

Introducing NepalEHR; contributing national Health Management Information System (HMIS) through automation of aggregated facility-based reports using integrated electronic health records (EHRs)

Introduction and history

NepalEHR (an open-source software) is an integrated electronic medical record (EMR), built to keep patients' organized documents of medical history, the complication a patient has, and the prescription to follow in the future. ^[1, 2] Integrated EMR differs from an ordinary EMR as it encompasses patients' longitudinal care across outpatient, in-patient, emergency, laboratory, radiology, and pharmacy site of patient care. ^[2,3,4] It also has store management, an insurance support system, DHIS2 integrated module, which an ordinary EMR across the country fails to keep a record of. In addition, it can be generalized as a holistic patient health tracker software.

Looking behind using integrated EMR in Nepal, it was first used by an organization called Nyaya Health Nepal (NHN) as a pilot in Bayalpata hospital (residing in the hilly remote district Achham) in 2015. ^[1] The integrated system included all the vertical programs of the government in its digital forms and provided electronic data to prepare monthly facility reports for the national Health Management Information System (HMIS). Different modules inside clinical service can be observed in figure (ii). It can be tracked for the first time in the history of the country's health system as well.

Currently, NepalEHR is being accepted and used at the provincial level. NepalEHR seems to be accepted and utilized in both low-resource settings as well as in district hospitals and other hospitals of Nepal. However, it has the potential to incorporate and solve health information management



Figure i: NepalEHR login page

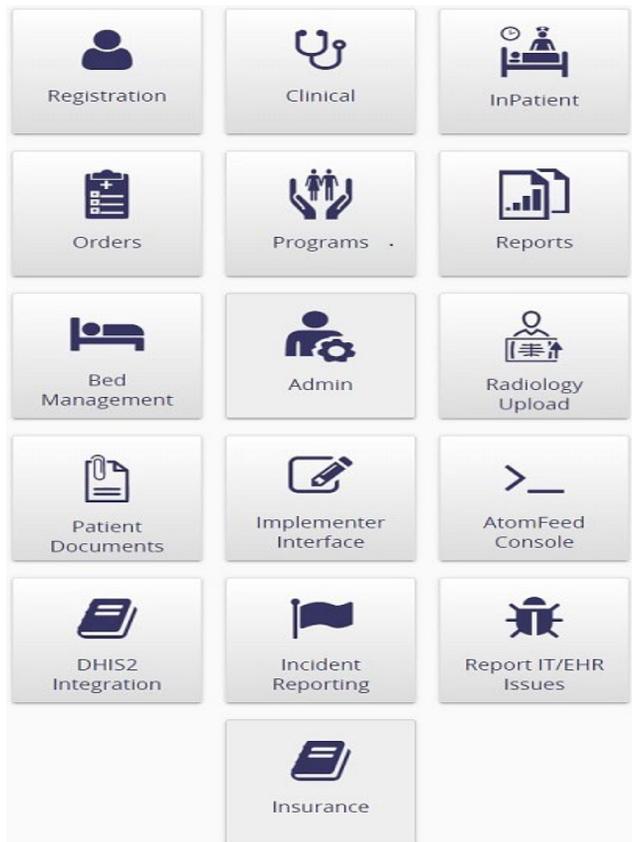


Figure ii: Different modules inside clinical service

and data-related issue nationwide.

Reporting structure and DHIS2

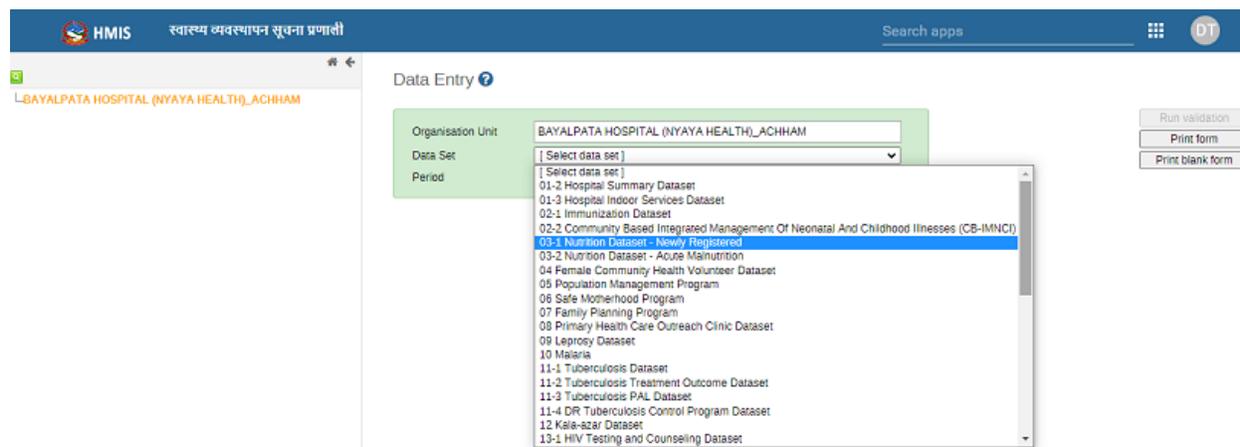


Figure iii: DHIS2 data entry selection page

Ministry of health and population (MoHP), Nepal has a reporting structure, which governs priority health programs from the municipal level to the central level. It has nine different types of forms based on the priority programs; the ninth one has reporting forms and covers five different levels of the reporting form. Current HMIS uses paper based HMIS tools to record data, aggregate records on HMIS paper forms, and deliver them to the municipal office or District health/public health office. It is then put on DHIS2 as shown in figure (iii). DHIS2 is also open-source software, that is being used in more than 70 countries; ^[8] it is easy to use and needs 2-3 days of basic training to master it for recording, reporting and information sharing purposes. Its user interface, data entry, validation of data, and visualizers are built so conveniently that a computer literate can start using it with a short orientation. The government started using this software as a national reporting platform in 2017.

On average, the process of report preparation and submission into DHIS2 takes a week or more. This paper-based tool is serving national HMIS since 1993. These paper forms were designed to aggregate facility and community health data into national health reports. These paper records encounter human errors while recording, reading hand-written data, aggregating the data, and entering the report/data on a web-based platform. ^[5,7] The process is not error-free and tends to affect data analysis and national-level decision-making and policy implementation.

As defined by MoHP Nepal in “Hospital Management Strengthening Program (HMSP)”, a checklist to identify gaps in minimum service standards of district hospitals says, “Patient’s registration should be computerized using standard software.” ^[7] However, it still lacks reliable software, which can assure the standard of the national health record. The country seems to be waiting for reliable national software to onboard in the national health management information system. NepalEHR is built to satisfy the national requirement of keeping digital patient records and solves issues of human errors during report preparation. Facility level reporting continues from HMIS 9.3 and onwards. EHR’s observation forms are based on the national HMIS programmatic forms and program guidelines to fulfill the requirement of both clinical protocols to be followed and to prepare the HMIS report.

The integration module makes work easier in preparing the national HMIS report

The digital platform, NepalEHR is integrated with national HMIS's reporting platform-DHIS2 through the "DHIS2 integration" module in EMR. It provides aggregated platform for entire hospital-based data for national HMIS reports, where data can be pushed directly from NepalEHR into the national DHIS2 platform. The full phased implementation of the data integration module in NepalEHR has been successfully used in several public-private, public, district, and province hospitals in provinces 3, 5,6, and 7 of Nepal.



Figure iv: DHIS2 integration module inside clinical service in NepalEHR

NepalEHR has the entire data source to fulfill the required facility-based data to complete national HMIS reports from the health post level to the central-level hospitals. Aggregated facility-based data required for HMIS 9.3, 9.4, and 9.5 can be pushed from NepalEHR's "DHIS2 integration" module to the government's DHIS2 platform (as shown in figure (iv)). The submitted report shows status as "complete" as it is pushed successfully to the DHIS2 platform and if it is unable to push, status as "failed or incomplete" will be displayed (as shown in figure v). In failed conditions, one

Programs					
Name	Nepali Month		Comments (*)		Status
01 Reporting Status Dataset	Shrawar ▼ 2077 ▼	Download	submit	Submit to DHIS2	Incomplete
02-1 Immunization Dataset	Shrawar ▼ 2077 ▼	Download	submit	Submit to DHIS2	Complete
02-2 Community Based Integrated Management Of Neonatal And Childhood Illnesses (CBIMNCI) 2-59 months	Shrawar ▼ 2077 ▼	Download	Submit	Submit to DHIS2	Complete
02-2 Community Based Integrated Management Of Neonatal And Childhood Illnesses (CBIMNCI) less than 2 months	Shrawar ▼ 2077 ▼	Download	Submit	Submit to DHIS2	Complete
03-1 Nutrition Dataset Newly Registered	Shrawar ▼ 2077 ▼	Download	Submit	Submit to DHIS2	Complete
03-2 Nutrition Acute Malnutrition	Shrawar ▼ 2077 ▼	Download	Submit	Submit to DHIS2	Complete
06 Safe Motherhood Program	Shrawar ▼ 2077 ▼	Download	Submit	Submit to DHIS2	Complete
07-Family Planning Program	Shrawar ▼ 2077 ▼	Download	Submit	Submit to DHIS2	Complete
09 Leprosy Dataset	Shrawar ▼ 2077 ▼	Download	Submit	Submit to DHIS2	Complete
11 Tuberculosis Control Program	Shrawar ▼ 2077 ▼	Download	Submit	Submit to DHIS2	Incomplete
13 HIV-AIDS	Shrawar ▼ 2077 ▼	Download	Submit	Submit to DHIS2	Complete
14 Gender Equity and Social Inclusion Dataset	Shrawar ▼ 2077 ▼	Download	Submit	Submit to DHIS2	Incomplete
15 OPD Programs(1-5)	Shrawar ▼ 2077 ▼	Download	Submit	Submit to DHIS2	Complete
15 OPD Programs(6-10)	Shrawar ▼ 2077 ▼	Download	Submit	Submit to DHIS2	Complete
15 OPD Programs(11-15)	Shrawar ▼ 2077 ▼	Download	Submit	Submit to DHIS2	Complete
16 Laboratory Services Dataset	Shrawar ▼ 2077 ▼	Download	Submit	Submit to DHIS2	Complete
16 Laboratory Services Dataset(Other)	Shrawar ▼ 2077 ▼	Download	Submit	Submit to DHIS2	Complete
17-1 Hospital Summary Dataset	Shrawar ▼ 2077 ▼	Download	Submit	Submit to DHIS2	Incomplete
17-2 Hospital Indoor Services Dataset	Shrawar ▼ 2077 ▼	Download	Submit	Submit to DHIS2	Complete
18-01 Inpatient Morbidity Dataset	Shrawar ▼ 2077 ▼	Download	Submit	Submit to DHIS2	Complete
EWARS Plus	Shrawar ▼ 2077 ▼	Download		Submit to DHIS2	

Figure v: Showing report submission status of HMIS listed programs in DHIS2 integration module

can resubmit and ensure its status of completeness.

The focal person for reporting or medical recorder then verifies the data in the DHIS2 platform and the dataset is clicked on “Complete” in DHIS2 to submit all the data available (as shown in figure v). The process takes less than 15 minutes with medium internet bandwidth. Comparing the current time taken to prepare a monthly HMIS report to submission of it in DHIS2, it is much faster, and the data submitted are also error-free i.e. it exactly comes from original data recording forms. In addition, the data set can be reviewed in excel format before submission as well, which can be used for sharing aggregated monthly data with other stakeholders and can be used for program monitoring and improvement as well. It is useful for focal persons and team leaders to monitor the progress of the individual program. This integration work, which aggregates electronic data of a health facility and sends it to a national reporting platform, is one

Data Set: 06 Safe Motherhood Program
 Period: Shrawan 2077 Prev year Next year

५. सुरक्षित मातृत्व कार्यक्रम

गर्भवती सेवा	< २० वर्ष	≥ २० वर्ष
पहिलो पटक गर्भवती जाँच गरिएका महिला	7	63
दोस्रो महिनामा गर्भवती जाँच गरिएका महिला	7	32
प्रोटोकल अनुसार ४ पटक गर्भवती जाँच	3	18
प्रसूति सेवा		
दक्ष प्रसूतिकर्मीबाट	87	
अन्य स्वास्थ्यकर्मीबाट	0	
प्रसूतिको किसिम	Presentation	
	Cephalic	Shoulder
	Breech	
सामान्य	62	0
भाकुम/फोरसेप	0	0
सत्यक्रिया	2	2
प्रसूतिको परिणाम	एकल बच्चा	बहु बच्चा
		जुम्याहा
		≥ तिम्प्याहा
आमाहरूको संख्या	67	0
जम्मा जीवित जन्म		
महिला	28	0
पुरुष	28	0
जन्म तौल	जिवित जन्म	
	जम्मा संख्या	विकलांग
सामान्य (≥ २.५ के.जी.)	62	1
कम (१.५ - < २.५ के.जी.)	0	0
धेरै कम (< १.५ के.जी.)	1	0
मृत जन्म संख्या		
Fresh	0	
Macerated	1	
नाभी मलमल लगाएको	0	
रक्त संचार गरिएका		
महिला	0	
पिन्ट	0	
सुत्केरी जाँच	२४ घण्टा भित्र	66
	प्रोटोकल अनुसार ३ पटक	4

Obstetric Complications	ICD Code	Number
Ectopic pregnancy	O00	0
Abortion complication	O08	0
Preg.-induced hypertension	O13	1
Severe/Pre-eclampsia	O14	0
Eclampsia	O16	0
Hyperemesis gravidarum	O21.0	0
Antepartum haemorrhage	O46	0
Prolonged labour	O63	0
Obstructed Labor	O64-O66	0
Ruptured uterus	S37.6	0
Postpartum haemorrhage	O72	0
Retained placentas	O73	2
Puerperal sepsis	O86	0
Other complications	O76	3
स्वास्थ्य संस्थामा भएको मातृ मृत्यु	गर्भावस्था	प्रसूति अवस्था
	0	0
	सुत्केरी अवस्था	स्वास्थ्य संस्थामा भएको नवजात शिशु मृत्यु
	0	0
आमा सुरक्षा कार्यक्रम		महिला संख्या
	यातायात खर्च	पाउनुपर्ने
प्रोत्साहन	67	67
	गर्भवती उत्प्रेरण	पाएका
	0	67
सुरक्षित गर्भवतन सेवा		
	मेडिकल	सर्विकल
गर्भवतन सेवा पाएका जम्मा महिला	< २० वर्ष	2
	≥ २० वर्ष	26
गर्भवतन पक्षत प. नि. साधन अपनाएका	छोटो अवधिको	13
	सानो अवधिको	3
गर्भवतन पक्षत जटिलता भएका	3	0
PAC सेवा पाएका	10	

Complete
Incomplete
Run validation

Figure vi: Gov. DHIS2 platform showing status of safe motherhood report, sent from DHIS2 integration module

of its first kind in the country.

Conclusion

The time has now come for the government's assent in implementing national EMR software to prevent data errors and the use of information efficiently. It is easy to retrieve electronic data compared to a paper-based system. Due to the scarcity of space in keeping bulky Calculating the budget required to procure, use, and store the paper forms in a facility, the integrated EMR can be a substitute for paper-based records/reports from both space and financial perspectives. The integrated EMR is a one-time investment and the electronic medium can be friendlier to its implementers in many ways. In a nuts shell, implementing NepalEHR can be an opportunity in improving data management and information sharing by the nation in a holistic approach.

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