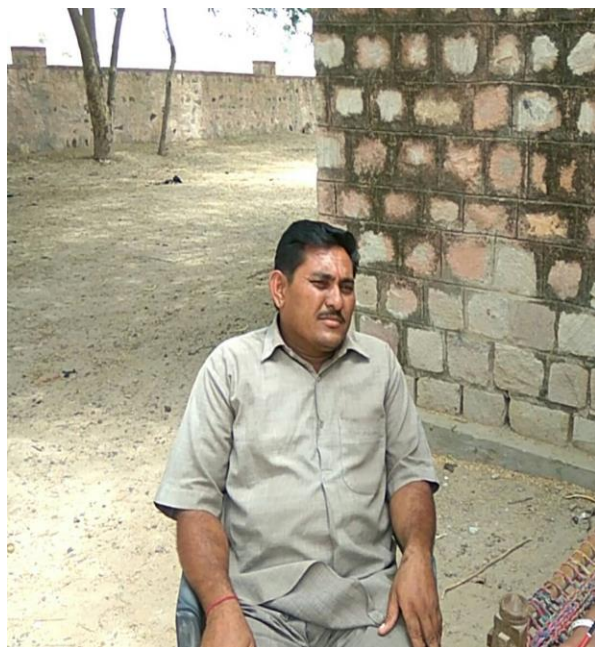


Fig 20: RO user Bura Ram

Bura ram is a resident of Adel village in Barmer district, is working as a RO operator in the plant established by Cairn India. Before started drinking RO water his family members fall ill very frequently with some minor illness like cold, fever, cough etc, which is not the scenario now. After drinking RO water, he and his family members are free from all the minor health problems and he stopped spending money on hospitals and medication. He is very positive that people will know the importance of RO water and start drinking.

There are two other segments of respondents which we have found in our study

1) People who are aware of safe drinking water and who are willing to drink RO water. This segment is aware that they are consuming unsafe water which is developing health problems in their families. The respondents were residing far from the main village in the farming field (Dhani's) which makes them impossible to get RO water from such a long distance every day. The people in this segment are mostly in lower income group which makes them difficult to spend ample amount of money on RO water. Tough there are RO plants with proper distribution mechanism in the villages there still some RO plants with no proper distribution mechanism, when they try distributing RO water into core of the village they charge 20 rupees instead of 5 rupees which is also an important hurdle in the penetration of RO water into the community. Most of the RO plants are having operational issues like they were not working properly, regularly & not round the clock, this operational issue raised a question in consumers mind that *what if you stop providing us RO water when we get used to it*. These operational issues are another hurdle which stops community from using RO water.

2) People who are not aware of safe drinking water and not willing to drink RO water. This segment says all drinking water are same moreover RO water is artificial which came out from a machine with full of chemicals in it which makes the water sweet. Why should I spend money on RO water/Artificial water instead I would drink water which we are drinking from decades and our family member are safe with no major illness. The drinking water which we depend are safe to drink, available within our premises & it's free of cost.

Hurdles affecting the utilization of RO water and MHV services provided by Cairn India; -

Economic status of people – Most of the people in the village fall under low income group, spending ample amount of money on drinking water is a main difficulty for the people. This condition is forcing them to consume unsafe water which is bringing them no life.

Operational issues of RO plants – RO plants are working in a community based model where the community need to take care of the maintenance of the plant, unfortunately people of the community are failing to manage RO plants. Some of the RO plants are not working properly and some are not working regularly ultimately making the community to suffer. This behavior raised a question in the people of the village ***what if you stop providing us RO water when we get used to it.***

Distribution mechanism of RO water – Ideally distribution of RO water should be done through “JAL RATH’S”. i.e.- RO water from the RO plant should be transported through a vehicle in to the village, but there are still some RO plants which do not have vehicles to distribute water, when we asked RO operators regarding this issue they said “the consumption of RO water in this plant is very less and it is very hard to maintain a vehicle and pay salaries to the staff in such a limited resource. RO water costs 5/- per every 20 liters in these plants, when they distribute the same water in to the home the cost of the same water varies from 10/- to 20/- depending on various factors like cold water, distance covered to distribute the water, operational cost of the RO plant and operational cost of vehicle used in the distribution and the staff of the staff working the vehicle. These issues again raise a question the mind of people saying, ***“Today you are providing water for 5/- on later stages what if you charge more for the same 20 lit of water?”*** Because of these issues ultimately people are forced to drink the same unsafe water.

Type of the services provided in MHV; - Mobile Health Van can be compare with a PHC (Primary Health Center) and ideally it should all the Curative, Reproductive & Child and Family planning services which is provided by a PHC. Unfortunately, the Mobile Health Vans are not providing all these services. Not only these services basic services like parenteral administration of drugs, first aid and diagnostic test (except rapid diagnostics) are also not provided by these MHV’s.

Availability of Government Hospitals - A Mobile Health Van should serve in an underserved or unreachable area, but out of 7 villages only 3 villages were found where a government or private health provider is not present and far from the village.

Recommendations; -

- Organization should uphold the responsibility of maintenance and monitoring instead of providing full control to community, it should ensure to hire some people from the community to monitor the plants and by this they can empower the lower income group and reduce the operational issues.
- Proper monitoring of RO plants should be done in regular basis to ensure that RO water produced from the plants is not being commercially utilized.
- Proper distribution mechanism should be maintained through Jal Raths.
- Mobile Health van services should be stopped in areas where hospitals are present & Curative, Reproductive & Child services should be provided in underserved areas.

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