Original Article

Assessment of eVIN (Electronic Vaccine Intelligence Network) in utility and constraints of various stakeholders in Nainital District: A mixed method study

Kunal Chaudhary[1], Sadhana Awasthi[2], Thakkar H. Kanubhai[2], Mohd. Maroof[3], Preeti[4]

[1]MO (Medical Officer), MOHFW, Rudraprayag, Uttarakhand, India, [2]Department of Community Medicine, Government Medical College, Haldwani, Uttarakhand, India, [3]Department of Community Medicine, Rani Durgavati Medical College, Banda, Uttar Pradesh, India, [4]Department of Community Medicine, Soban Singh Jeena Government Institute of Medical Sciences and Research, Almora, Uttarakhand, India

Abstract

Vaccines are important tools in the fight against many diseases for which eVIN was created. eVIN is working exceptionally, but the remaining gaps (electronic or non-electronic generated) are still present and cannot be assessed solely by the quantitative method. Thus, the objective of the present study was to assess the eVIN (Electronic Vaccine Intelligence Network) in utility and constraints of various stakeholders in Nainital District: A mixed method study. **Methodology:** This cross-sectional study was carried out among 8 available stakeholders in district Nainital, Uttarakhand. Open-ended KII was conducted individually. **Results:** Key informants comprised eight Stakeholders (7 medical officers in charge and one senior medical officer). The informants had a mean age of 40 ± 8 years with a mean experience of 10 ± 5 years. Big changes and benefits to the immunization program from eVIN were stated by all the stakeholders. The lacunas that remained and need further lookout, were the funds (for minor maintenance and purchase), the capacity building, more technical training, and the regular practices of vaccination. While in low-lying areas there were no major issues stated but for high altitude blocks, all stated persisting facing issues of road accessibility, mobile network, and CCE wear and tear, which makes them tough to carry for outreach sessions on foot. Thus, the findings suggest positive changes in the regions of vaccine usage, stock management distribution, and documentation. However, an Unreliable power supply at public health centers appears to be a continuous major challenge in maintaining the recommended temperature range. Adherence to good storage and handling practices, Supportive supervision, regular training, and budgetary provisions require the attention of higher-level management.

Keywords: eVIN, immunization, Nainital, qualitative, stakeholders

Introduction

Electronic Vaccine Intelligence Network, i.e. eVIN, provides a fused solution for the constraints in the infrastructure, monitoring, human resources, inadequate vaccine stocks, and related challenges.[1] The Ministry of Health and Family Welfare introduced the Electronic Vaccine Intelligence Network (eVIN) and its implementation by the United Nations Development Programmers. UNDP along with the Gavi (2017-21), Health System Strengthening (HSS), and Govt of India support had rolled out eVIN phase-wise across the country.[2]

A programmatic assessment was conducted to determine the efficacy and to see the benefits and obstacles of eVIN. Several

Address for correspondence: Dr. Preeti, Department of Community Medicine, Soban Singh Jeena Government Institute of Medical Sciences and Research, Almora, Uttarakhand, India.
E-mail: kpreeti775@gmail.com

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immunization supply chain studies, like the "National Effective Vaccine Management (EVM) Evaluation" by the National Cold Chain Vaccine Management Resource Centre, have been undertaken on vaccine and cold chain management yet no assessment has been conducted on eVIN implementation and its programmatic outcomes. Also, a broader investigation on the "Techno-economic Assessment of eVIN," was carried out to share knowledge in preparation for an eVIN rollout on a national scale.[3] There is limited data available regarding eVIN. With the study in the sample area, we can look for improvements and changes that eVIN has brought and also we can know its drawbacks and various hurdles that will come with its full implementation. As this study has never been conducted in this region before and similar studies are very limited to date, therefore we have planned for it to assess the utility and challenges as gaps persist in vaccination coverage and in maintaining the cold chain of eVIN implementation in district Nainital.

Material and Methods

This was a mixed methods study of triangulation design in which a cross-sectional quantitative component (survey) and a descriptive qualitative component (interviews) were conducted. It was conducted in eight blocks of the Nainital District of Uttarakhand State. The Stakeholders of the Nainital District were taken as the study unit. The study was conducted from February 2022 to August 2022. Stakeholders who will be available at the center or on a mobile call were included and those who refused to participate or were not found even after 3 visits or not through any type of contact method were excluded. There are 40 Cold Chain Points in 8 blocks of district Nainital Haldwani (Bhimtal, Ramnagar, Kotabagh, Dhari, Betalghat, Ramgarh, Okhalkanda) in which eVIN system is installed.

All stakeholders were contacted, consented, and explained about the study.

Stakeholders were interviewed at blocks or via call. Key informant interviews were conducted and recorded using a recorder. KII (Key Informant Interview) was conducted with the respective stakeholders by the interviewer after a brief self-introduction. Interviews lasted approximately 1 hour and were conducted in Hindi. Questionnaires were developed in English and then translated and back-translated into both languages. All interviews were conducted in a defined study period. The primary data were collected using an audio recorder after verbal consent. Their insights of differences they had noticed in the pre- and post-eVIN period, and their suggestions were interviewed.

Initially, the audio recordings were transcribed by the primary data collector in the native spoken languages. Then transcripts were cross-validated by a second data collector. The data was initially compiled and structured in MS Word, and subsequently evaluated for trends using both inductive and deductive methodologies. The coding process involved generating codes and re-verification twice in parallel. Identification of subthemes was done by the principal investigator whenever they were present. Once the themes and subthemes were reviewed, the process of defining and naming the themes was completed. The acquired and separated data were subjected to thematic analysis, which involved manual computations and the use of MS Excel for tabulation and quantitative analysis. The data was presented in both graphical and tabular formats, as per requirements.

Ethical clearance was obtained from the ethical committee, GMC, Haldwani, Uttarakhand vide letter no. 624/GMC/IEC/2021/Reg. No. 584.

Results

The present study titled "Qualitative Assessment of eVIN (Electronic Vaccine Intelligence Network) in Nainital District" was conducted in the Healthcare structures of District Nainital. It was a cross-sectional study conducted in eight blocks of the district. A qualitative approach was used to explore the challenges with cold chain management. Eight stakeholders were involved in the qualitative study, seven of the eight medical officers in charge and one Senior Medical Officer were included. One stakeholder could not contact from every means of contact and, hence, was removed from the study. They were selected because they were focal persons for cold chain management and had a deep and wide insight into cold chain activities at the subdistrict and district levels. This study design was employed because it aids in getting a piece of in-depth information from the topic under study.

The quantitative data was analyzed with SPSS version 16.0 and MS-Excel using descriptive statistics, and the qualitative data from a key informant interview was transcribed and converted to themes and subthemes, which were further discussed accordingly.

Results are generated in two parts quantitative and qualitative segments as follows:

Quantitative

Key informants are eight Stakeholders (7 medical officers in charge and 1 senior medical officer). The informants had a minimum age of 33 years and a maximum age of 59 years with mean age of 40 ± 8 years. The mean years of experience in cold chain management among the key informants was 10 ± 5 years. All had received training on eVIN [Table 1].

Qualitative assessment

As depicted in Table 2 the programmatic benefits as the data demonstrate that eVIN has successfully transformed the entire vaccine management system. Numerous quantifiable and non-quantifiable benefits of the program were uncovered through discussions with stakeholders. To comprehend the overall programmatic benefits of eVIN for the district, the responses of all stakeholders are classified as benefits, challenges, and sustainability.

eVIN system has played a direct role in improving the overall management of vaccines in the states in the following ways:

Programme benefit [Figures 1 and 2]

Capacity building

Most of the respondents agreed that the cold chain network across the states was strengthened through the training of cold chain handlers and the deployment of vaccine and cold chain managers (VCCMs) in districts. Seven out of eight specifically highlighted the improvement in staff's routine work and overall performance while one respondent was overwhelmed with the increased reach of the cold chain points in the region.

Stock management

Implementation of eVIN in states has resulted in information on real-time stock availability, and data regarding stock-outs and overstocks. A prior understanding of the stock data has made it easier to distribute and share across CCPs. Most of the respondents mentioned that now they have been able to concentrate more on coverage than worrying about stocks. The availability of information has also contributed to a significant drop in levels of wastage.

Table 1: Sociodemographic details of Stakeholders (*n*=8)

Designation	Age (Years)	Experience (Years)	Training
MOIC	44	8	yes
MOIC	36	9	yes
MOIC	59	15	yes
SMO	38	12	yes
MOIC	35	5	yes
MOIC	33	5	yes
MOIC	37	8	yes
MOIC	42	18	yes
Mean	40±8	10±5	100%

*MOIC: Medical Officers Incharge, SMO: Senior Medical Officer

Temperature monitoring

The temperature loggers included with eVIN have simplified the process of temperature management. The respondents said that temperature alarms for rise and fall from recommended temperature helped in regular monitoring so that timely actions could be taken to prevent vaccine waste and to improve the overall health of cold chain equipment.

Overall program planning and management

All respondents acknowledged that connectivity of their smartphones with eVIN data and dashboards was now

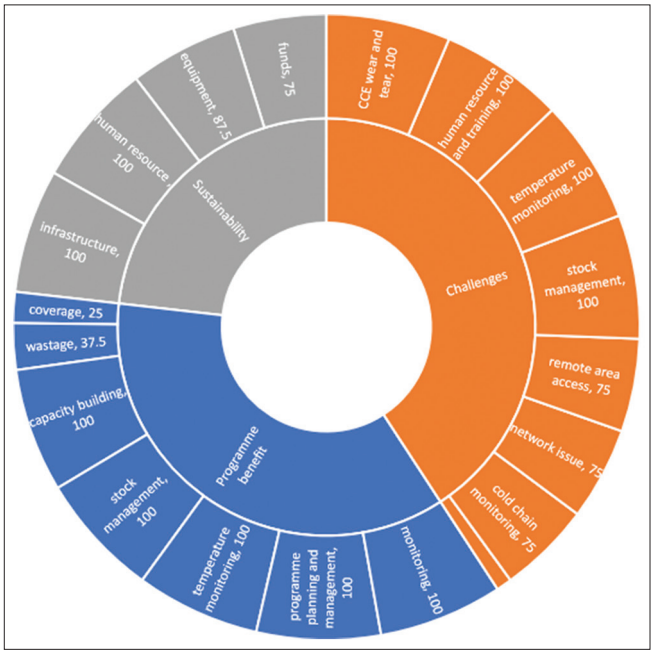

Figure 1: Sunburst chart showing responses of Stakeholders in percentage (n = 8)

Table 2: Qualitative assessment of utility and constraints in eVIN

Themes	Sub-themes	Responses (%)	Key points from interviews
Programme benefit	Capacity building	100	Staff, CCP
	Stock management	100	Stock out events are none now
	Temperature monitoring	100	Helped the overall health of CCE
	Programme planning and management	100	Easier to cover areas and populations now
	Monitoring	100	Ensured both quality and potency
	Wastage	37.5	Still, BCG wastage has not improved in hilly areas
	Coverage	25	Not much difference
Challenges	App usage	12.5	Not user friendly
	Stock management	100	Improved with no challenges
	Temperature monitoring	100	Reduced the challenges
	Cold chain monitoring	75	Network issue makes sometimes difficult
	Human resource and training	100	Less than required
	Network issue	75	Persists
	CCE wear and tear	100	Admits as challenge
	Remote area access	75	Difficult in hilly distant regions
Sustainability	Funds	75	Required
	Human resource	100	Insufficient
	Infrastructure	100	Required
	Equipment	87.5	Require upgrade

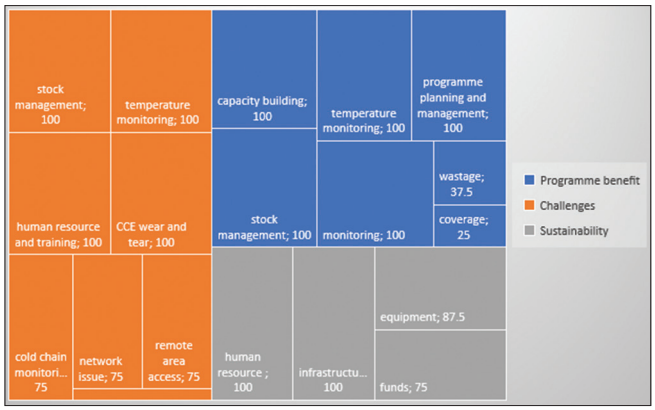

Figure 2: Treemap in rectangle showing Responses of Stakeholders in percentage with rectangle area (n = 8)

their mainstay for helping in making decisions related to the procurement, and distribution of vaccines and keeping an eye on the health of cold chain equipment.

Key officials acknowledged that they noted that their planning process had never been as successful and efficient as it is now, with the necessary technical platform, trained personnel, and real-time information on vaccine supplies and storage temperatures.

Better monitoring mechanism

The majority of stakeholders acknowledged that the conditions of CCEs, which were often neglected in the pre-eVIN era, were one of the biggest assets of eVIN. They were very pleased with the eVIN that keeps the equipment at the recommended temperature and even the slightest fluctuations come to their notice.

Respondents also stated that they are ensured of the quality and potency of vaccines in the CCE, with the continuous monitoring of storage temperatures.

Vaccine wastage

Almost all the stakeholders are highly appreciative of eVIN, which keeps the equipment at the recommended temperature and even the slightest fluctuations come to their notice very soon. Most of the respondents mentioned that they critically monitor the vaccine distribution vis-a-vis vaccine utilization, stocks, and vaccine wastage rates. They also acknowledged the significant improvement in vaccine wastage compared to the pre-eVIN period.

Sustainability [Figures 1 and 2]

Almost all responders stated the benefit of eVIN on immunization coverage, as more potent and several vaccines are being delivered at the right time.

Funds

The fund is important for meeting country-specific strategies in the eradication, elimination, and control of vaccine-preventable diseases (VPDs).

Human resource

All (8/8) stakeholders mentioned that they were in dire need of strengthening the existing human resource management as existing CCHs are overburdened in the present system. They believed that the new appointments of the CCHs and training for the eVIN system should be considered. Another issue highlighted is the frequent transfer of trained staff leaving the spot empty. They also request the retention of CCHs to the appointed CCP for at least three years or replace them with trained personnel alone.

Infrastructure

All the key stakeholders stated that electricity backup, adequate network coverage, and adequate workforce are essential requirements and are important to function uninterruptedly and continuously. They also mentioned that infrastructure should not be neglected especially when attempts are being made to scale up and extend the program to other demanding areas.

Equipment support

Most stakeholders mentioned there were challenges in maintaining functional equipment with minimal equipment breakdown at any point in time. All repairs should be responded to and repaired within week/7 days in case of minor repairs, and within 21 days in case of major repairs. In the existing program, there is also no provision for providing additional spare parts or financial support. Few stakeholders emphasized that an attempt should be made to procure CCEs with preinstalled data loggers. However, the stakeholders are satisfied with the ongoing facilities and the overall system of eVIN.

Challenges [Figures 1 and 2]

Past studies have documented various challenges in the immunization chain system. With this assessment, an attempt was made to understand the technical and implementation challenges that stakeholders were facing in pre-eVIN time.

eVIN APP interface

"I don't find it user friendly, like if I operate it, I had to use back repeatedly, which is annoying many times" Betalghat

Stock management

"Till now through eVIN I can have information only about stocks and not dosage of individual vaccines" Padampuri

Temperature monitoring

To overcome challenges like temperature fluctuations, errors in manual temperature recording, and undocumented registers, eVIN has placed sensors and data loggers in equipment and CCPs, respectively. All were satisfied and overwhelmed with the temperature monitoring that was achieved with eVIN.

Cold chain system monitoring

The post eVIN era is successful in addressing these issues but monitoring by the grounds needs to be strengthened.

Current system challenges [Figures 1 and 2]

Refresher training

To tackle the lack of competent human resources issues, CCHs are required periodic training in eVIN and equipment handling.

Network issues

All work is largely dependent on network and communication. They mentioned that the whole purpose of eVIN gets defeated when the necessary information is not communicated on time due to serious network issues.

CCE wear and tear issues

Most of the stakeholders stated that the logger provided to them runs only on a 3G network while most of the good network providers provide only 4G. Also, lack of proper guidelines for equipment management.

Remote area access

"In my opinion there is less problems faced by workers in URBAN areas in comparison to RURAL areas, network is not good, electricity is not full time available." Ramgarh. "Previously vaccines first delivered to Kotabagh (a nearby hub) then we had to go there to receive our share of vaccines by our own convenience. Now all that has eliminated saving time, money and maintaining vaccine quality." Kaladunghi

Discussion

This is amongst the very few studies on eVIN qualitatively.

Programmatic benefits

Capacity building

It shows that the benefits outweigh the loss of eVIN implementation. Different studies by Fahrni *et al.* (2022),[4] Aggarwal *et al.* (2019)[2] and Hanson *et al.* (2017),[5] Lloyd *et al.* (2015)[6] also show considerable program benefits in aspects of training and skill development of CCHs, vaccine exposure to temperatures, and fewer vaccines being rendered ineffective and wasted. Also in stock management practices, better monitoring mechanisms there is good outcomes with CCHs using the knowledge helped them focus more on avoiding overstocking at CCPs, and Real-time information on stock outs and overstocks has also helped in a tremendous reduction in wastage. Respondents pointed out that known stock numbers have led to the apt use of FIFO and FEFO and utilization at the right time as in Aggarwal *et al.* (2019),[2] Devi *et al.* (2019)[7] studies stated.

Coverage

Their study participants indicated that there were neither explicit policy guidelines defining community engagement nor pertinent evaluation metrics, despite awareness that community engagement is complex and under-researched. Examples of different approaches to community engagement ranged from vaccine imposition to empowered community vaccination decision-making.

The studies of Aggarwal *et al.* (2019)[2] and Dutta *et al.* (2020)[8] show similar results, most stakeholders stated that the demand for vaccination services has increased but attaining higher coverage levels and impartial objectives require additional approaches and framework. According to the respondents to improve the systems, there is a need to improve efficiencies in service delivery, innovative technology, and filling remaining funding gaps.

Fahrni *et al.* (2022)[4] showed that appropriately trained handlers on cold chain equipment are necessarily required to manage and monitor cold chain, from accidental interruption of the storage temperature conditions and vaccine instability can be avoided. According to Aggarwal *et al.* (2019)[2] key stakeholders stated that the electricity backup, network coverage, and proper storage areas were some essential requirements to function uninterruptedly and continuously. Asamoah *et al.* (2021)[9] state that constant pressure is placed on the participants due to their lack of control over external factors such as personnel and power supply.

In terms of Equipment Support; Aggarwal *et al.* (2019),[2] Asamoah *et al.* (2021)[9] reported that there is a clear lack of guidelines on maintenance, have an insufficient supply of cold chain logistics such as refrigerators, cold boxes, and vaccine carriers, and no provision of providing additional spare parts. While in Haidari *et al.* (2017),[10] Pambudi *et al.* (2022),[11] Nadimuthu and Victor (2022)[12] studies show positive aspects of the use of solar power in cold chain equipment health and vaccine efficiency, which in turnout to improved vaccination coverage.

Challenges

Despite being the latest technology, 100% has not been achieved yet. This means there are still gaps to look out which we tried to look after through this gap analysis.

In aspects of eVIN APP interface: Pambudi *et al.* (2022)[11] study shows the potential issue of monitoring based on Internet technology, SMS, IoT, big data cloud computing, Artificial Neural Network (ANN), Vaccine Vial Monitors (VVM), an electronic Vaccine Vial Monitors (eVVM) similarly in by one stakeholder was in line with this study.

In Stock Management part Asamoah *et al.* (2021),[9] Fahrni *et al.* (2022)[4] and Devi *et al.* (2019)[7] stated that each stakeholder/Mos/CCHs has a very specific role to play in completing the entire process flow.

In Temperature Monitoring: Aggarwal *et al.* (2019)[2] reporting the remaining challenge of the temperature management of the cold box. Montgomery *et al.* (2018)[13] reporting the inconsistent supply of electricity and the access to internet availability are in line with our reports too especially in hilly and outreach regions.

In the Cold Chain System Monitoring as our report found out is also stated in the study of Aggarwal *et al.* (2019)[2] stakeholders mentioned that frequent change or transfer

of staff was a challenge in continuous monitoring and the replacement of trained staff by untrained staff was also a bigger hindrance in monitoring an otherwise continuous functioning system.

Current system challenges

The Refresher Training Most state officials mentioned that long intervals in refresher training were another challenge, and this should be addressed at the earliest also by Aggarwal *et al.* (2019),[2] Asamoah *et al.* (2021),[9] Mohammed *et al.* (2021).[14] One stakeholder quoted *"Young age handlers could be sent along with old CCHs for training. Other option could be the training of CCHs on a timely basis"*.

The CCE Wear and Tear Issues were reported by all of the stakeholders and as per the studies of Aggarwal *et al.* (2019),[2] Asamoah *et al.* (2021),[9] Devi *et al.* (2019)[7] reports the lack of proper guidelines, insufficient cold chain logistics, mobility, accessibility and shortage of supply as challenges for equipment management.

The remote area access challenge was reported by most of the stakeholders as one of the potential issues. As quoted by Montgomery *et al.* (2018),[13] Asamoah *et al.* (2021)[9] in their study participants reported the inconvenience of traveling long distances from their place of residence to the workplaces several times to check on the state of the vaccines outside their working schedule also the unreliable nature of the power supply and network system makes them suffer a lot.

Funds

funding issues were reported by over half stakeholders for the proper functioning and running of the vaccination drive in the district also Aggarwal *et al.* (2019)[2] reported that being a technology-driven system, funds are necessary for making the system sustainable and repair of CCE, mobile phones, replacement of malfunctioning equipment and/or mobile phones.

Conclusion

In the present study, 8 Stakeholders from the Nainital district were interviewed to assess the gaps in eVIN (Electronic Vaccine Intelligence Network), in terms of utility and constraints from various stakeholders' perspectives.

The findings of this assessment point to positiveness in the areas of vaccine usage, stock management, distribution, and documentation. The states have benefited from eVIN and have improved the planning, stock management, and distribution of vaccines to the last mile.

Unreliable power supply and unavailability of cellular networks at public health centers appear to be the major challenges in maintaining the recommended temperature.

Adherence to improved storage practices like arrangement of products within the refrigerator, temperature monitoring, and recording also needs an attentive eye from cold chain handlers.

Some budgetary constraints require the attention of higher-level management while most are correctable by low-level administration at public health centers or CCPs.

Supportive supervision and regular training and equipment maintenance would improve their work efficiency.

Strength and limitations

This is one of the first kinds of study in India, known to the investigator, where eVIN was not assessed much by any method for further strengthening. Therefore, this study serves as a preliminary step toward achieving bigger objectives. The study's paradigm might be employed to evaluate the eVIN on a state level, providing a more comprehensive understanding of its shortcomings. However, the study does have several drawbacks. The study sample size is small for generalization of the various findings, being a cross-sectional study could not generate the temporal relationship between the several factors and the interviewer error cannot be ignored here too.

Relevance

It is a well-known fact that vaccines have played a major role in controlling many diseases, which could become a community problem in major parts of the world. It is the part of primary care that is delivered to communities globally. For this to be maintained potent and stable vaccines are required, which is why vaccines were transported by keeping the cold chain potent. Hence, with the implementation of Evin, it has become more compatible with systems to monitor and maintain the cold chain.

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Conflicts of interest

There are no conflicts of interest.

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