i-MANN: A Web-Based System for Data Management of Mental Health Research in India

Jasmine Kaur[1,2,3,4], Vijay C Verma[1,2], Vinit Kumar[1,2], Ravinder Singh[5], Triptish Bhatia[6], Sushree Sahu[6], Madhur Manak[1,2], Harish Kumar Buttolia[1,2], Bhavik Choudhary[1,2], Yogesh Singh Sharma[1,2], Santosh Kumar Shah[1,2], Prabhat Kumar[1,2], Jasleen Kaur[1,2], Smita Deshpande[6,7], Harpreet Singh[1,2]

ABSTRACT

Background: National Mental Health Program (NMHP) was launched by the government with an aim to improve mental health of the society through precise and focused interventions and policies. In order to provide reliable data and evidence for NMHP, there is a strong requirement of a comprehensive system for integrative collection, storage, and analysis of data generated by this program.

Methods: Data collection tools, questionnaires, instruments, and scales provided by the National Coordinating Unit were digitized using the District Health Information Software 2 (DHIS2) framework (version 2.30). The rules for data validation and automated scoring were implemented as per the scales. The developed system (i-MANN, ICMR-Mental Health Assessment National Network) is based on modular architecture with role-based access to data input forms and dashboards.

Results: The data are stored on a centralized server at ICMR. i-MANN captures data on basic and advanced demographic details followed by category specific forms from 15 multicentric ICMR-funded projects. Data collection module is divided into 12 categories containing 93 scales/instruments with built-in validation rules, scoring patterns, and indicators. As of August 2020, the system contains 17,690 records.

Conclusions: i-MANN is the first web-based, modular, robust, and extendable system for collection, integration, management, and analysis of data on mental health in India.

Keywords: API, capacity building, database, data management, datasets and data elements, DHIS2, e-Health, i-MANN, implementation, server

Key Messages: The major objective of the paper is to discuss the development of a modular and extendible web-based system for collection, integration, management, and analysis of data from various projects on mental health. In future perspective, the authors intend to make this tool (with copyright free scales) available for use by researchers working on different areas of mental health.

Mental disorders encompass a variety of illnesses ranging from mild anxiety to severe abnormalities,[1,2] thus affecting 970 million people worldwide (about 12% of global population).[3] According to the projections in Indian National Mental Health Survey 2016, 170 million adult

[1]Division of Biomedical Informatics (BMI), Indian Council of Medical Research, Ansari Nagar, New Delhi, Delhi, India. [2]Data Management Laboratory, Indian Council of Medical Research, New Delhi, Delhi, India. [3]School of Computational & Integrative Sciences, Jawaharlal Nehru University, New Delhi, Delhi, India. [4]Data Science Laboratory, Amity Institute of Integrative Science & Health, Amity University, Gurgaon, Haryana, India. [5]Division of Non-Communicable Diseases (NCD), Indian Council of Medical Research, New Delhi, Delhi, India. [6]National Co-ordination Unit (NCU), Dept. of Psychiatry, Atal Bihari Vajpayee Institute of Medical Sciences and Dr Ram Manohar Lohia Hospital, New Delhi, Delhi, India. [7]Dept. of Psychiatry, Atal Bihari Vajpayee Institute of Medical Sciences and Dr Ram Manohar Lohia Hospital, New Delhi, Delhi, India.

Indians will be suffering from one or more mental disorders by 2020 (more than 20% of India's population).[4] As per 2017 estimates, about 197.3 million people suffered from mental disorders in India, of which 45.7 million had depressive disorders and 44.9 million had anxiety disorders.[5,6] Recognizing mental health as a serious public health indicator, Government of India initiated National Mental Health Program (NMHP) with a larger aim to improve mental health of the society through precise and focused interventions and policies. However, success of NMHP significantly depends on the integrated availability of supporting data and evidence from scientific studies.

Among various Indian public health programs generating data on different aspects of mental health, the ICMR Capacity Building Task Force for NMHP is unique.[6] It includes 12 mental health implementation research proposals (five multicentric and seven single site projects, with 24 principal investigators [PIs] across 15 sites). Once the projects were approved, there was an imperative need for a one stop repository for collection, management, and analysis of the data.[7–9] There are several databases available across the globe providing free and open access resources on various aspects of mental health disorders (**Table 1**).

Thus, the data management team initiated the development of an open source tool for collecting the data generated from the projects in real time. Considering the features and functionalities of

the DHIS2 (District Health Information Software 2) platform, it was finalized for development of the database after due consultation with participating investigators and experts. The DHIS2 is an open source, web-based health management information system (HMIS) platform, currently being used by 67 low- and middle-income group countries across the globe.[12] It is based on data warehouse model along with open web-based Application System Interface (API) that can provide integrated access to data from multiple sources.[13] The developed system called "i-MANN (ICMR-Mental Health Assessment National Network)" has been implemented in 12 mental health implementation research proposals and has collected more than 17,000 entries till August 2020. The system can help revolutionize digital data collection with real-time monitoring and surveillance in the area of mental health.

Materials and Methods

Prototyping

To develop a comprehensive web-based management system, the very first thing was to identify the required specifics that define the nature of the project. In due deliberations and discussions with the end users and data management experts, following prerequisite were identified.

Software and Hardware Requirements

The project aims to collect the data from multiple locations, and it requires

a web-based modular platform that is supposed to be nonspecialized and inexpensive besides being simple in its use and management. The platform must be portable and flexible enough to accommodate adaptive adjustment and subsequent expansion. The data transfer protocol should be based on World Wide Web (WWW) for more robust security of double encrypted data flow. Conventional data flow protocols such as telnet, ftp/sftp, or ssh do not permit bidirectional data flow, considering the high-end security to the servers.

API requirements

The proposed platform should allow the data export for statistical analysis, user friendly with convenient data entry, and system operation modules which allow accommodation of users with minimal computing and basic equipment skills. A modular, navigable, and machine-readable interface will be required where one can access and navigate through the data element using the provided hyperlink. It should be flexible to contain, organize, and maintain all types of data including images, clinical tests, and personal and demographic information. It has also been realized that the data should be accessed by uniform interface (URLs) through HTTP protocol. This will also enable the third-party developer to develop software without knowing specific technology and design constrains. The complex nature of our implementation research project requires data that

---

TABLE 1.

Various Databases and Data Sets Available Based on Mental Health Resources

Database	Year	Full Name	Remarks
PsyGeNET	2015	Psychiatric disorders Gene association NETwork	Resource for the exploratory analysis of psychiatric diseases and their associated genes
SAMHDA	1992	Substance abuse and Mental Health Data Archive	Resources to reduce the impact of substance abuse and mental illness
PsycINFO	1967	Psychological information	Resource for abstracts and citations of behavioral and social science research
MHSDS	2019	Mental Health Services Data Set	Collects data from the health records of individual children, young people and adults who are in contact with mental health services
PsycBITE	2004	Psychological Database for Brain Impairment Treatment Efficacy	Enables clinicians to quickly identify, evaluate, and implement evidence-based interventions for psychological issues experienced by people with acquired brain impairment
ScotSID	2009	Scottish Suicide Information Database	Individuals who have died due to probable suicides registered with the National Records of Scotland (NRS)
PsyBASE		Psychological database	Practice Management Software for Auxiliary Healthcare Professionals

To the best of our knowledge, there is no open source system available in public domain for collection/integration of data from multiple sources and multiple domains of mental health.[10,11]

can be retrieved in most popular formats of the web such as HTML, XML, JSON, PDF, and PNG, which could be widely supported in most of the programming languages with a wide range of implementation options.

Data Flow and Security

The platform must enable real-time data entry and data validation from multiple sites and allow double encrypted inbound and outbound data transfer. The online real-time information and storage of data especially multiple variables investigated through follow-ups should be maintained on a central server linked to the repository for all incoming data from various sites. The data entry needs to be continuously monitored and data to be verified for its integrity and completeness.

The collected data are structured and comprise values based on the scales selected by the PIs. Patient images, health records, audio files, pharmaceutical details, etc are not collected as a part of these projects. Sensitive identifiers like Aadhaar, name, contact number, etc. are also NOT uploaded into the database. Only site IDs, PI IDs, and individual IDs are stored. Since the database is developed in a recognized DHIS2 framework, the collected data can be easily exchanged with any other system developed in DHIS2. For exchange of data with other tools, DHIS allows data import export options in a variety of formats.

Several security features are implemented, such as two factor authentication, role-based access (password protected access to role-based pages),

strong firewall, and use of SSL (HTTPS/ encryption).

The Platform

Considering the requirements and features of DHIS2 (dhis2.org) framework, it was finalized for the development of *i*-MANN. Additionally, being open source external applications (apps) can easily be developed to introduce new functionality to the core platform. Moreover, DHIS2 has strong built-in data analytical dashboards integrated with geographic information system (GIS). The developed system is hosted on Ubuntu 18.04 platform.

System Design and Development

The system was designed based on inputs from 21 investigators from the ICMR Implementation Research on National Mental Health Programme. National Coordinating Unit (NCU) collected and compiled requirements from the investigators and coordinated with the Data Management Unit (DMU) for system design and development. Based on requirements, DMU developed System Requirements Specifications, created data elements, designed data flow and entry screens, and implemented validation rules (**Figures 1** and **2**).

PIs were requested to choose copyright free instruments, as the database would eventually be free for public use. Lengthy scales were split into multiple data entry screens. The first prototype was developed on DHIS 2.29 version and rolled out in October 2018 for pilot testing.
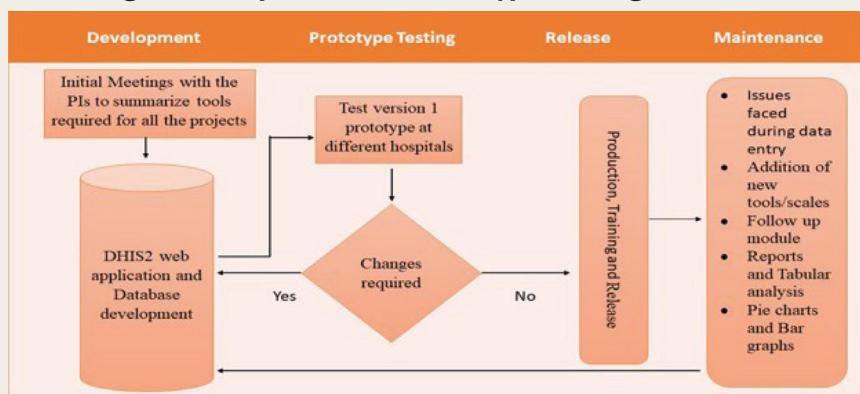
After feedback from all PIs, the tool was re-designed. Each scale/instrument used for collecting data on a specific aspect of mental health indicator was developed as an independent information provision module. Developed modules were further grouped into 12 different programs (excluding basic and advanced sociodemographic sections) (**Table 2**).

Data Modules and Access

In consultation with the NCU, role-based access for data entry and analysis was allowed to different sites/PIs. Data access and analysis was site-specific, and users were not allowed to access or analyze data from other user's data. With the modular design of the tool, dynamic access to the modules could be easily incorporated. Three types of modules were distinguished: (a) basic module, which included common registration and enrollment forms; (b) information provision module, which comprised different scales or instruments for different PIs from multiple locations; and (c) analytics module, which provided basic analytical tools including the data downloaded in different variable formats. Technically, the database components and its virtual interface allow to collect all data entry forms including importing data through LMIS (logistic management information system), EMR (electronic medical records), and HR (human resource) analytics which is then fed into the data analytic module for metadata analysis and the outcome is supported through graphics, maps, and infographics (**Figure 2**).

Results

i-MANN Database

The final version of the tool was developed in DHIS 2.30 and released to all the sites in early 2019. Each site has been provided a user account for data entry and analysis. Quality check of the data is done by NCU. The final version has a total of 93 scales/instruments digitized based on the study proposals. These instruments are regularly being used by research personnel for mental health interventions related to suicidality, depression, alcohol abuse disorders, autism, and various aspects of community and telemedicine.

FIGURE 1.

The Design, Development, and Prototype Testing Protocol

DHIS2, District Health Information Software 2; PI, principal investigator.

The *i*-MANN Database Components and Its Virtual Interface. The database is enabled to collect all data entry forms including importing data through LMIS (logistic management information system), EMR (electronic medical records), and HR (human resource) analytics and analyze them in order to identify data elements. DHIS2, District Health Information Software 2; *i*-MANN, ICMR-Mental Health Assessment National Network.
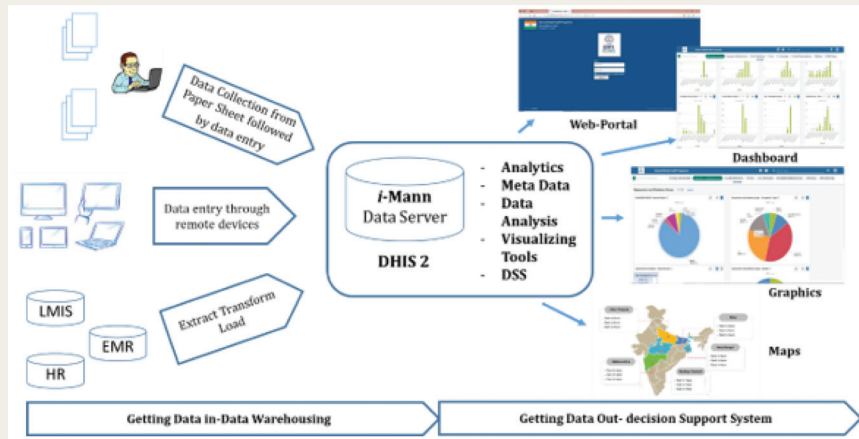
DSS: Decision Support System

Data Entry and Quality Control

Data from all the sites are captured using web-based data entry form. Upon authentication, user can access only allowed scales/modules/sections. Basic data validations such as data type, value range, conditional data fields, etc. have been incorporated into the system. The system allows follow-up data for individual participants accessible by the date of visit. Access to records is strictly site specific; however, NCU can view and manage all records. NCU can also monitor the data entry progress at each site and monitor data quality. A consolidated monitoring dashboard was developed for NCU to monitor all sites on one dashboard. PIs can edit their data but cannot delete any entry from their dashboard (**Figure 3**). NCU regularly checks all data for quality control (QC), outliers, or incorrect entries, and co-ordinates with PIs for checking and

TABLE 2.

Projects and Scales in i-MANN (a Total of 12 Programs, Grouped by Mental Health Interventions, Accommodating 93 Individual Modules)

| Group/Programs	Mental Health Indicators	Total No. of Modules	Name of Some Representative Modules*
Program-1	Telemedicine in alcohol use disorders (AUDs)	9	1. Clinical Global Impression Scale—Schizophrenia Version Indian 2. Indian Disability Evaluation Assessment Scale 3. Burden Assessment Schedule of SCARF 4. WHO Disability Assessment Schedule 5. Brief Addiction Rating Scale
Program-2	AUD in tribal adolescents	4	1. Alcohol, Smoking and Substance Involvement Screening Test
Program-3	Managing depression in diabetes	11	1. Five Facet Mindfulness Questionnaire 2. Hamilton Depression Rating Scale 3. Hamilton Anxiety Rating Scale 4. Diabetes Distress Screening Scale 5. WHO Quality of Life
Program-4	Intervention for depression in pregnancy	14	1. Post Natal child Assessment WHO Quality of Life—Brief 2. Post Natal Care—Follow-Up form 3. Patient Health Questionnaire 2 and 9
Program-5	Future suicide risk in suicide attempters	11	1. Alcohol Use Disorders Identification Test 2. Visual Analog Scale 3. Presumptive Stressful Life Events Scale
Program-6	Community-based intervention on mental health	2	1. Hopkins Symptoms Checklist

(Table 2 continued)

(Table 2 continued)

Group/Programs	Mental Health Indicators	Total No. of Modules	Name of Some Representative Modules*
Program-7	Psychiatric services to the severely mentally ill	6	1. Severe Mental Illnesses-Elderly Questionnaire 2. Client Satisfaction Questionnaire 3. Barriers to Access to Care Evaluation
Program-8	Community-level module for psychiatric illness	10	1. WHO Physical Measurement 2. WHO Demographic Information 3. WHO Behavioural Measurements 4. WHO Biochemical Measurements
Program-9	Community-based rehabilitation	8	1. Community-Based Rehabilitation (CBR) Matrix 2. Clinical Global Impressions-BP Version 3. WHO- Disability Assessment Schedule 4. Community Attitude Towards Mental Illness 5. Clinical Global Impression Scale-Schizophrenia Version
Program-10	Validation of screening version of Indian Scale for Assessment of Autism	4	1. Developmental History Records 2. Indian Autism Screening Questionnaire 3. Indian Scale for Assessment of Autism
Program-11	Community extension clinics	10	1. Hamilton Anxiety Rating Scale 2. Hamilton Depression Rating Scale 3. Barriers to Access to Care Evaluation
Program-12	Psychological intervention by video conference for vulnerable family members of farmers who have committed suicide	4	1. Hamilton Depression Rating Scale 2. Short General Health Questionnaire 3. Hopelessness Depression Symptom Questionnaire

*Only free scales.
i-MANN, ICMR-Mental Health Assessment National Network.

FIGURE 3.

Data Flow into the *i*-MANN (ICMR-Mental Health Assessment National Network) Database
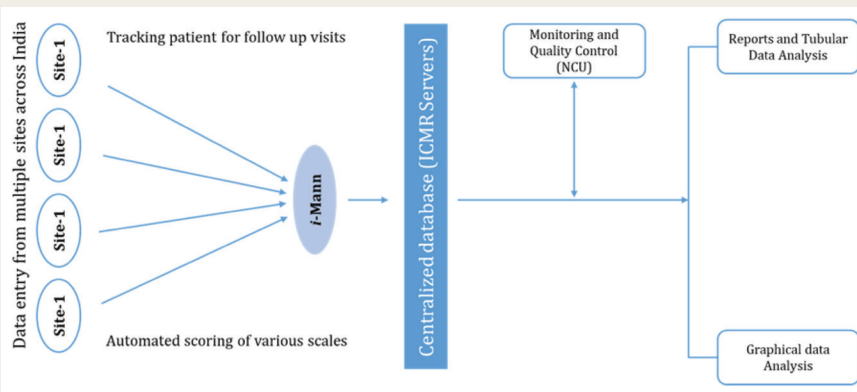
correcting entries. NCU and DMU are actively engaged in data validation on routine basis for any issues in the uploaded data. The PIs were immediately asked to intervene if any such discrepancy is observed in their data and fixed the issue.

Data Analysis Dashboards

The system allows real-time data analysis for validated records using visualization tools. Separate dashboards for each individual PI are also available. NCU has a dashboard where it can observe dashboards of all PIs and their data entry status. NCU has exclusive rights to access and modify and/or delete the data from all PI's dashboard if they find that the data are false or incorrect. The dashboard is enabled both in tabular and graphical displays (**Figure** 4).

Additionally, individual dashboards for users display the number of patients enrolled and basic analytics such as enrolled patients by occupation, sex, or any other category filled in enrollment form (**Figure** 5).

The system has built-in tables and graphs for visualization of data entered from various sites. We have developed monthly and quarterly time-trend graphs with drop-down options to visualize multiple time period graphs. The graphs are interconvertible into tabulated forms. Apart from graphics, we have several analytical graphs and maps options like geographical mapping, time trend graphs, pie charts, and thematic maps. The dashboards are interactive and can be used to perform various

FIGURE 4.

The Dashboard View of the i-MANN (ICMR-Mental Health Assessment National Network) Database, Both Tabular and Graphical Display
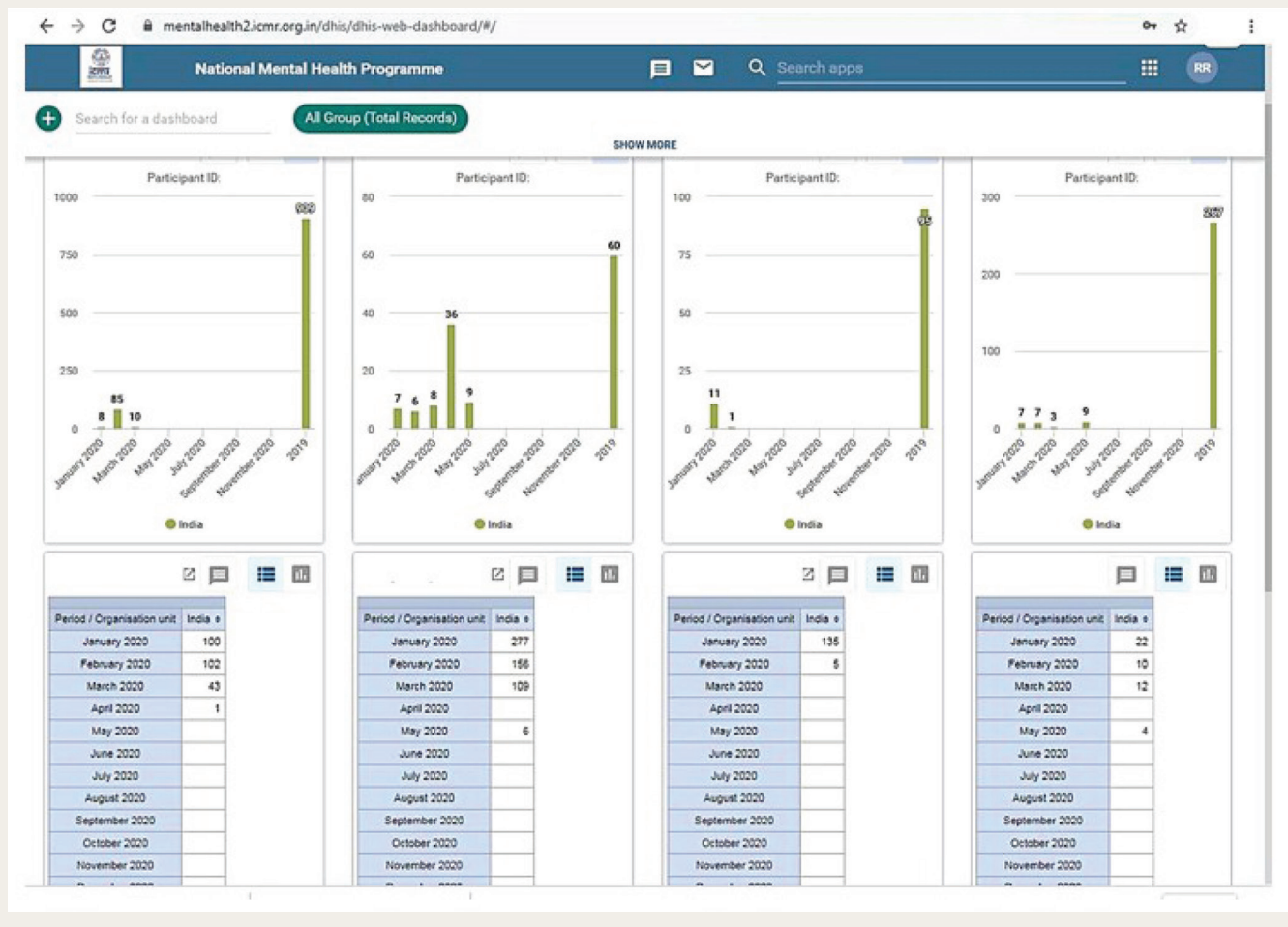
analyses. Graphs can be downloaded as image and/or pdf. Additionally, data used in graphs can be downloaded in excel format.

Server and Data Security, Confidentiality, and Interoperability

Security of the research data has been a high priority, and multitier approach is adapted to secure data and server security. Since our system is a web-based system, the monitoring of inbound and outbound internet data traffic is the first line of defense we adopted. Role-based access and unique participation IDs were generated both for user sites and for PIs. Two factor authentications are enabled but are optional for users. The database provides limited, authorized, password protected access to PIs only. It enforces security on different components of the

database like data storage, servers, management, and workflow of the database systems. Since our system is DHIS2 based, it is capable of integration and interoperability. DHIS2 is designed as a data warehouse model, can receive and host data from different data sources, and share it to other systems and reporting mechanisms.
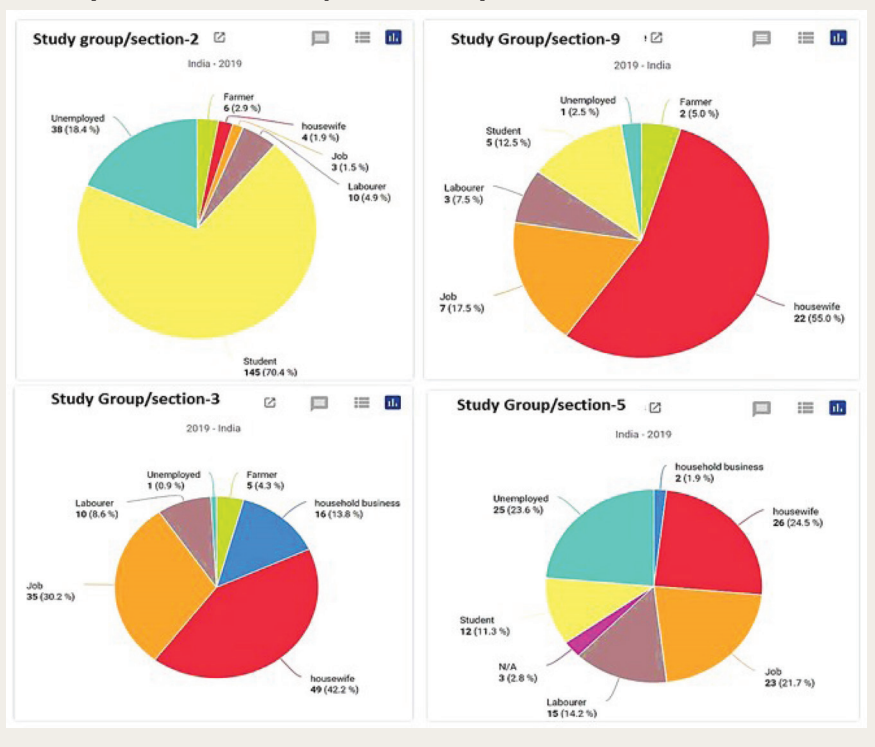
Discussion

i-MANN is the first of its kind in India, a curated and secure database for building a permanent resource in mental health research in India. This platform, where more than 21 different sites all across the India are involved in collecting data on several aspects of mental health indicators, provides real-time data entry. Compared to other existing database like PsyGeNET, which only focusses on genetic markers; PsycBITE on brain impairment and treatment

efficacy; ScotSID on suicide information, PsyBASE for auxiliary healthcare professionals, the i-MANN deals with multiple health indicators that include autism, suicide, depression, telemedicine, and community medicine on a single platform, no such efforts have been made to develop such a diversified platform/system. The uniqueness of this curated database is that instead of focusing on any specific mental health indicator, it serves multiple mental health indicators and that too from different investigators from different parts of the country. Potentially portable, it has a flexible framework with expansibility, and can be adapted for use in multiple auxiliary devices. Being developed in DHIS2, the i-MANN database is enabled for third-party software clients running on devices such as mobile phones, smartphones, and tablets and can connect to its servers through web API and read and write to

FIGURE 5.

The Basic Analytical Module of the i-MANN (ICMR-Mental Health Assessment National Network) Database, Depicting the Individual Dashboard of Users Considering the Number of Total Participants Recruited by Their Occupation

Therefore, multiple PIs who were to use common scales and instruments were grouped together (**Figure 3**), and selective access between the modules was granted for PIs and their groups. A total of 93 mental health screening and assessment tools/instruments were digitalized. Many tools are copyrighted and monetized and required permission to use both in hard copy and digital form. NCU in co-ordination with PIs obtained these copyright permissions for use on the *i*-MANN platform. However, copyright exemptions are exclusively for these projects and new projects or users will need renewed permission. Users would be able to freely use only copyright free instruments available on the platform.

The huge data traffic from multiple sites and its quality control as data matrix are even more challenging. To make the monitoring user friendly, the NCU has been provided a separate administrative account, where administrators can visualize the data entered by each PI on their dashboard.

i-MANN has strong inbuilt security features. All the data received at a centralized ICMR server are properly encrypted/encoded both at rest and in motion. Apart from access control and access authorization for users, data protection and server security were prioritized by firewalling storage servers. The database has a vast storage of data, which is sensitive and confidential. Considering the importance of its procurement and retrieval, ICMR drafted a Standard Operating Protocol (SOP) which allows access to the data for study purposes by writing to ICMR-DMU and ensuring a noncommercial application of the data.[15]

The features of *i*-MANN that make it a unique and comprehensive mental health data management system are (a) modular structure and customization through user interface; (b) functionalities of export-import of data and metadata, supporting synchronization of offline installations as well as interoperability with other applications; (c) data element entry, validation, and improvement tools in standard lists and tables; (d) integration of external report design tools; (e) flexible and dynamic data analysis modules; and (f) easy to use user interfaces for metadata management.

The future of research is data driven. For rapid and accurate collection of

relevant resources. This feature further upgrades the database to be user friendly, when PIs can enter their data through tablets and mobile phones.

Availability of a system providing integrated access to mental health data from multiple sources is absolutely essential for providing necessary evidence for the mandates of NMHP so as to enable formulation of effective policies and stronger implementation of the NMHP. Our system can be used to generate all kinds of psychiatric indicators for informed policy making, from research to epidemiology to implementation. Strong in-built analytics and integrated access through R renders *i*-MANN ideally suited for large-scale implementation and use by multiple stakeholders. It is best suited for collection of data under NMHP in field conditions. The system has the capability of generating stronger evidence for the implementation programs. The *i*-MANN database can revolutionize digital data collection and real-time monitoring of research projects, and even create a surveillance

mechanism in mental health research in India. These abilities will further strengthen our capacity to implement large-scale studies at community level with precise command over the huge data inflow and its management.

Three independent technological architectures have been used in the past for developing integrated data resources. First, it involves transfer of data through emails or physical media followed by use of program to integrate the data. Second technology involves use of client server architecture where sites submit data from browser to a centralized server. Third technology involves the use of APIs to map and integrate data from multiple sources.[14] The *i*-MANN uses both client server architecture for data collected at the participating sites and can be enabled for API enabled mapping and integration for data from other data sources.

Maintaining a data flow in such a diverse environment was a challenge, as only a few scales/instruments were common amongst various studies.

data, while preventing human errors in collecting and entering data, digital platforms will be needed. Digital data collection is the future of all research. In future, a user-friendly data management system is going to be in high demand. This can help in using the data for future projects and can be available for interested researchers. The digital data do not require space and can be stored potentially forever. The major application of *i*-MANN will be creating the "models of care" from collected data and integrating them into NMHP. This huge data set can help government agencies in formulating policy as well.

Limitations

Since the entire system works on internet-based access to the *i*-MANN platform, the issues are the access to high speed internet and devices for collection of data from fields. Appropriately trained human resources are required. Currently, this database is open for the 12 implementation projects of ICMR as a pilot study, and thus research outside the *i*-MANN platform cannot access the database till the ICMR projects get completed. However, ICMR intends to provide conditional and restricted access to the data for researchers for research purpose only that too after ICMR approval. It has been also proposed that once the ICMR projects get completed the access to database can be made public with the condition that user must obtain copyright permissions for their study separately for copyright scales into the *i*-MANN database.

Challenges and Future Directions

There are several new avenues to explore for further refinements of the *i*-MANN database, data visualization and analytics being most crucial. Customization of analytical tools for individual PIs/projects as per the specific tools/instruments used in the study is a major challenge. The

collected analysis of the entire meta-data from all PIs and the sites through interlinking of the data also needs to be developed. The modular design of *i*-MANN is extendable with additional software modules, which can be run either parallel or integrated with database or its menu system. A feature that needs extension is web-based API, which provides navigable and machine reading interface through the hyperlink-based navigation into the data elements and list of forms.

Declaration of Conflicting Interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

References

1. Barnes C and Wills M. *Understanding mental illness: A comprehensive guide to mental health disorders for family and friends*. New York : Skyhorse Publications; 2019.
2. Lancet Editorial Commentary. Think globally, act locally. Lancet Psychiatry 2020; 7: 109.
3. Rise of mental illness worldwide tied to austerity, inequality. *A report in New York Times*, published on June 29, 2019. https://nypost.com/2019/06/26/rise-of-mental-illness-worldwide-tied-to-austerity-inequality/
4. Global Burden of Disease Collaborative Network, Institute for Health Metrics and Evaluation (IHME). *Global burden of disease study 2017 results*. Seattle, USA; 2018.
5. Sagar R, Dandona R, Gururaj G, et al; India State-Level Disease Burden Initiative Mental Disorders Collaborators. The burden of mental disorders across the states of India: The global burden of disease study 1990-2017. Lancet Psychiatry 2020; 7: 148–161.
6. Shidhaye R. Unburden mental health in India: It's time to act now. Lancet Psychiatry 2020; 7: 111–112.
7. Murthy RS. National Mental Health Survey of India 2015–2016. Indian J Psychiatry 2017; 59: 21–26.
8. Pradeep BS, Gururaj G, Varghese M, et al. National Mental Health Survey of India, 2016—Rationale, design and methods. PLoS One 2018; 13: e0205096.
9. Aledavood T, Triana HAM, Alakörkkö T, et al. Data collection for mental health studies through digital platforms: Requirements and design of a prototype. JMIR Res Protoc. 2017; 6: e110.
10. Anderson W, Dhansay MA, Phillips A, et al. Grand challenges in global mental health. Nature 2011; 475: 27–30.
11. Maron E, Baldwin DS, Balõtšev R, et al. Manifesto for an international digital mental health network. Digital Psychiatry 2019; 2: 14–24.
12. Sahay S, Rashidian A, Doctor HV. Challenges and opportunities of using DHIS2 to strengthen health information systems in the Eastern Mediterranean Region: A regional approach. EJISDC 2019; 86: e12108.
13. Hawk M, Nimgaonkar V, Bhatia T, et al. A "Grantathon" model to mentor new investigators in mental health research. Health Res Policy Syst 2017; 15: 92.
14. Aledavood T, Triana Hoyos AM, Alakörkkö T, et al. Data collection for mental health studies through digital platforms: Requirements and design of a prototype. JMIR Res Protoc. 2017; 6(6): e110.
15. Protocol for a coordinated approach for building Capacity of Mental Health Researchers in India. Indian J Psychological Med, (Supplement), 2020 (in press).