Remittances Review
June, 2023
Volume: 8, No: 4, pp. 2286-2299
ISSN: 2059-6588 (Print) | ISSN 2059-6596 (Online)
remittancesreview.com

Received: 11 November 2022 Accepted: 15 March, 2023
DOI: https://doi.org/10.33182/rr.v8i4.158

Application of Association Rule Mining in Biomedical Waste Management -A case study of Ayushman Bharat-Health Welfare Centres (AB-HWC)

P.Sunil Kumar [1]* R.Raghunatha Sarma[2] and Subhendu Kumar Pani[3]

Abstract

Achieving sustainable development goals and more specifically universal health coverage had been one of the areas of concern for the Government bodies in the recent past. Health waste management is a part of preventive healthcare service envisioned by the stakeholders of the Government to keep health workers, patients, and their attendants away from health hazards. The effect of improper practice of health waste management guidelines as laid down by the stakeholders had been one of the major causes of such hazards. In this paper, we have used the association rule mining technique to provide a prior insight for the stakeholders about the most prominent cause for such hazards, among the three most common causes namely health-care staff strength and motivation, awareness and training on Bio-Medical Waste Management and availability of infrastructural and transportation facilities at a PHC which has been renamed as Ayushman Bharat-health welfare centre (AB-HWC) from 2018.

Keywords: *Association Rule mining, Bio-Medical Waste Management, Ayushman Bharat-health welfare centre (AB-HWC).*

Introduction

Sustainable Development Goals-12(SDG-12), on "Ensure sustainable consumption and production" focuses on "Environmentally Sound Management of Hazardous Wastes." Agenda 21 which is an action plan made in 1992 by the organizations of the United Nations System, Governments, and Major Groups, underscores the vital role of controlling hazardous waste processes to safeguard health, environment, and sustainable development. It emphasizes waste prevention, contaminated site restoration, necessitating expertise, facilities, funding, and technical capabilities. The World Health Organization defines healthcare waste as materials ranging from used needles to pharmaceuticals and radioactive substances. Biomedical waste (BMW) is produced by various establishments such as hospitals, clinics, veterinary institutions, and research laboratories, among others. While the majority of healthcare waste (about 85%) is non-hazardous, the remaining 15% is considered hazardous due to its potential infectious, toxic, or radioactive

[1] iSri Sathya Sai Institute of Higher Learning,Puttaparthi,psunilkumar@sssihl.edu.in,P.Sunil Kumar
[2] Sri Sathya Sai Institute of Higher Learning,Puttaparthi,rraghunathasarma@sssihl.edu.in,R.Raghunatha Sarma
[3]KEC,BPUT,Odisha, skpani.utkal@gmail.com,Subhendu Pani
[3] Sri Sathya Sai Institute of Higher Learning,Puttaparthi,rraghunathasarma@sssihl.edu.in,R.Raghunatha Sarma
[3]KEC,BPUT,Odisha, skpani.utkal@gmail.com,Subhendu Pani

nature. Proper management and disposal of BMW are crucial to safeguard public health and the environment (Kumar SR et al., 2019). Ensuring the safe handling and disposal of BMW protects healthcare workers, patients, and the community from potential risks associated with hazardous waste. Adequate measures must be implemented to handle both hazardous and non-hazardous biomedical waste responsibly and efficiently. Proper biomedical waste disposal is vital for public health, though challenging.

In India, "biomedical waste" encompasses waste from human/animal diagnosis, treatment, immunization, research, and health camps. Neglecting appropriate disposal can lead to infections spreading among healthcare workers and the public. Each year, approximately 16 billion injections are given worldwide. Unfortunately, not all needles and syringes are properly disposed of, posing risks of injury, infection, and potential reuse. Needlestick injuries carry risks of hepatitis B, hepatitis C, and HIV transmission, highlighting the importance of safe needle disposal and adherence to biomedical waste management protocols as advised by World Health Organization (2018). Hence it is crucial to prioritize safe handling, collection, transportation, and treatment of biomedical waste to safeguard public health.

WHO recommends adopting a primary health care (PHC) approach as a foundation for Universal Health Coverage (UHC). PHC offers inclusivity, cost-effectiveness, and efficiency, providing access to integrated health services close to people's everyday environments. It can deliver 90% of essential UHC interventions and contribute to about 75% of the health gains projected by the SDGs, saving millions of lives and increasing global life expectancy by 3.7 years by 2030 (WHO.,2023). Limited research is conducted on Primary Health Centers (PHCs), despite serving a substantial rural and urban slum population. In Karnataka, the annual patient load in 2018-19 was 1.67 crore for District Hospitals, 2.43 crore for Subdivisional Hospitals, 1.19 crore for Community Health Centers, and a significant 4.14 crore for PHCs (NHSRC, National Health Mission HMIS., 2019).

In this paper association rule mining techniques are used to analyze biomedical waste management (BMWM) for 9 AB-HWC's in Chikballapur District, Karnataka. The analysis has been carried out through a survey done on 80 beneficiaries who visited the centers and are registered under Arogya Karnataka Yojana, merged with AB-PMJAY scheme in 2018

BMWM- Global scenario and conventions

During a significant World Health Organization (WHO) assembly held in Geneva in June 2007, a set of fundamental principles were formulated to establish a secure and sustainable framework for the management of healthcare waste. All stakeholders engaged in the financing and support of healthcare endeavors were recognized as morally and legally responsible for ensuring the well-being of others. Consequently, a shared financial commitment towards the effective management of Bio-Medical Waste (BMWM) was deemed essential.

In the realm of crafting waste management policies, it was advised to consider three paramount international agreements and conventions. These agreements have direct relevance to Bio-Medical Waste Management (BMWM), environmental safeguarding, and the imperative of sustainable development. The identified conventions include the Basel Convention on Hazardous Waste, the Stockholm Convention on Persistent Organic Pollutants (POPs), and the Minamata Convention on Mercury.

Remarkably, this initiative boasts an extensive membership of 170 countries. An instrumental milestone occurred on October 10, 2014, in Japan, when over 90 nations formally endorsed an innovative global convention intertwining environmental preservation and public health. This historic treaty encompasses a phased reduction of particular medical equipment employed in healthcare services. Among the targeted items are medical implements containing mercury, such as thermometers and blood pressure devices (Datta P et al.,2018).

BMWM- Indian Scenario and data analytics

The Biomedical Waste Management Rules of 2016 delineated explicit guidelines for both Health Care Facility (HCF) operators and Common Biomedical Waste Treatment and Disposal Facility (CBMWTF) operators, encompassing various aspects such as waste segregation, packaging, transportation, and storage. However, the emergence of the COVID-19 pandemic brought to light a significant challenge in the realm of waste management. (Khosla Ritu et.al.,2022).

The Central Pollution Control Board (CPCB), India's regulatory authority, conducted a comprehensive assessment that revealed a concerning trajectory of biomedical waste generation. The data indicated a surge from 517 tons per day (TPD) in 2015–2016 to approximately 619 TPD in 2018–2019. Projections pointed towards an even more staggering figure of 775.5 TPD by 2022. In response to this impending waste crisis, efforts were undertaken, resulting in the establishment of 199 common bio-medical waste treatment facilities (CBWTFs) in 2016 and an additional 202 facilities in 2019. Furthermore, 35 CBWTFs were in the process of construction. Despite these initiatives, the efficacy of biomedical waste (BMW) management had not reached optimal levels. [DHR, BMWM Rules,2016].

The unforeseen eruption of the COVID-19 pandemic further exacerbated the existing challenges. Contrary to anticipated projections for 2020 and 2021, the pandemic led to an unprecedented surge in the BMW generation. By May 2021, a peak period marked by a surge in COVID-19 cases, the daily production of BMW escalated to a staggering 800 tons, surpassing even the projected figures for 2022. Notably, the influx of COVID-19-related waste added an extra burden of 15%–20% on top of the already substantial waste load during the period spanning from June 2020 to May 2021. (Datta P et al.,2018, DHR, BMWM Rules,2016).

It is noteworthy that despite the escalating demands placed upon waste management systems during the pandemic, the number of operational Common Biomedical Waste Treatment Facilities

(CBWTFs) remained constant. This indicated a potential gap in addressing the surge in waste generation effectively, underscoring the need for strategic augmentation of waste management infrastructure.

The confluence of factors, including the pre-existing trajectory of waste generation, the establishment of treatment facilities, and the sudden influx of COVID-19 waste, underscores the complexity of biomedical waste management. The situation calls for a comprehensive and adaptable approach to ensure the sustainable and effective handling of biomedical waste, safeguarding both public health and environmental well-being.

The Swachh Bharat Abhiyan, initiated by the Prime Minister on October 2, 2014, prioritizes cleanliness in public spaces. This is particularly important in healthcare facilities to prevent infections, enhance patient experiences, and encourage hygiene. To align with this, the Ministry of Health & Family Welfare, India, is introducing the KAYAKALP awards based on 6 criteria viz. Hospital Upkeep, Sanitation and Hygiene, Waste Management, Infection Control, Hospital Support Services, and Hygiene Promotion, recognizing public health facilities, which is now expanded to urban and Sub Centre health centers. (NHSRC.,2022).

Even though data mining techniques in the biomedical domain are used efficiently for critical diagnosis, seldom research work is carried out in the field of waste management. To specify a few, A study was made by Kashyap (2023) to analyze the implementation of BMWM in India during the period 2008-2017 across the states by collecting the inventory. A systematic study was made to analyze the geographical and temporal variations in bio-medical waste management (BMWM). The study revealed that the quantity of bio-medical waste treatment is highest in Karnataka and Maharashtra. Work was carried out by Harri Niska (2018) using a Self-Organizing Map (SOM) and K-Mean Algorithm to generate a waste generation profile for the metropolitan area of Helsinki, Finland. The spatial as well as temporal data were scaled to generate policies and operations which are feasible to be used by individuals at different levels.

The current study is based on the 10 criteria set for the Health Welfare Centers (AB_HWC) under the waste management head of KAYALAKP. Award.

About -Ayushman Bharat-Health Welfare Centers (AB-HWC)

Ayushman Bharat (AB) marks a transformative shift from a targeted healthcare approach to a comprehensive spectrum of services encompassing preventive, promotive, curative, rehabilitative, and palliative care. Comprising two complementary components, the initiative is designed to elevate healthcare accessibility and quality. In 2017, the National Health Policy was launched, based on the recommendations of the Task Force for Comprehensive Primary Health Care (CPHC). It endorsed the establishment of Ayushman Bharat - Health & Wellness Centers (AB-HWCs) and committed that two-thirds of the budget be allocated towards primary health care. The initial facet entails the establishment of 1,50,000 Health & Wellness Centers (HWCs),

Remittances Review
June, 2023
Volume: 8, No: 4, pp. 2286-2299
ISSN: 2059-6588 (Print) | ISSN 2059-6596 (Online)
remittancesreview.com

serving as the cornerstone for Comprehensive Primary Health Care. This universal and cost-free provision prioritizes wellness and extends an enriched array of services in proximity to communities. Beyond maternal and child health, the envisioned services encompass non-communicable disease management, palliative and rehabilitative care, oral, eye, and ear care, mental health support, and initial care for emergencies and trauma. This holistic approach includes the dispensation of essential drugs and diagnostic services (NHP.,2022).

To ensure the delivery of Comprehensive Primary Health Care (CPHC), existing Sub Health Centers (SHCs) covering a population of 3,000 - 5,000 are being transformed into Health and Wellness Centers (AB-HWCs). Primary Health Centers (PHCs) in rural and urban areas are also being converted into AB-HWCs (NHM.,2018).

Criteria for Biomedical Waste Management at AB-HWC

The 10 criteria under waste management prescribed by IPHS (2022) are as follows:

Criteria-1: Implementation of Biomedical Waste Rules:

- Ensure proper waste segregation: Soiled Waste in yellow bin & bag, keep General & Biomedical Waste separate. Display work instructions for Biomedical waste handling. Ask staff about segregation protocol (Red bag for recyclable, Glassware into puncture-proof and leak-proof containers with blue marking, etc.).

Criteria 2: Segregation, Collection, and Transportation of Biomedical Waste:

- The CBWTF operator collects and transports the PHC's waste in closed bags and trolley. Check for linkage records or functional deep burial pits within the facility and trolley availability.

Criteria 3: Sharp Management:

- Follow the proper procedure to disinfect broken or discarded glassware. Pre-treat waste with 1-2% Sodium Hypochlorite for 20 minutes. Alternatively, use autoclaving, microwave or hydroclave. Store waste in puncture-proof and leak-proof containers for recycling. Sharp waste should be stored in puncture-proof containers. Use white translucent containers for needles, syringes with fixed needles, needles from cutter/burner, scalpel blades, and other objects. Follow the proper procedure to disinfect broken or discarded glassware. Pre-treat waste with 1-2% Sodium Hypochlorite for 20 minutes. Alternatively, use autoclaving, microwave or hydroclave. Store waste in puncture-proof and leak-proof containers for recycling. Sharp waste should be stored in puncture-proof containers. Use white translucent containers for needles, syringes with fixed needles, needles from cutter/burner, scalpel blades, and other objects.

Criteria 4: Storage of Biomedical Waste:

- A dedicated storage facility is available for biomedical waste. Ensure waste is disposed of within 48 hours of generation, including holidays. Check disposal records.

Criteria 5: Disposal of Biomedical waste

- PHC must dispose of Biomedical waste properly. Health facilities within 75 KM of CTF should have a valid contract with a Common Treatment facility for disposal. Otherwise, they must have deep burial pits approved by the Prescribed Authority. Recyclable waste should be managed according to approved procedures. IV bottles (plastic), IV tubes, urine bags, syringes, catheters, etc. should be treated with autoclaving, microwaving, hydroclaving, or a combination of sterilization and shredding. Later, treated waste should be handed over to registered vendors. Follow the proper procedure to disinfect broken or discarded glassware. Pre-treat waste with 1-2% Sodium Hypochlorite for 20 minutes. Alternatively, use autoclaving, microwave or hydroclave. Store waste in puncture-proof and leak-proof containers for recycling. Sharp waste should be stored in puncture-proof containers. Use white translucent containers for needles, syringes with fixed needles, needles from cutter/burner, scalpel blades, and other objects.

Criteria 6: Management Hazardous Waste:

- Staff should be aware of Mercury Spill Management and the availability of a spill kit. Hazardous chemicals such as Glutaraldehyde and Lab Reagents should not be drained untreated into the sewage system.

Criteria 7: Solid General Waste Management:

- Managing General Waste in Health Facilities

Criteria 8: Liquid Waste Management:

- The laboratory should have a protocol for managing discarded samples. Staff should be aware of the protocol. Additionally, the facility should have a treatment system for managing infectious liquid waste. It is important to check for the availability of an effluent treatment system.

Criteria 9: Equipment and Supplies for Bio Medical Waste Management:

- Ensure appropriate bins and plastic bags are available for waste segregation. Provide needle/hub cutters and puncture-proof boxes at each point of generation for sharp waste.

Criteria 10: Statuary Compliances:

- PHC has valid authorization for Biomedical waste management from the prescribed authority. PHC maintains records as required under the BMW Management Rule 2016 and subsequent amendments. Check the following records: annual report submission

Volume: 8, No: 4, pp. 2286-2299
ISSN: 2059-6588 (Print) | ISSN 2059-6596 (Online)
remittancesreview.com

(before 30th June), yearly health check-up record of all handlers, BMW training records of all staff (once-in-a-year training) and immunization records of all waste handlers.

Association Rule Mining

Data Mining is the discovery of hidden information found in databases. Dunham (2003) categorized various models and tasks of data mining into two groups: predictive and descriptive. Association rule mining is one of the important techniques which aims at extracting, interesting correlations, frequent patterns, associations, or casual structures among a set of items in the transaction databases or other data mining repositories.

A formal statement of the association rule problem is as follows:

Let I be a set of m distinct attributes and D be a database where each record (tuple) T has a unique identifier and contains a set of items T⊆I. An association rule is an implication of the form X⟹Y, where X, Y, and I are item sets and X∩Y=ϕ. Here, X is called antecedent while Y is called consequent. Association rules can be classified based on the type of values, dimensions of data, and levels of abstraction involved in the rule. If a rule concerns associations between the presence or absence of items, it is called a Boolean association rule. The dataset consisting of attributes that can assume binary (0-absent, 1-present) values is called a Boolean database. This paper discusses interesting measures taken by Dinesh J. Prajapati (2017)

Table-1. Interesting Measures used in this paper

Measure	Formula
Support($\boldsymbol{X}$)	Probability of X:$P(X)$
Confidence($\boldsymbol{X} \Longrightarrow \boldsymbol{Y}$)	$P(X,Y)$
Cosine($\boldsymbol{X} \Longrightarrow \boldsymbol{Y}$)	$\frac{P(X,Y)}{\sqrt{P(X) * P(Y)}}$
Added-Value($\boldsymbol{X} \Longrightarrow \boldsymbol{Y}$)	$P(X,Y) - P(Y)$
Lift($\boldsymbol{X} \Longrightarrow \boldsymbol{Y}$)	$\frac{P(X,Y)}{P(Y)}$
Corelation($\boldsymbol{X} \Longrightarrow \boldsymbol{Y}$)	$\frac{P(X,Y) - P(X) * P(Y)}{\sqrt{P(X) * P(Y)}(1 - P(X))(1 - P(Y)}$
Conviction($\boldsymbol{X} \Longrightarrow \boldsymbol{Y}$)	$\frac{1 - P(Y)}{P(X,Y)}$

Support: The support (s) for an association rule X⇒Y is the percentage of the transaction that contains X⇒Y.

June, 2023
Volume: 8, No: 4, pp. 2286-2299
ISSN: 2059-6588 (Print) | ISSN 2059-6596 (Online)
remittancesreview.com

Confidence: The confidence or strength (⇒) of an association rule X⇒Y is the ratio of the number of transactions that contain X.
Cosine: It measures the similarity between two vectors. When the angle between them is close to 0°, cosine approaches 1, indicating that the vectors are very similar. When the angle is 90 degrees, they are perpendicular, and the cosine is 0. For an association rule X, Y, a cosine value closer to 1 means that transactions containing X also contain Y, and vice versa. On the other hand, a cosine value closer to 0 indicates that transactions contain X without Y, and vice versa. Transactions without either X or Y have no effect on the cosine value. Cosine is a symmetric measure.
Added value: The rule XY's added value, denoted by AV(XY), measures the proportion of transactions containing Y among transactions containing X and whether it is greater than the proportion of transactions containing Y among all transactions. We can only say that X implies Y and that they are associated if the probability of finding item Y when item X has been found is higher than the probability of finding item Y at all. A positive number indicates that X and Y are related, while a negative number means that the occurrence of X prevents Y. Added Value is closely related to another well-known measure of interest, the lift.
Lift: A lift above 1 implies a strong correlation between X and Y, while a lift around 1 means P (X, Y) = P(X)*P(Y), indicating that X and Y are independent events. A lift of 1 corresponds to an added value of 0, a lift greater than 1 corresponds to a positive added value, and a lift below 1 corresponds to a negative added value.

Correlation: Correlation is a symmetric measure. A correlation of 0 indicates no correlation between X and Y. Negative correlation is shown by a negative figure, while a positive figure indicates a positive relationship. Note that the denominator is positive and less than 1. Therefore, even if the lift is around 1, the correlation can still vary significantly from 0.
Conviction: Conviction is not a symmetric measure; a conviction around 1 suggests that X and Y are independent, while conviction is infinite as conf (X⇒Y) approaches 1. Note that if P(Y) is high, then 1-P(Y) is small. In that case, even if conf(X, Y) is strong, conviction may be small.

These measures are calculated on the test data.

AB-HWC's Data collection

The 10 criterions stated above were broadly divided into three major categories for the purpose of analysis (Aruna Devi1et al., (2019)

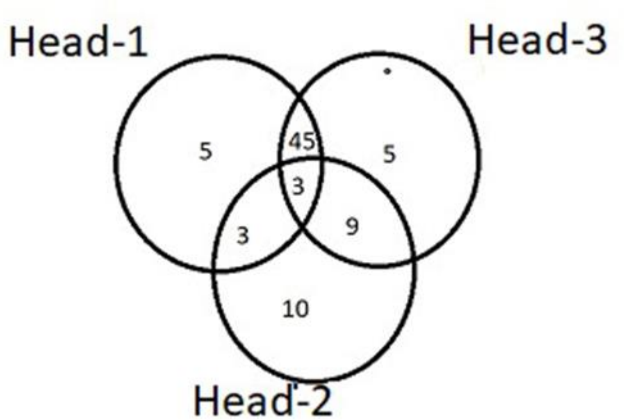
- Availability of Health-care staff strength and motivation.
- Awareness and training on Bio-Medical Waste Management.
- Availability of infrastructural and transportation facilities.

An opinion survey was carried out among 80 individuals comprising of health-care workers and patients associated with different AB-HWC's in Chikballapur District, Karnataka to analyze the performance of the center. The data consists of:

Remittances Review
June, 2023
Volume: 8, No: 4, pp. 2286-2299
ISSN: 2059-6588 (Print) | ISSN 2059-6596 (Online)
remittancesreview.com

Category	Possible Values	Head
1	Bins, Bags, Trolly, Pit, CBWTF operator, Recyclable items	Availability of infrastructural and transportation facilities (**Head-1**)
2	MO MBBS-1, MO Ayush-1, MO Dental-1Nurse-2, Pharmasist-1, Lab-Technician-1, Health Worker (Female (ANM)-1, Health Worker-Male-1, Dresser-1, Accountant-1, Data Entry Operator-1, Counsellor-1, Sanitary-1	Health-care staff strength and motivation. (**Head-2**)
3	Bio-Medical Waste Rules, Segregation protocol, Transport Protocol, Storage Protocols, Dispose Protocols. Recycling Procedure	Awareness and training on Bio-Medical Waste Management. (**Head-3**)

Figure:1 A Venn diagram representing opinion survey about AB-HWC's



So, in this study it has been attempted to find out the heads affecting the AB-HWC 's performance with regard to BMWM. The very purpose of representing the collected information in the form of Venn diagram is that the performance of the Health Welfare Centres was affected by multiple heads such as

- 6 individuals feel that Head-1 and Head-2 are the cause of low performance.
- 12 individuals feel that Head-2 and Head-3 are the cause of low performance.

Volume: 8, No: 4, pp. 2286-2299
ISSN: 2059-6588 (Print) | ISSN 2059-6596 (Online)
remittancesreview.com

- 48 individuals feel that Head-1 and Head-3 are the cause of low performance.
- 3 individuals feel that all the Heads are the cause of low performance.

Performance evaluation of AB-HWC's using the interesting Measures

On the basis of available data, it was decided to calculate the support of each head affecting the performance. Table-1 shows the support level for each head. It describes that head-3 i.e., awareness and training on Bio-Medical Waste Management, contributes most to performance whose support value is 0.77.

Table:2 Support Analysis

Heads affecting the Performance	support
Head-1	0.72
Head-2	0.31
Head-3	0.77
(Head-1, Head-2)	0.6
(Head-1, Head-3)	0.07
(Head-2, Head-3)	0.15
(Head-1, Head-2, Head-3)	0.03

Table 3 describes about the 85% of individuals who feel that performance was affected due to unavailability of infrastructural facilities and the staff who are not trained adequately to handle BMWM. Also 74% of them claim that AB-HWC's, where the un-trained staff exist, and also infrastructural facilities like bins and bags ae not available for proper disposal. 41 % of said that staff strength also affecting the training about the basic protocols. Only 15 % confirmed that the trained staff are totally aware about the BMWM protocols.

Table:3 Confidence Analysis

Heads affecting the Performance	Confidence
$\boldsymbol{Head1 \Rightarrow Head3}$	0.85
$\boldsymbol{Head3 \Rightarrow Head1}$	0.74
$\boldsymbol{Head2 \Rightarrow Head3}$	0.41
$\boldsymbol{Head3 \Rightarrow Head2}$	0.15

Table 4 describes cosine analysis value. It is a symmetric analysis. It means two sets give same results in either direction. In this paper it reflects the angular value between two different heads affecting the performance. Table-4 shows that Head-1 and Head-3 has lower angle (37.72) in comparison to Head-3 and Head-2. According the survey, it can be concluded that the performance of the AB-HWC's is degraded due to improper transport facilities and inadequate training as these heads are more similar than the similarity measure between training head and the health workers provided in the health centers for waste management.

Table:4 Cosine Analysis

Heads affecting the Performance	Cosine	Angle
$\boldsymbol{Head1 \Rightarrow Head3}$	0.791	37.72
$\boldsymbol{Head3 \Rightarrow Head1}$	0.791	37.72
$\boldsymbol{Head2 \Rightarrow Head3}$	0.267	74.51
$\boldsymbol{Head3 \Rightarrow Head2}$	0.267	74.51

In table:5 It can be seen that $Head3 \Rightarrow Head1$ *and* $Head3 \Rightarrow Head1$ have positive numbers which shows that they are related to each other. Hence the survey asserts that presence of both these heads cannot prevent the existence one without the other. To be more precise, if training is not provided then the staff will not be utilising the existing facilities so also the performance of the AB_HWC and vice-versa. On the other hand, it can be observed that the $Head3 \Rightarrow Head2$ *and* $Head2 \Rightarrow Head3$ has a negative value, which shows that the presence of one head prevents the other to occur. It can be concluded that the opinion of the individuals in this survey with regard to staff availability and periodical training provisions at AB-HWC is totally independent of each other.

Table:5 Added Value Analysis

Heads affecting the Performance	AV
$\boldsymbol{Head1 \Rightarrow Head3}$	0.0875
$\boldsymbol{Head3 \Rightarrow Head1}$	0.0775
$\boldsymbol{Head2 \Rightarrow Head3}$	-0.352
$\boldsymbol{Head3 \Rightarrow Head2}$	-0.125

Table 6 contains lift analysis. It is a symmetric analysis. It shows the occurrence of one item to another item. In this table $Head3 \Rightarrow Head1$ *and* $Head3 \Rightarrow Head1$ relation has similar positive value (1.1) which is greater than 1, hence shows that occurrence of first is strongly correlated with the other. In the case of $Head3 \Longrightarrow Head2\ and\ Head2 \Longrightarrow Head3$, it has also same positive value but less than 1 which shows that they are negatively correlated. The lift measures clearly depict the survey outcome about the performance of a centre as the combined effect of available provisions or facilities and skilled staff.

Table:6 Lift Analysis

Heads affecting the Performance	Lift
$\boldsymbol{Head1 \Longrightarrow Head3}$	1.1
$\boldsymbol{Head3 \Longrightarrow Head1}$	1.1
$\boldsymbol{Head2 \Longrightarrow Head3}$	0.53
$\boldsymbol{Head3 \Longrightarrow Head2}$	0.53

Table 7 contains correlation value. In this table $Head3 \Longrightarrow Head1\ and\ Head3 \Longrightarrow Head1$has similar positive values indicating that they are positively correlated to each other. $Head3 \Longrightarrow Head2\ and\ Head2 \Longrightarrow Head3$ has similar negative value showing that they are negatively correlated to each other. The correlation measure reveals that irrespective of the strength of health personnel in the center the training component should be considered seriously for maintaining the quality of services provided at the centers.

Table:7 Correlation Analysis

Heads affecting the Performance	Corelation
$\boldsymbol{Head1 \Longrightarrow Head3}$	1.57
$\boldsymbol{Head3 \Longrightarrow Head1}$	1.57
$\boldsymbol{Head2 \Longrightarrow Head3}$	-2.69
$\boldsymbol{Head3 \Longrightarrow Head2}$	-2.69

Table 8 shows conviction analysis. It shows that highest conviction is found in the association of $Head3 \Longrightarrow Head1\ and\ Head3 \Longrightarrow Head1$ with value 1.34. Lowest conviction is found in association of $Head3 \Longrightarrow Head2\ and\ Head2 \Longrightarrow Head3$ with value 0.36. It reveals that setting up of all the items required for a health center as per the guideline documents and providing necessary training to the health personnel regarding the proper usage of the same is also essential.

Volume: 8, No: 4, pp. 2286-2299
ISSN: 2059-6588 (Print) | ISSN 2059-6596 (Online)
remittancesreview.com

Table:8 Conviction Analysis

Heads affecting the Performance	Conviction
$\boldsymbol{Head1 \Rightarrow Head3}$	1.34
$\boldsymbol{Head3 \Rightarrow Head1}$	1.18
$\boldsymbol{Head2 \Rightarrow Head3}$	0.36
$\boldsymbol{Head3 \Rightarrow Head2}$	0.83

Conclusion

Association rules are useful to find the association between two elements and shows relationship between them. In this paper seven different parameters are used to find the relationship between two different heads affecting performance of AB-HWC. From the above analysis it can be concluded that the Centers are showing poor performance due to the staff who are not aware about different protocols of BMWM than the facilities provided and the staff strength. However, anther conclusion is also extracted from interesting measures like confidence, cosine, AV analysis, lift, correlation and conviction analysis is that most of the performance issues are because of insufficient training as well as absence of infrastructural and transport facilities. So, the Government Authorities in Karnataka where the BMW is highest Kashyap (2023) should take necessary steps to facilitate the centers with infrastructure facilities as well as arrange periodical trainings for the health care workers in order to avoid hazards.

References

Aruna Devi, K. R. (2019). Evaluation of biomedical waste management practices in public. *Environmental Science and Pollution Research*, 20682-20689. doi:https://doi.org/10.1007/s11356-019-05785-9

CENTRE, N. H. (2021, May). *LEVEL OF IMPLEMENTATION OF KAYAKALP IN PHCS OF KARNATAKA AND ITS IMPACT*. Retrieved from https://qps.nhsrcindia.org/node/2230

Datta P, M. G. (2018). Biomedical waste management in India: Critical appraisal. *J Lab Physicians.*., 10(1): 6–14.

Dinesh J. Prajapati, S. G. (2017). Interesting association rule mining with consistent and inconsistent rule detection from big sales data in distributed environment. *Future Computing and Informatics Journal*, 19-30.

Group, U. N. (n.d.). *SDG-12-Ensure sustainable consumption and production*. Retrieved from Sustainable Development Goals: https://sdgs.un.org/topics/chemicals-and-waste

Harri Niska, A. S. (n.d.). Data analytics approach to create waste generation profiles for waste. doi:https://doi.org/10.1016/j.wasman.2018.04.033

June, 2023
Volume: 8, No: 4, pp. 2286-2299
ISSN: 2059-6588 (Print) | ISSN 2059-6596 (Online)
remittancesreview.com

Kashyap, S. (2023). Geographical and temporal analysis of bio-medical waste management in India. *GeoJournal*, 4269-4278.

Khosla Ritu, J. A. (2022). Upsurge in biomedical waste due to COVID-19 in India: A statistical correlation, challenges and recommendations. *Frontiers in Environmental Science*.

Kumar SR, A. N. (2019). Bio-medical waste disposal in India: From paper to practice, what has been affected. *Indian Journal of Health Sciences Biomedical Research*, 202-210.

Mission, N. H. (2018). *AYUSHMAN BHARAT-Health Welfare Centre-Realzing Universal Health Care*. Retrieved from https://www.nhm.gov.in/New_Updates_2018/publication/Final_English_HWC_Booklet.pdf

Mission, N. H. (2022). *Indian Public Health Standards(IPHS)*. Retrieved from Health and Welfare Centre-Primary Health Centre: https://nhm.gov.in/images/pdf/guidelines/iphs/iphs-revised-guidlines-2022/03_PHC_IPHS_Guidelines-2022.pdf

Organization, W. H. (2022). *Universal Health Coverage*. Retrieved from https://www.who.int/news-room/fact-sheets/detail/universal-health-coverage-(uhc)

Organization, W. H. (n.d.). *Health Care Waste*. Retrieved from https://www.who.int/news-room/fact-sheets/detail/health-care-waste

Portal, N. H. (2023). *Ayushman Bharat - Health and Wellness Centre*. Retrieved from https://ab-hwc.nhp.gov.in/download/document/Jan_Aarogya_Samiti_Web_Compressed.pdf

Research, D. o. (2016). *bio-medical-waste-management-rules-2016*. Retrieved from https://dhr.gov.in/document/guidelines/bio-medical-waste-management-rules-2016