HEnRY: a DZIF LIMS Tool for the Collection and Documentation of Biomaterial Samples in Multi-Centre Studies

Stephanie HEINEN[a,b,] , Nick SCHULZE [a], Bernd FRANKE[a], Florian KLEIN[c], Clara LEHMANN[a,d], M. STECHER[a,b], Jörg Janne VEHRESCHILD[a,b]

[a] Department I for Internal Medicine, University Hospital of Cologne, Cologne, Germany
[b] German Centre for Infection Research, partner site Bonn-Cologne, Cologne, Germany
[c] Institute for Virology, University Hospital of Cologne, Cologne, Germany
[d] Medizinisches Versorgungszentrum der Uniklinik Köln, Fachbereich Infektiologie, Kerpener Str. 62, 50937 Cologne

Abstract

Background: High-quality and well-described clinical samples, especially of patients with rare diseases or with well-defined clinical conditions, have great potential for acceleration and quality improvement in translational research. Due to the unmanageable number of individual material collections, efforts have been made in recent years to create central biomaterial banks and catalogues. Available technical solutions for connecting local sample catalogues to central systems are cost-intensive and/or technically complex to implement.

Methods: At the Department I for Internal Medicine of the University Hospital of Cologne, the Laboratory Information and Management System (LIMS) HIV Engaged Research Technology (HEnRY) is developed for the Translational Platform HIV (TP-HIV, www.tp-hiv.de). The technology platforms used are Microsoft Visual C #, Microsoft SQL Server and the .NET Framework Version 4.6. The software is compatible with all Windows versions from Windows 7 or higher and Microsoft SQL Server Standard from version 2012.

Results: HEnRY is a versatile biobanking tool for managing the processing and storage of different sample types. The storage locations can be recorded up to the slot in the storage box. In addition to pseudonymous patient data, basic clinical information can be collected or the records can be linked to a study database. The stored information can be monitored by a study supervisor and marked accordingly. Data can be selected via various query tools and SQL and documents in several formats, including printed scannable search lists, can be created. Samples can be recorded in the system in various ways and provided with self-adhesive, user-configurable QR code labels. A key feature is the user-generated study scheme, which can be used to centrally create specific drawing schemes and processing steps with the chemicals used in the laboratory for the materials used in the study. These study templates can then be distributed via XML to the other participating laboratories or study centers. A virtual shipping module allows the user to prepare the shipment of aliquots and to generate packaging notes for shipping.

Discussion: With HEnRY is a free MIT-licensed tool, which provides the essential features of commercial and free LIMS on the market, available for the TP-HIV of the DZIF, with particular strengths in the field of study delivery. Future developments should expand the scope of application to other scientific areas.

Background

Since a heterogenic sample quality is one of the main problems to be addressed for the insurance of the quality of a bio bank, the use of standardized documentation and processing of biomaterial gains more and more impact in research.

Initially many bio banks started as a private collection of "left-over" samples. With the growing demand for biological sample material, especially of human bio, bio banks gained more impact for researches. The need of well-documented sample processing and storage became interesting for the industry. The aim is to guarantee the comparability of the quality of sample and data.

Methods

HEnRY is developed for the Translational Platform HIV (TP-HIV). The used technologies are Visual C#, SQL Server and.NET Framework Version 4.6..

During the developmental process of HEnRY a close collaboration with the laboratory stuff, which represents the target user group of the tool and the study coordinator of the TOPHIV study was established.

Results

The HEnRY is in use at the University of Cologne since 2016 for several working groups with good user feedback. This tool is specialized for the documentation of the storage and processing of samples and aliquots in analytically working laboratories. It simplifies and accelerates laboratory work, increases the quality of documentation and minimizes potential sources of errors. In HEnRY, information about studies, patients, samples, aliquots and processing steps is stored in a structured manner. This information can be exchanged via pseudonym export and import functions in HEnRY, which improves cooperation between different participants of the TP-HIV.

The figure 1 shows a diagram of the workflow for multicentre studies and the use of HEnRY. A multi user access to the local database for one clinic is possible. The online access is available using the clinic own citrix access. A study supervisor or study coordinator can develop the study properties, drawing schemes and processing steps and send the study as an XML file to other participating centers.
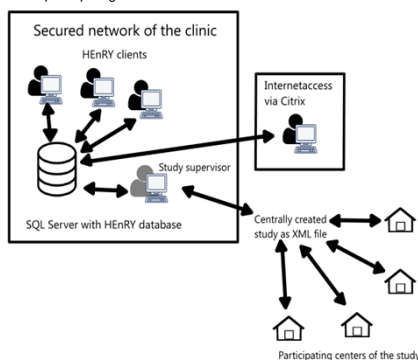

Figure 1: Scheme of the use of HEnRY for local working groups and multicenter studies.

More features of HEnRY are:
- **Study Management:** Studies can be added with different properties, drawing scheme (see figure 2), aliquot processing letter for the laboratory (see figure 3), addresses and UN shipment names. Studies can be exported and send to other participating centers and imported there.
- **Shipping Module:** A virtual shipment box can be prepared in HEnRY. A box or singles aliquots can be selected for the shipment. The way and the reason for shipment, as well as the address of the receiver, can be linked to a study. The documents are a printable overview of the box, an excel table with a selectable range of properties of all aliquots for the shipping, and a letter.
- **Quick Look:** Via the quick look function a virtual look in all boxes and upon the contained aliquots is possible (see figure 2).
- **Label Designer:** The label designer gives the user the opportunity to create own layouts for labels. The amount of aliquot properties and their sorting can be selected and saved as templates. Additionally, a live preview of the label is shown.
- **One Click Application of a Drawing Scheme:** Large numbers of aliquots can be created with all properties and the storage location contained in the drawing scheme by one click.
- **Many Massedit Functions:** Mass edit functions for the aliquot properties are available, to enhance the working speed and precision for large amounts of aliquots.
- **SQL Query Tool:** The data contained in the database can be selectively and complex queries using SQL. As output, a scannable list of QR codes for aliquots can be printed or aliquots can directly be send to the shipment module an prepared for shipment.
- **Different Filter Functions:** reports for all aliquots of one study, in one box, in one storage location or all patients of one praxis can be created in various file formats.
- **User Rights:** HEnRY offers different user functions, which are linked to different user rights. The function of the user can be described as physician, laboratory staff member and study supervisor.
- **Export of Aliquot Data:** Aliquot and sample data can be anonymously serialized into XML files and send to another centre along with a shipment. There, the files can be imported and the receiving center is fully aware of all documented storage conditions, processing steps and used chemicals so far.
- **Monitoring:** The study supervisor has the opportunity to supervise the entered bio material data for completeness and accuracy and mark them accordingly.
- **Pseudonymisation Function:** Patient data can be fully reversible or irreversible pseudonymized or deleted at the end of a study.

Figure 2: The HEnRY surface for the sample and aliquot management. The upper table shows all samples of one patient. The table below shows pall aliquots of an selected sample. The virtual quick view insight the box is opened. The selected aliquot is marked by a blue background.
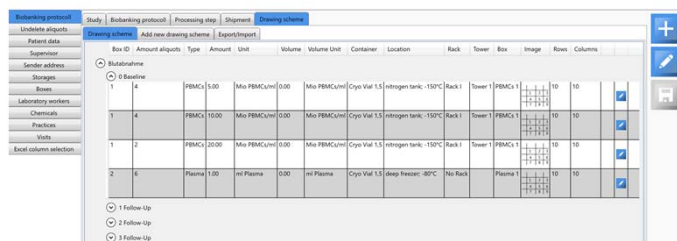
Figure 3: Drawing scheme in HEnRY as part of the TOPHIV study. The local storage location has been added to the imported drawing scheme.
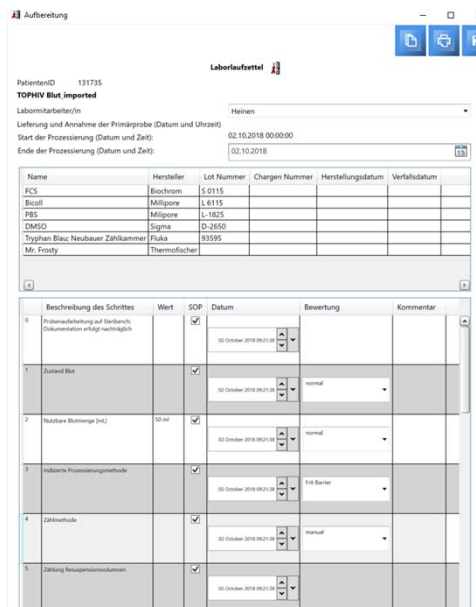
Figure 4 : The laboratory sample processing letter for the TOPHIV stud Application.

Discussion

HEnRY is an open source biobanking tool, which contains all the main feature like other Laboratory Management Systems (LIMS) with a specialisation for the management of multicenter studies and their practical deployment. It has originally been developed for the documentation of blood and stool samples for the TP-HIV of the DZIF, but at the University Hospital of Cologne first working groups are using HEnRY for the documentation of biomaterial drawn for cancer or tuberculosis studies.

Outlook

In the future, a further extend of annotatable sample and aliquot types, various organisms, machines used in the laboratory and the documentation of different diseases is planned to enforce the precise documentation for non-HIV scientific research. A DZIF wide distribution of HEnRY for all scientific fields in the DZIF is proposed to the DZIF.

Reference: Stecher, M.; Jablonka, A.; Lehmann, C.; Gusenheimer-Bartmeyer, B.; Heinen, S.; Fätkenheuer, G.; Degen; O., Draenert, R.; Bogner, J.; Rockstroh, J.; Jesen, H., Scholten, S.; Wyen, C.; Postel, N.; Behrens, G.; Vehreschild, J.J.. (2016). Translational Platform HIV: Implementation of the treatment of primary HIV cohort. In: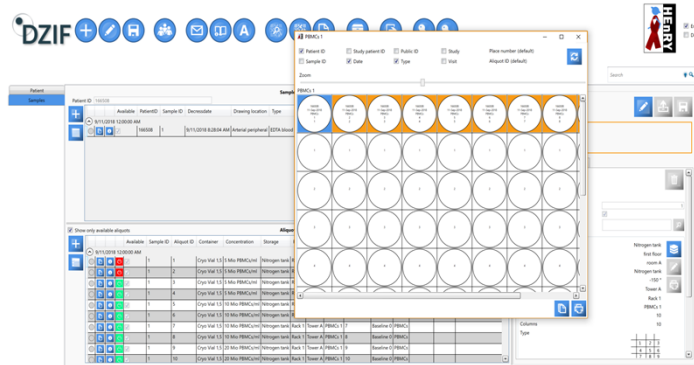 *DZIF Annual Meeting, Abstractbook*.