ORIGINAL ARTICLE

The next generation of risk assessment and management: Introducing the eHARM

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Big data and analytics are rapidly changing healthcare and enabling a degree of measurement and quality improvement not previously seen. For a variety of reasons, including the limited number of quality indicators in mental healthcare, these technological advances have not yet been introduced in the area of psychiatry. The use of technology to measure, monitor, and assess risk in this area would have a significant impact for key stakeholders, including patients, care providers, and the community. The field of analytics offers an opportunity to increase our understanding of psychiatric populations, target effective programs and interventions, and direct more personalized care at a critical intersection of risk assessment: risk management. The electronic Hamilton Anatomy of Risk Management (eHARM) aims to harness the capabilities afforded by data analytics to enhance the assessment, monitoring, and management of risk within psychiatry at the clinical interface.

Key words

Violence risk assessment, violence risk management, data analytics, eHARM, AIS

Introduction

Healthcare organizations are increasingly seeking ways to modernize their operations to improve patient care, increase productivity, promote cost-efficiency, and streamline everyday practices. This phenomenon is evident through the adoption of electronic health records and health information technologies designed to generate and store data in more accessible electronic formats. Electronic health records aim to organize an overwhelming growth of valuable clinical data, but due to a lack of built-in analytical software, the data is often underutilized [1]. This highlights the need for tools that go beyond merely storing the data to using it to inform clinical decisions, particularly at a time of increased pressure for evidence-based, patient-centered practice [2,3]. Proposed solutions to these challenges include small data analytics, big data analytics, and visual analytics [1,4,5]. Data analytics refers to the systematic use of data through applied analytical disciplines to drive fact-based decision-making for measurement, management, planning, and learning [6]. Similarly, visual analytics refers to the combination of analytical techniques with visual interfaces [7]. These approaches provide outputs in the form of graphical analyses or concise summaries, thereby offering a vast array of uses in healthcare.

Integrating data analytics and psychiatry

Real-time depictions of changes in patient status, treatment, and response over time have the potential to revolutionize clinical decision-making. By accessing a visual of a patient's status over time, clinicians can pinpoint times of decompensation or improvement and better identify the factors that may have led to the changes. Moreover, by combining this data with graphs depicting medication dose, or treatment status over time, clinicians can better understand that individual's treatment responses, therefore allowing for more individualized care.

On a larger scale, the use of data analytics may increase the knowledge and understanding of trajectories of specific illnesses by providing large quantities of data for patients with similarly presenting concerns. This information could then be used to inform best practices by identifying

the most effective treatment options for a particular presentation, for instance. In turn, this data can inform administrative decisions about resource allocation.

As a result, data analytics can inform treatment and care at all organizational levels, increasing the effectiveness and timeliness of care, and promoting a shift towards more proactive treatments [1]. Moreover, the better use of large sectors of data has the potential to improve drug discovery, diagnostics, and resource allocation, thus enabling data-driven decisions at lower costs [8,9].

While data analytics programs have been utilized in healthcare to inform predictive risk assessments, clinical decision-making, in-home health monitoring, finances, and resource allocation [9], such tools have yet to be used in the field of psychiatry. One potential reason for this is a lack of direct indicators within psychiatry which can act as measures of progress over time. Nonetheless, the growth of data analytics within psychiatry would provide unparalleled opportunities for exploration, hypothesis generation, and risk prediction at the clinical, administrative, and research levels [10].

One key consideration within the area of psychiatry is risk, including one's risk to them self and to others. In fact, the risk of harm to others is a primary criterion for certification in mental health legislation for all Canadian jurisdictions [11]. In Canada, an individual's status within the forensic psychiatric system is dependent on their identified risk to others, and the onus is on the designated hospital to determine whether an individual represents a significant risk to the safety of the public [13]. Risk is also a key consideration within general psychiatry, where psychiatrists are typically required to assess risk as frequently as forensic psychiatrists [14]. As a result, risk assessments are necessary in all areas of psychiatry, including emergency, inpatient, and forensic psychiatry [12]. Numerous risk assessment tools have been developed in an effort to assist clinicians in the prediction, assessment, and management of risk. Examples include the Hamilton Anatomy of Risk Management (HARM) [15], Violence Risk Appraisal Guide (VRAG) [16], Historical Clinical Risk Management-20 (HCR-20) [17], and Classification of Violence RISK (COVR) [18]. Such tools provide a unique platform for introducing data analytics to psychiatry due to the wide variety of dynamic recordable indicators measured on a regular basis.

The eHARM: an analytics-based tool

The Hamilton Anatomy of Risk Management (HARM) [15] is a structured professional judgement (SPJ) tool developed for use in a variety of inpatient and outpatient psychiatric settings. The HARM has been adapted for forensic, general, community, correctional, and youth psychiatric settings. Designed for use in a multidisciplinary team setting, the HARM guides assessors to formulate opinions regarding risk of violence and guides discussions of risk and risk management through three stages: past, present, and future. Stage one consists of historical risk factors such as major mental illness, substance use, cognitive deficits, and criminal history. Stage two consists of empirically-supported and dynamic risk factors and protective factors. Risk factors are recorded based on their presence, status ("managed," "monitor," "needs improvement"), and change from the previous report ("better," "worse," "same"). Finally, stage three consists of final risk estimates, which includes an individual's clinical likelihood of violence and escape risk. Teams score these estimates based on a 5-point scale for two time frames: "immediate future" (days) and "short term" (weeks). An additional consideration regarding the clinical likelihood of violence is the presence of professional support including inpatient and community supports. Specifically, clinicians are asked to consider whether an individual's likelihood of violence would change in the absence of professional support. As a result, there are a total of four estimates of the likelihood of violence.

Also embedded within the HARM is the Aggressive Incidents Scale (AIS) [15], which is a 9-point scale designed to record

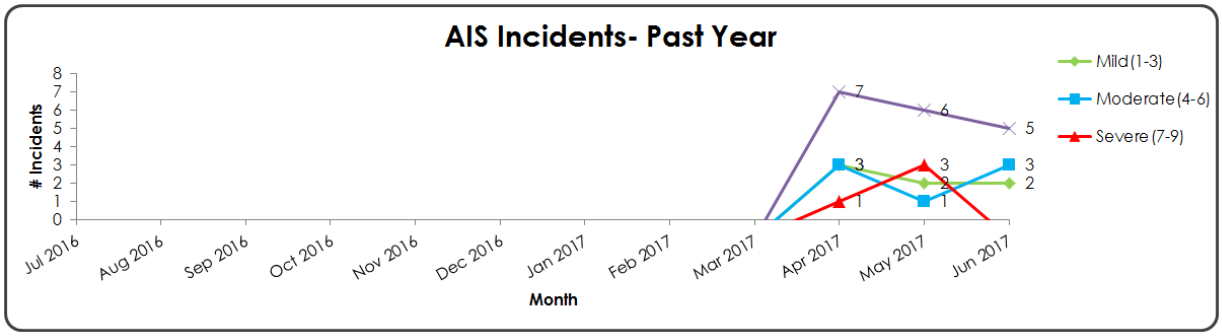
varying acts of aggression easily and consistently. The HARM also guides the assessors to develop and record a personalized risk management plan, based on an individual's past and current risk. This may include specific treatment plans, interventions, and medications designed to reduce risk and improve outcomes. Combined, the AIS and the HARM have been indicated to improve the clinical documentation of dynamic risk factors and outcomes, communication of aggressive incidents, and discussions of risk and relevant risk factors [15,19]. Moreover, the AIS demonstrates excellent reliability as a measure of inpatient aggression [19], while the HARM demonstrates promising predictive validity for inpatient aggression, and has shown good reliability with the HCR-20 [20]. The HARM is completed on a weekly to monthly basis, making it a hub for rich, longitudinal data.

Combining the HARM tool with data analytics allows the ability to visually identify in a quick and efficient manner any fluctuations in risk, which then informs the current and future risk assessments. The result is the Electronic Hamilton Anatomy of Risk Management (eHARM); an electronic, Excel-based tool that transformed the original HARM risk assessment process using data analytics. The eHARM has introduced the potential for individual, patient-level analytics, as well as group-level analytics for descriptive observation of an entire unit or program at a time, and the collection of real-world, electronic data for further use. The tool is comprised of two components that work in conjunction: The Patient Tool and the Patient Aggregator.

The Patient Tool is the function most often used to complete risk assessments, access past assessments, and view individual-level analytics. This tool contains the HARM form, which has been modernized to include drop-down menus, required fields, and embedded definitions. These features improve the documentation of aggression and risk-related data, ensure reliability and consistency of documentation, and also streamline the risk assessment process for teams who may have limited time for large group discussions.

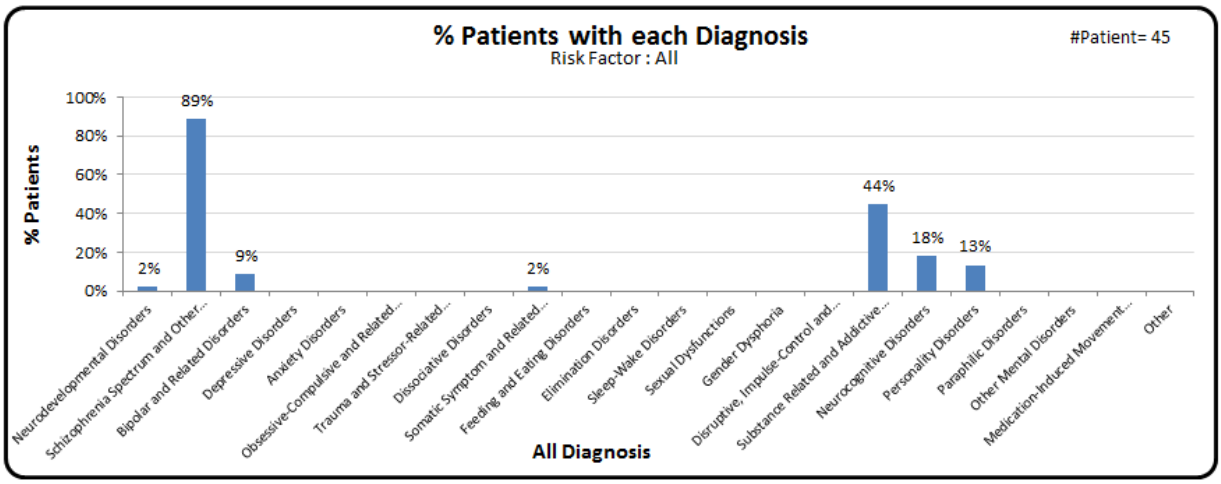
As well, the functionality adds a level of innovation and widespread applicability not seen before within psychiatric risk assessment. In addition to the user-friendly electronic form, the Patient Tool contains individual patient analytics, which collect and graph data as a team completes their regular assessments. These analytics allow users to view individual performance trends in AIS scores, risk factors, and risk ratings over time, thus providing automatic, graphic depictions of an individual's progress (Figure 1). Users can refer to the analytics during an assessment as a way to track decompensation or improvement and inform the assessment process. These analytics may also allow teams to better distinguish antecedents to specific incidents or behaviours, and then use this information to inform future treatment or interventions.

Figure 1: Patient-level analytics depicting aggressive incidents over one year for one patient



The second component of the eHARM is the Patient Aggregator, which introduces additional unique capabilities. Specifically, it allows users to upload multiple individual HARM files in order to view trends across groups of patients. Users may select any number of patient files, by physician, unit, or program as a whole. Upon uploading the files, the Patient Aggregator automatically generates a number of descriptive analytics of group trends in diagnosis, risk factors, and treatment (Figure 2). This includes the percentage of patients for each diagnosis, the percentage of patients referred to each program or intervention, and more. In addition, the Aggregator allows users to download imported data, including a de-identified database of each existing eHARM report for each patient selected. As a result, users can access an accurate, real-time, longitudinal database that contains historical, treatment, risk, and outcome data for further analysis.

Figure 2: Group-level analytics depicting diagnoses for a group of n=45 patients



Conclusion

The usefulness of the eHARM Tool and Patient Aggregator is self-evident; within moments, users can generate a program overview for an entire hospital, service, or unit, or answer a specific research question. The research possibilities are vast, but include examining the efficacy of specific medications, programs, and interventions, exploring trajectories for specific groups of patients, and even assessing the validity of the eHARM tool itself. In addition, the eHARM database contains data regarding risk management and transition planning, and patients' responses to specific programs or interventions. Using this data, users can easily identify which programs have the highest number of referrals, greatest involvement, longest waitlists, and least engagement to inform program planning and resource allocation. Moreover, decision-makers may cross-reference this with data on dynamic risk factors, aggressive incidents or risk ratings to determine where a need exists for a given program or unit.

In addition to aggregated data, a closer look at longitudinal data from an individual patient can demonstrate the eHARM's applicability for program evaluation. Specifically, users may graph AIS scores, risk ratings, and performance on a specific risk factor before and after a new program is introduced, to determine the program's effectiveness. This data may allow clinical staff to better target effective as well as ineffective programs, resulting in more timely, individualized and efficacious care.

These benefits are aligned with the immense need within healthcare to increase cost-efficiency, improve prediction of health trends, and implement more efficacious practices [8-9].

The eHARM offers extensive opportunity across many domains within psychiatry and a solution to the need for better management and use of electronic clinical data. The database derived from the eHARM is generated at the clinical interface, removing any need for data collection or data entry and the potential for errors occurring during these steps, and increases the ecological validity of future studies. With numerous time and data points, the eHARM database has the potential to inform risk management, research, service planning, quality improvement, and introduces unprecedented opportunity to improve violence risk assessment in psychiatry.

Conflict of Interest: none

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