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IMPACT OF PERIODIC SAFETY UPDATE REPORTING SYSTEM IN A TERTIARY CARE TEACHING HOSPITAL OF SOUTHERN INDIA: A DELPHI STUDY

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Keywords:

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ABSTRACT: The process and functioning of newly implemented periodic safety update report system (PSUR) in the hospital were assessed using validated PSUR function assessment questionnaire (PFAQ) vetted by Delphi panel. Classical Delphi survey method was used to assess and validate the PFAQ in two successive review rounds with Delphi panel. Final validated PFAQ was circulated among health care practitioners (HCPs) to rate their responses. Responses were recorded for 2 phases of 9 months intervals each and assessed. Success factors and performance indicators listed in the PFAQ were successively added or deleted by the Delphi panel, in two successive rounds of revisions, yielding the final draft of PFAQ. One hundred sixty (160) PFAQs were circulated among HCPs in different wards of hospitals out of which 94 (58.75%) filled forms were received by the end of phase 2 study period. We observed a significant improvement in the visibility and functioning of PSUR system in the responses collated from the HCPs during phase 2 of the study, compared to the phase 1 responses. Majority of responses for each performance indicator for respective success factor were found shifting towards 1 (very good) and 2 (good) on Likert scale during phase 2 study period. This study illustrates the value of feasible and inexpensive ways to improve poorly designed pharmacovigilance system in India, which rely heavily on data from overseas. This study emphasizes how establishing a drug safety reporting network can helpfully fill-in country-specific data to assess the incidence and prevalence of ADRs of newer drugs.

INTRODUCTION: Pharmacovigilance (PV) is a scientific discipline which determines the safety of drugs used in clinical practice and to balance the risk-benefit ratio to the public [1].

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Many important iatrogenic illnesses, regarding both morbidity and mortality, are considered due to adverse drug reactions (ADRs). Thus, adverse events have economic and medico-legal consequences.

A number of studies have proved that 10% of hospital admission is ADR related, adding significant onus to the socio-economic burden of healthcare [2]. ADR constitutes a considerable burden to society, both financially and regarding human suffering.

Systematized ADR monitoring and reporting may sensitize physicians to rational prescribing [3]. Public health protection is of the utmost importance when deciding on product withdrawals and amending labeling with the emergence of new safety data. ADR reporting improves databases from which we could draw safety conclusions - improving methods of reporting leads to early identification and development of risk management plans by the regulator or marketing authorization holders (MAHs), appropriate training to the reporter, faster and transparent regulatory decisions and rapid spreading of safety-related change among health care professionals [4].

Reporting of unidentified, unlisted and suspected ADRs add value to the database of existing ADR reports from healthcare practitioners (HCPs). This helps to identify new potential signals and to analyze causality, severity, and outcome of ADRs on patients' lives [5]. PV and safety monitoring are barely a decade old and relatively new in India. However, the ever-rising number of global clinical trials being conducted in India and an increasing number of new drug approvals with limited drug safety data, underscore the need for a robust PV system that is in line with international norms [6].

The idea of PV in India traces back to 1986, the year when an official ADR monitoring and reporting system, consisting of 12 regional centers with a population base of 50 million per each regional center was proposed. However, only 6 regional centers were established by 1989, in which only 2 centers were active and involved in ADR monitoring. The momentum of ADR monitoring and reporting picked up in 1997 when India joined World Health Organization (WHO) as a member of the Programme for International Drug Monitoring, managed by the Uppsala Monitoring Centre (UMC). National Pharmacovigilance Programme (NPP) took shape when India received the funding support from the World Bank for this programme in 2004. [7]

So far, very little attention has been given to ADR monitoring. Very few original studies have been done in this regard. Active ADR monitoring centers are few and are unable to create an environment for safety surveillance. If HCPs offer more time and attention to understand drug, disease and their patients better, ADRs can be reduced significantly and avoided substantially [8]. When MAHs are granted marketing authorization of a given product; MAH is obliged to monitor the safety of their products. Their responsibility includes continuous dialogue with regulators to optimize the benefit-risk ratio of their product by ensuring the right strategies. Periodic safety update report (PSUR) can be considered one of the basic tools to facilitate communication between MAH and regulator. In one of the studies on markers of safety-related regulatory actions on marketed drugs, post-authorization regulatory actions in a sample of biopharmaceuticals were found to be 38% from PSUR evaluations. Another study published in 2010 says that 64% ADRs and safety signals originated from PSURs [9].

As per the Indian regulatory agency rules, after drug marketing authorization, its ADRs on Indian patients need to be documented and reported in the form of PSUR every 6 months in the first 2 years, and after that annually for next 2 years. It was noted that drug companies were grossly abusing the rule. Parliamentary standing committee (PSC) set up by the Indian government randomly selected 42 drugs to scrutinize the compliance and obligation towards PSUR from the MAHs. The PSC found that PSURs were only available for 8 drugs. It was also noticed that PSUR submitted by few companies were not India specific, for marketed products in India. The PSC recommended union health ministry to direct the Central Drugs Standard Control Organization (CDSCO) to send a strict warning to all MAHs to have an obligation with PSUR submissions as per the rules or face suspension of marketing authorization [10, 11].

The Drug Controller General of India (DCGI) is keenly involved in framing newer laws to recall drugs from the market and expanding the reviewer panel for clinical trial and drug safety. Indian drug regulatory authority wants more professionals to be involved in PSUR so that the current situation improves. To comply with the direction of DCGI to hospitals of India on mandatory drug safety reporting, we implemented a PSUR setup in our hospital wards. Various committees, *i.e.*, PSUR committee, safety review panel, *etc*., were constituted for the PSUR system implementation and reporting.

This committee included persons from diverse departments of the hospital (*e.g.,* Medical Superintendent, Chief Pharmacists, Medical Operations Head, and Nursing Head, *etc*.) [12]. To assess the process, functioning and success of ADR reporting and monitoring system, quality indicators were developed using systematic or non-systematic methods. Non-systematic approaches like case studies rely on data availability and real-time monitoring of critical incidents.

Though non-systematic approaches are vital; they fail to utilize more of available scientific evidence. Indicator selections in systematic approaches based on the available evidence including subject matter experts' opinion, if required. Experts scrutinize the available evidence including their opinion and arrive at a consensus. Systematic methods are the assets to facilitate the development of quality indicators where evidence alone is inadequate or disagreement and produce accumulated expert opinion. Delphi technique has been extensively used method among others for quality-indicator development in health care [13]. The Delphi method is a useful way of discovering and determining uncertainties and has been widely exploited in medical and health services [14]. Outcome and decision of the Delphi method are based on the collaborative opinion of experts who share similar knowledge in a particular field. This method has wide implications in health and social care, enabling us to take appropriate decisions based on cumulative knowledge and expert opinions [15, 16].

The Delphi technique is a structured process, where a series of questionnaires (known as "rounds") are circulated successively to informed individuals (known as experts) to gather information until a consensus is reached. Classical Delphi method, used in this study, involves the presentation of a preliminary questionnaire containing several performance indicators and success factors (based on a literature review) to a panel of experts in order. After experts respond to preliminary questionnaires, data are summarized based on the aggregate results analysis and a new questionnaire is designed. This modified second questionnaire is again circulated among each participant to provide their opinion. Repeated rounds of this questionnaire validation may be carried out until consensus over agreed points is reached [16, 17].

To measure opinions, perceptions, and behaviors, the Likert scale is most preferred. This method reveals degrees of outlook that possibly construct a real difference in understanding the feedback. It can also give a better understanding of the areas where you need to focus more and improve the process and function. Compared to binary questions, which give you only 2 answer options, it can help to decide whether you strongly agree or strongly disagree with any system or process [18]. To assess the process and functioning of newly implemented PSUR system in the hospital, we drafted a preliminary PSUR function assessment questionnaire (PFAQ) that included several pre-identified success factors and performance indicators based on the literature review. Classical Delphi survey method was used to assess and validate the PFAQ in two successive review rounds with subject experts on a five-point Likert scale1 to 5, where 1 corresponds to agree strongly, and 5 corresponds to disagree strongly.

MATERIAL AND METHODS:

Implementation of the PSUR System in the Hospital: Prior Ethical permission was obtained from the hospital Institutional Ethics Committee (Ref: IEC 195/2013). The PSUR committee was constituted in January 2013. To facilitate the prerequisite of ADR reporting in hospital, ADR reporting forms, drug information leaflets, and ADR reporting guidelines were prepared and circulated in all wards of a hospital for manual ADR reporting. To make it convenient for HCPs, ADR reporting software was also developed and linked with the intranet website, accessible from all wards of the hospital. Necessary training was provided to HCPs on the basics of ADR, and manual/online ADR is reporting for newer drugs under PSUR system.

Non- commercial subscription for a medical dictionary for regulatory activities (MedDRA) was obtained from the Maintenance and Support Services Organization (MSSO) of the International Council for Harmonization (ICH). MedDRA was used to code preferred terms and system organ class of the reported ADRs. Hands-on training on MedDRA coding software, vigiflow, and hospital information services software (hospitals internal patient management and billing software) were provided to Pharm. D interns and students.

Validation of PFAQ *via* Delphi Panel:

Design: Classical two-round Delphi PFAQ survey after preliminary validation of success factors and performance indicators within the department of pharmacy practice in the hospital. Preliminary PFAQ was drafted, consisting of success factors and performance indicators based on the literature review. Delphi panel consisting of 10 members constituted on 24 Oct 2013.

The successive rounds of first and final PFAQ survey were carried out to finalize and validate PFAQ vetted by a Delphi panel. Success factors and performance indicators listed in the PFAQ were successively added or deleted by the Delphi panel, in 2 rounds of revisions, yielding the final draft of PFAQ. Final PFAQ draft lists 11 success factors and 8 performance indicators based on which 88 questions were listed in the final PFAQ.

Assessment of Impact of Implemented PSUR System in the Hospital Using Validated PFAQ: Final validated PFAQ was circulated among HCPs (physicians, nurses, pharmacists, interns, and Pharm. D to rate their responses. The sample size for 2 proportions (responses on PFAQ for the particular period, Phase 1 and Phase 2) was calculated to 40 respondents in each phase (considering 500 HCPs population size in hospital) with a confidence interval of 95% and margin of error 15%. Each factor responsible for the functioning of the PSUR system in the hospital was assessed on a Likert scale of 1 to 5, where 1 corresponds to very good and 5 corresponds to very poor.

RESULTS:

Validation of PSUR System Functioning Using Delphi Panel: In round 1, the panel of experts was asked to provide their responses on Likert scale on the importance of each of the success factors and performance indicators and to provide inputs for revisions or addition of any new items. The consensus was considered reached if at least 70% of the expert panel members strongly agree or disagree that success factors and performance indicators should be included or excluded. The preliminary draft PFAQ contained 19 items (10 success factors and 09 performance indicators) for evaluation, and it was sent out to all 10 panel members in round 1 of the Delphi process.

First review round of PFAQ (see **Table 1**) item validation was initiated on 01 Jul 2014. Responses on PFAQ from all the panel members were completed and received on 20 Aug 2014. All 19 items mentioned in PFAQ draft were answered and received in the first review round. Expert panel members reached 70% consensus to include (Aggregate percentage of Likert scale 1 and 2) 7 success factors and 8 performance indicators in PFAQ (see **Fig. 1** and **Fig. 2**).

TABLE 1: PRELIMINARY LIST OF SUCCESS FACTOR'S AND PERFORMANCE INDICATOR'S CIRCULATED IN FIRST REVIEW ROUND OF PFAQ VALIDATION

S. no.	Success factors	Likert scale					Performance Indicators	Likert scale				
		1	2	3	4	5		1	2	3	4	5
1	Latest Drug List						Information					
2	Drug brands						Awareness					
3	Reporting of IP Nos.						Accessibility					
4	Patient follow-up						Relevance					
5	Collection of ADRs						Training					
6	Reporting of ADRs						Practicability					
7	Safety Review						communication					
8	Periodic review and analysis						Quantity of data					
9	Preparation of PSUR						Quality of data					
10	Submission of PSUR											
	Average Rating											

Likert scale: 1: Strongly agree; 2: Agree; 3: Neutral; 4: Disagree; 5: Strongly disagree

However, the panel also reached to 70% consensus to exclude (Aggregate percentage of Likert scale 4 and 5) 3 success factors (latest drug list, reporting of IP numbers and patient follow up) and 1 performance indicator, practicability. Delphi panel also suggested considering some additional success factors (Drug dispensing database, wards/ departments, nursing station, and pharmacy) and performance indicator (Overall feedback) to be included in the second review round of PFAQ.

The updated list of 20 items (success factors and performance indicators) based on first review responses for PFAQ was circulated for the second review round to Delphi expert panel on 01 Sep 2014 (see **Table 2**). Delphi panel responded to all the PFAQ items on 31 Oct 2014. In the second review round, 70% consensus was achieved for 7 success factors to include them in final PFAQ and to exclude 3 success factors (Drug brands, safety review, and periodic review and analysis) and one performance indicator (Relevance) (see **Fig. 3** and **Fig. 4**). Additionally, there has been a strong proposal by Delphi panel to include 4 more success factors (Safety review/consultation, review, and analysis of data, ADR data and PSUR News-Letter) in the final PFAQ.

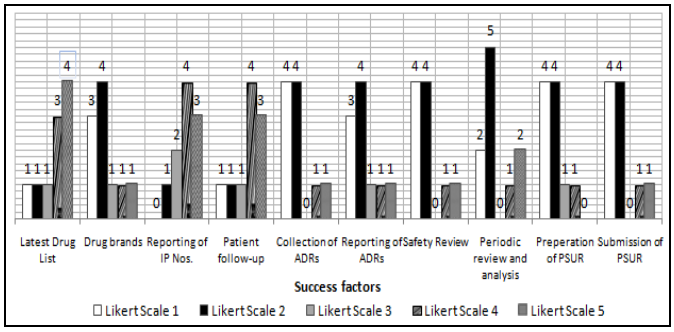

FIG. 1: RESPONSES ON PFAQ SUCCESS FACTORS BY DELPHI PANEL EXPERTS IN FIRST REVIEW ROUND. Likert scale: 1: Strongly agree; 2: Agree; 3: Neutral; 4: Disagree; 5: Strongly disagree

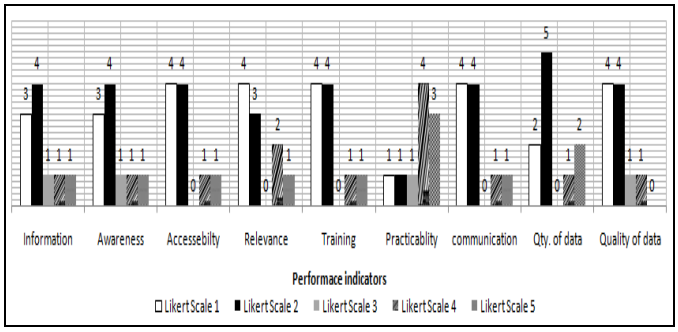

FIG. 2: RESPONSES ON PFAQ PERFORMANCE FACTORS BY DELPHI PANEL EXPERTS IN FIRST REVIEW ROUND. Likert scale: 1: Strongly agree; 2: Agree; 3: Neutral; 4: Disagree; 5: Strongly disagree

TABLE 2: UPDATED LIST OF SUCCESS FACTORS AND PERFORMANCE INDICATORS CIRCULATED IN SECOND REVIEW ROUND OF PFAQ VALIDATION

S. no.	Success factors	Likert scale 1	2	3	4	5	Performance Indicators	Likert scale 1	2	3	4	5
1	Drug Dispensing Database						Information					
2	Drug Brands						Awareness					
3	Wards/Departments						Accessibility					
4	Nursing Station						Relevance					
5	Pharmacy						Training					
6	Collection of ADRs						Communication					
7	Reporting of ADRs						Quantity of data					
8	Safety Review						Quality of data					
9	Periodic Review and Analysis						Overall feedback					
10	Preparation of PSUR											
11	Submission of PSUR											
	Average Rating											

Likert scale: 1: Strongly agree; 2: Agree; 3: Neutral; 4: Disagree; 5: Strongly disagree

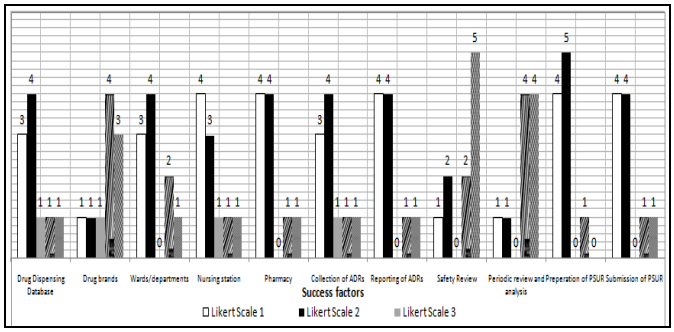

FIG. 3: RESPONSES ON PFAQ SUCCESS FACTORS BY DELPHI PANEL EXPERTS IN SECOND REVIEW ROUND. Likert scale: 1: Strongly agree; 2: Agree; 3: Neutral; 4: Disagree; 5: Strongly disagree

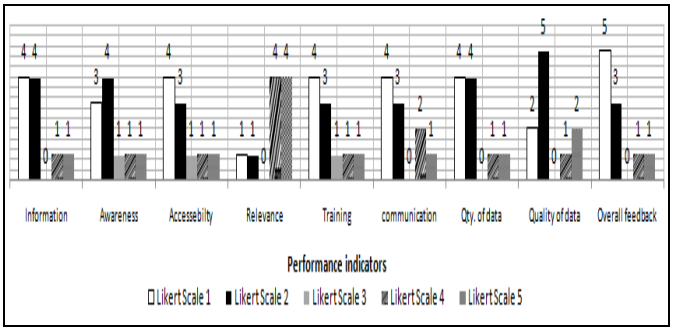

FIG. 4: RESPONSES ON PFAQ PERFORMANCE FACTORS BY DELPHI PANEL EXPERTS IN SECOND REVIEW ROUND. Likert scale: 1: Strongly agree; 2: Agree; 3: Neutral; 4: Disagree; 5: Strongly disagree

A total of 88 questions were framed and included in final PFAQ (see **Table 3**) based on the validated success factors and performance indicators vetted by Delphi panel during first and final review

rounds. The questions were framed for each of the 11 success factors to assess their success for implemented PSUR system using 8 validated performance indicators (11 success factors × 8 performance indicators = 88 questions). Responses to each question were recorded on a Likert scale of 1 to 5 where 1 corresponds to very good and 5 corresponds to the very poor. Structure of final PFAQ with an example of a few questions are given below in **Table 4**.

Assessment of Impact of Implemented PSUR System in the Hospital Using Validated PFAQ: One hundred sixty (160) PFAQs were circulated in the different wards of hospitals from 15 Nov 2014 till 16 May 2016. Total 94 filled PFAQs responses were received till 16 May 2016. The PFAQ responses were recorded in 2 phases with 9 months interval between each phase. The PFAQs received in the first 9 months were kept in phase 1(15 Nov 2014 to 15 Aug 2015) and remaining PFAQs received in last 9 months were kept in phase 2 (16 Aug 2015 to 16 May 2016). Forty-six (46) responses were received during the first 9 months of study duration (Phase 1). Forty-six (46) Responders consisted of Physicians: 04, Pharmacists: 03, Nurses: 10, MBBS/MD/Pharm. D Interns: 09 and MBBS/MD/Pharm. D students: 20.

There were total of 48 responses received from 3 Physicians, 2 Pharmacists, 9 Nurses, 10 MBBS/ MD/Pharm. D Interns and 24 MBBS/MD/Pharm. D students in phase 2 of the study. The aggregate results are summarized for each success factor and performance indicators individually and overall combined. There was a significant improvement in the visibility and working of PSUR system seen in the responses received from the HCPs during phase 2 of the study compared to the Phase 1 responses. Several responses for each performance indicators for respective success factor were seen shifting more towards 1 (very good), 2 (good) and 3 (average) on Likert scale.

The PSUR work station was taken as one of the success factors among others; there were significant changes noted for each of the performance indicators predicted to be a major player in the PSUR functioning. Feedback from HCPs in the hospital on the performance of the PSUR workstation moved from average towards very good during the phase 2 study period compared to the Phase 1 study. For example 26 (54.1%) out of 48 HCPs believed that there is a significant improvement in drug information provided at PSUR work station required to report ADRs from Phase 1 study to phase 2 period (4.2%). Similar trends were noted with other performance indicators as well (see **Fig. 5**).

The combined responses for good and very good ratings for another success factor, namely 'drug dispensing database' was also found to be higher during the Phase 2 study period. For instance, most of the HCPs (48%) responded that there was better communication with PSUR team to provide latest drug dispensing database for ADR tracking compared to only 21% during the Phase 1 study period. There was a similar inclination observed for other performance indicators as well (see **Fig. 6**).

Responses from the 3 success factors namely Wards/departments, nursing and pharmacy stations of the hospital were collected and analyzed to reveal that 25 (52%) out of 48 HCPs observed that necessary training materials were available at their working stations and appropriate training on detection and reporting of ADRs were provided compared to the 6 (13%) responses received during phase 1 from 46 HCPs. Other responses for remaining performance indicators were seen improving in the Phase 2 study period compared to Phase 1 as shown in **Fig. 7**.

A similar trend of improvement in the performance indicators for success factor, namely reporting of ADRs was also seen (see **Fig. 8**). Both accessibility to patient records and communication of PSUR team with HCPs significantly increased in phase 2 study period (50% and 43.7% respectively) compared to phase 1 (13% and 10%). Similarly, improving trends were observed in performance indicators such as success factors in the collection of ADRs, safety review/consultation and ADR data. For instance, significant improvement was reported by HCPs during Phase 2 study period for the training material and appropriate training on collection of ADRs (56.25%), safety review/ consultation (48%) and ADR data (48%) compared to the Phase 1 study duration (17.3%, 28.26% and 19.6% for respective success factor) as shown in **Fig. 9**, **Fig. 10** and **Fig. 11**.

TABLE 3: VALIDATED SUCCESS FACTORS AND PERFORMANCE INDICATORS BY DELPHI PANEL INCLUDED IN FINAL PFAQ

S. no.	Performance Indicators → / Success factor ↓	Drug Information					Accessibility					Awareness					Training					Communication					Quantity of data					Quality of data					Overall Feedback				
		1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
1	PSUR Work Station																																								
2	Drug Dispensing Database																																								
3	Wards/Departments / Nursing Station /Pharmacy																																								
4	Reporting of ADRs																																								
5	Collection of ADRs																																								
6	Safety review/ Consultation																																								
7	ADR Data																																								
8	Review & Analysis of Data																																								
9	PSUR Preparation																																								
10	PSUR Submission																																								
11	PSUR News-Letter																																								
	Total																																								

Likert scale: 1: Very good; 2: Good; 3: Average; 4: Poor; 5: Very poor

TABLE 4: STRUCTURE OF FINAL PFAQ BASED ON VALIDATED SUCCESS FACTORS AND PERFORMANCE INDICATORS

Success factors	Performance indicators	Questions in final PFAQ Responses recorded on Likert scale*
PSUR work Station	Drug Information	Drug information available for the drugs included under PSUR?
Drug Dispensing Database	Accessibility	Access to drug details available in online drug dispensing database?
Wards/Departments	Awareness	Awareness about the drugs given under PSUR and process of ADR reporting?
Nursing Station	Training	The Benefits of training provided for ADR reporting under PSUR, if any?
Pharmacy	Communication	Communications with PSUR work station on any query related to ADR reporting?
Reporting of ADRs	Quantity of Data	Satisfaction with the quantity of data reported under PSUR?
Collection of ADRs	Quality of Data	Satisfaction with the quality of data collected for reporting under PSUR?
Safety review/Consultation	Overall Feedback	Is overall feedback available on safety review and consultation under PSUR?
ADR Data	Accessibility	Is ADR Information available for the drugs included under PSUR?
Review & Analysis of Data	Communication	Communications with the PSUR team on how to retrieve and view review and analysis reports for the reported ADRs under PSUR?
PSUR Preparation	Training	Benefits of training on PSUR report preparations, if any?
PSUR Submission	Quality of Data	Quality of the data included PSUR?
PSUR News-Letter	Accessibility	Accessibility of the PSUR News-Letters?

*Likert scale: 1: Very good; 2: Good; 3: Average; 4: Poor; 5: Very poor

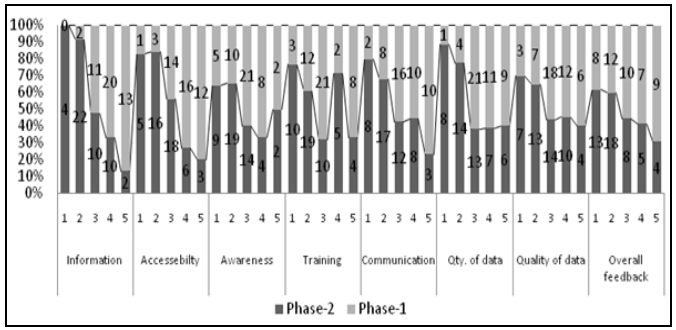

FIG. 5: PSUR WORK STATION

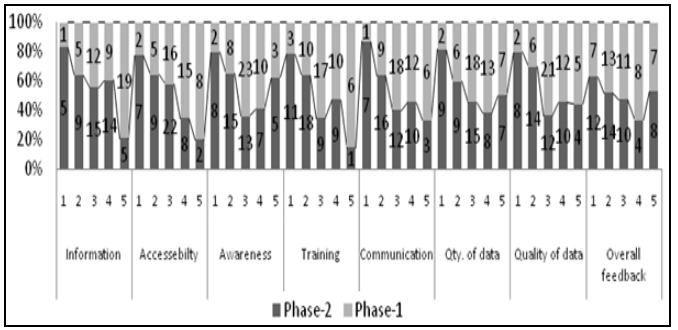

FIG. 6: DRUG DISPENSING DATABASE

Likert scale (1: Very good; 2: Good, 3: Average; 4: Poor, 5: Very poor)

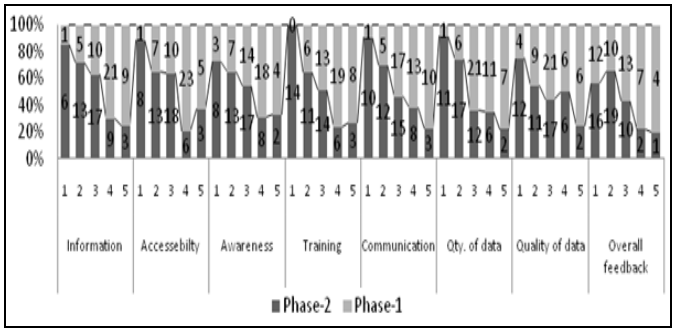

FIG. 7: WARDS/NURSING STATIONS / PHARMACY

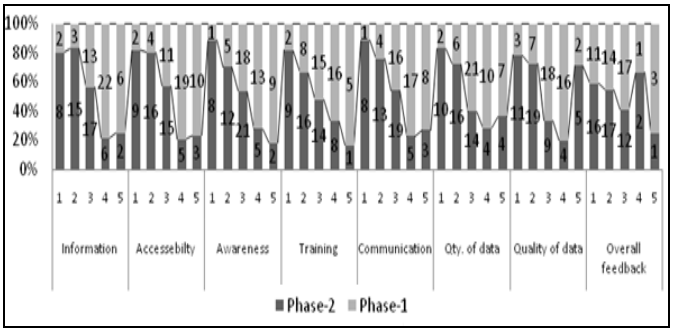

FIG. 8: REPORTING OF ADRS

Likert scale (1: Very good; 2: Good, 3: Average; 4: Poor, 5: Very poor)

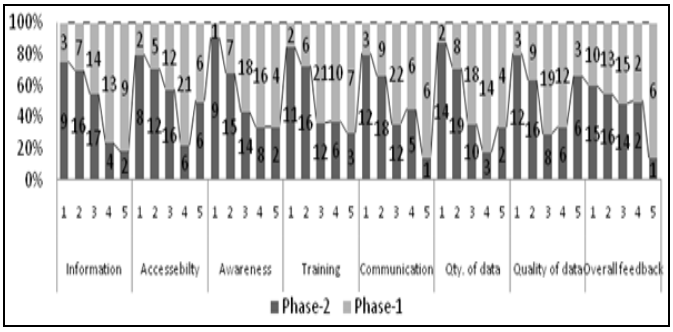

FIG. 9: COLLECTION OF ADRS

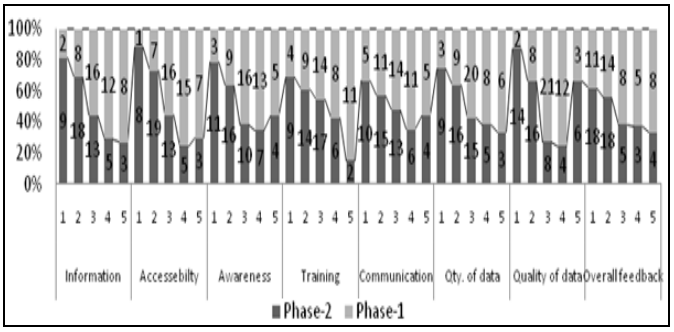

FIG. 10: SAFETY REVIEW / CONSULTATION

Likert scale (1: Very good; 2: Good, 3: Average; 4: Poor, 5: Very poor)

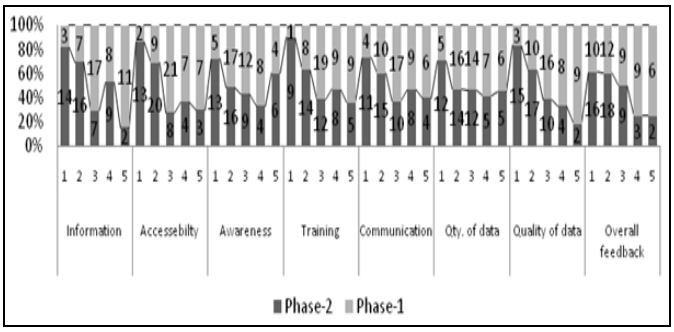

FIG. 11: ADR DATA

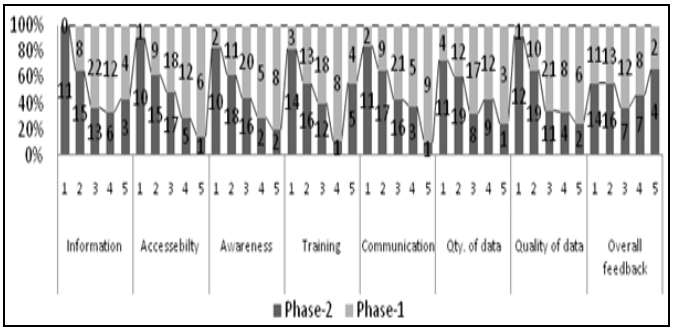

FIG. 12: REVIEW AND ANALYSIS OF DATA

Likert scale (1: Very good; 2: Good, 3: Average; 4: Poor, 5: Very poor)

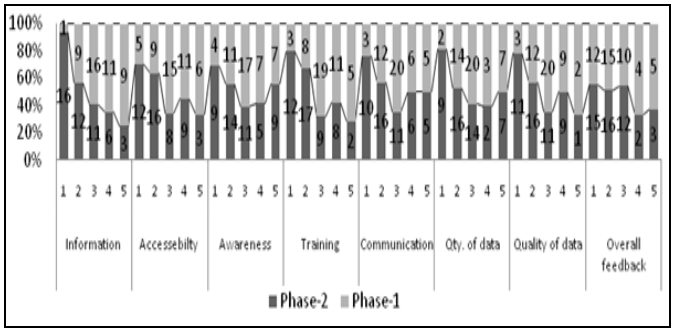

FIG. 13: PSURS PREPARATION

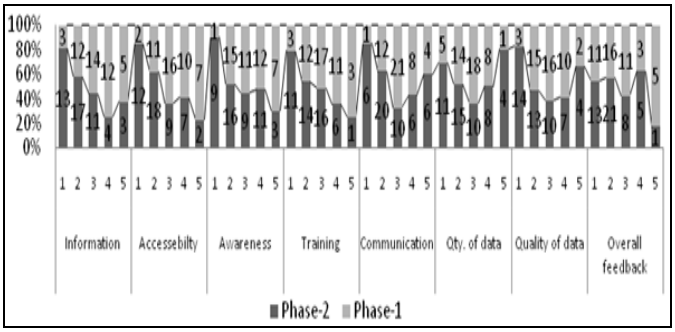

FIG. 14: PSURS SUBMISSION

Likert scale (1: Very good; 2: Good, 3: Average; 4: Poor, 5: Very poor)

Performance indicators for success factors, review, and analysis of data, PSUR preparation and PSUR submission were also seen moving towards Likert scale 1 and 2 compared to Phase 1. As shown in **Fig 12**, **Fig. 13** and **Fig. 14**, there was a tremendous improvement on the awareness among HCPs on review and analysis of data (58.3%), PSUR preparation (47.91%) and PSUR submission (52%) compared to phase 1 (28.26%, 32.60 and 34.7% respectively). Responses on success factors, PSUR news-letters and overall assessment of the functioning of PSUR system were also received

which indicates there is a significant improvement in the performance indicators rated by HCPs during the phase 2 study period compared to Phase 1. Overall feedback on the PSUR news-letters (72.9%) and overall assessment (68.7%) by HCPs shifted towards Likert scale 1 and 2 compared to phase 1 (56% and 50% for respective success factors) as shown in **Fig. 15** & **Fig. 16** respectively.

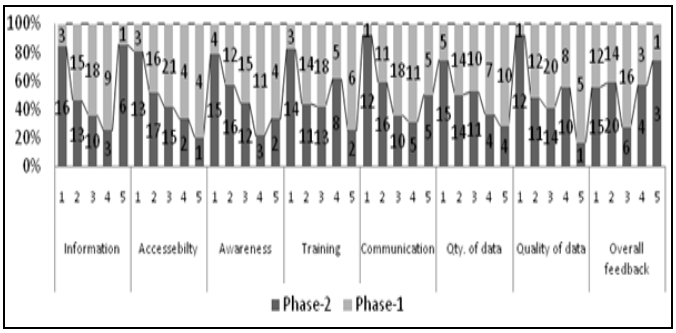

FIG. 15: PSUR NEWS-LETTERS

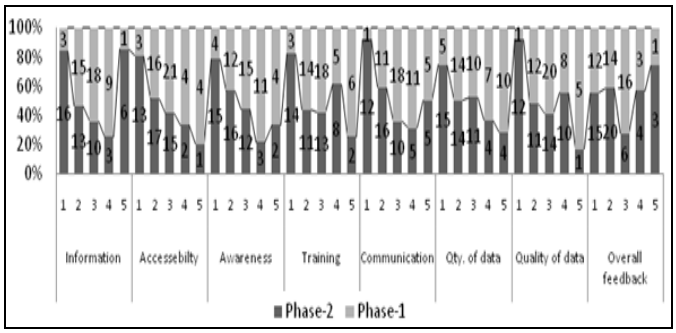

FIG. 16: OVERALL ASSESSMENT

Likert scale (1: Very good; 2: Good, 3: Average; 4: Poor, 5: Very poor)

DISCUSSION: This is among the first studies conducted in a health care setting in India to assess the process, functioning and implementation of drug safety reporting network in a tertiary care hospital. Therefore, there is a lack of data available from similar studies to compare the outcomes of this study. We have discussed here the outcomes along with indicators of the selection process carried out *via* Delphi methods and perception of HCPs towards ADR reporting, which have been reported in other developed countries. Clinical pharmacists are involved in improving the quality of patient care by assisting HCPs in promoting rational use of drugs, collaboratively, owning collective responsibility. This needs to be achieved by a validating system, process and follow-up, for effective, safe and efficient drug therapy [19]. Responses on Likert five-point scales give more depth of understanding on the queries concerned, compared to binary questions, which give only 2 answer options. Likert scale helped to decide whether HCPs strongly agree or strongly disagree with any system or process [18, 20].

It is always difficult to achieve 100% consensus in any group of people and experts are no exception. There is a lot of debate among researchers over what percentage of consensus among experts is acceptable with the Delphi method. The anticipation of Loughlin and Moore's in 1971 gave the acceptable consensus level at 51%. Green and Mckenna in 2002 report higher levels of consensus as desirable, setting their targets at 75% and 80% respectively. As there is no universal consensus on the level of consensus, Keeney in 2006 has proposed that researchers should choose the consensus level before initiating the study and always keep a high level of consensus of about 70%. Therefore, we decided to add or delete performance indicators and success factors in the final PFAQ for reaching 70% consensus among the Delphi panel. We have constituted 10 members expert panel (Delphi panel) for 2 PFAQ review rounds because; there is neither any recommendation nor indisputable consensus on "small" or "large" samples. There is no universal method or criteria specified for the selection of sample size. There have been studies reported with virtually any panel size [16, 17]. Responses to PFAQ *via* HCPs were better at 58.75% in our study compared to a similar study conducted in Malaysia (18%) to assess perception pattern of physicians towards ADR reporting [20].

United States Agency for International Development (USAID) in Ethiopia suggests the importance of why such drug reporting networks and training platforms are necessary for HCPs to encourage ADR reporting. The study suggests that about two-thirds 411 (65.8%) of the respondents had insufficient knowledge of the ADR reporting system. A very small proportion of respondents 101(16.2%) had ever reported ADRs they encountered during their professional practice [21]. ADR monitoring and reporting are still significantly suboptimal, even when many regional or national incident reporting schemes are in place. The outcome of one systematic review of papers published between 1986 and 2006 from Europe suggest that underreporting of ADRs was due to

lack of knowledge (95%), time shortage (77%), inappropriate report filling apprehension (72%), lack of interest and uncertainty about causality (67%), and perception of licensed drugs as safe (47%) [22]. One related study of perception on ADR reporting among physicians, in government and private hospitals in Kuwait, reveals that private physicians demonstrated a better knowledge of PV basics (75.8% *vs.* 65.3%; P = 0.001) and practice (75.2% *vs.* 64.8%; P = 0.002) [23]. A similar study carried out in Kolkata, India found that 92% of physicians in hospital settings believed that reporting ADRs is necessary and would benefit the patient. While 74% of physicians have a belief that ADR reporting is a professional obligation for doctors. That means HCPs are aware of ADR monitoring and reporting process, but the lack of implementation of such programme of drug safety reporting network in health care setup resist them to report ADRs [24].

Thus, this study justifies the significance of such drug safety reporting network in any health care system. The study results reveal that HCPs are better informed (52%), have better accessibility (54.1%), are more aware (52%), have gone through appropriate trainings (56.2%), have better communication with PSUR team and work station (54.1%), agreed to quantity (54.1%) and quality of data(56.2%) has improved and there is overall improvement (68.75%) in the drug safety reporting and monitoring system during the Phase 2 period since the PSUR system implementation (Phase 1). This significant improvement in perception and awareness among the HCPs about the knowledge, process, and functioning of implemented PSUR system in the hospital is helping them keep a constant vigil on the drugs, and ADR reports.

CONCLUSION: The current study supports the crucial importance of how implementing a drug safety and PSUR network can benefit the HCPs to keep surveillance on drugs for their safety and to overcome the unnecessary burden of ADRs and associated mortality especially in the Indian setup. Our Study outlines how a formal drug safety reporting network can be implemented in any hospital by utilizing existing resources in the right spirit and without additional capital investment in training or new hiring. PSUR system implementation in tertiary care hospitals has its benefits, which involves the participation of all players across the healthcare team, including students and interns. Linking of such systems with educational programmes also help to promote awareness on ADR reporting and analysis among the HCPs. Accessibility to the ADR data is of utmost need, especially for ethnically diverse countries like India. Most of the clinical trial and safety data originate from developed countries. There is just minimal contribution from India in global clinical or safety studies. India conducts very few formal clinical trials. Lack of stringent laws in practice discourages developed countries from investing in Indian trials. Drug safety and PSUR network implementation in hospitals is a road map to generate accurate drug safety surveillance data and assist DCGI in the assessment of safety-related issues of newer drugs and to validate PSURs submitted by MAHs. Drug safety reports (PSURs) generated by tertiary care hospitals are unlikely to be tainted by conflicts and can provide more accurate data accessible to the general public. Dissemination of PSUR outcomes in the form of newsletters, publications, etc. add significance to the exercise.

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