

iPath Telemedicine Platform and Experience of Its Implementation in Ukraine: Concepts, Strengths, and Challenges

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Abstract — iPath is a hybrid web- and e-mail-based telemedicine platform developed at the University of Basel (Switzerland) and then released as an open source project for use by regional networks and other projects, especially those implemented in low resource settings. This article outlines its history, some technical aspects and specific features, discusses the experience of its implementation in Ukrainian health care institutions facilitated by the Ukrainian-Swiss Mother and Child Health Programme, and analyzes its problems, limitations, and challenges.

Index Terms — distant consultation, education, e-Health, telemedicine, telemedicine platform iPath.

I. INTRODUCTION

Information and Communication Technologies (ICT) offer great potential for improvement of health services and systems [1]. Access to information in transitional countries continues to be a significant problem. Personal exchange of knowledge and expertise among colleagues is hampered by lack of ICT and transport infrastructure. Medical literature is scarce due to limited financial resources and distribution systems. The latest developments influencing clinical practice do not reach the medical community, especially those working outside of urban centers.

In these conditions, it is very important to employ telemedicine and other ICT tools in order to improve access to information for health professionals, foster professional networks, and establish a platform to share experience from daily clinical practice and make their expertise available to answer medical questions of colleagues.

II. ORIGIN

iPath telemedicine platform has grown out of the software developed at the University of Basel (Switzerland) to manage telemicroscopy images [2-6]. A database was created to store images and other related data captured and recorded during telemicroscopy sessions, and share them among members of a telepathology network for remote diagnosis. However, quite soon this database started being used as a standalone application, independently of the real-time telemicroscopy tools. It turned out that telepathology consultations were often focused not on the real-time microscopy but on discussion of still images, which can be done by e-mail in offline mode. The problem was to manage (1) all the data relevant to each specific case (images, diagnoses, opinions, questions, answers, and other comments), and (2) the network of all potential participants in

teleconsultations.

This was achieved by combining e-mail communication with a web-based database and a web-site interface. Then, the iPath platform – a hybrid web- and e-mail-based system – became independent of the telemicroscopy component, and was eventually released as open source software for use by regional networks and other projects, especially those implemented in low resource settings.

III. IPATH: A SUMMARY OF FEATURES

- iPath is a web-based telemedicine platform using open source technology (PHP/MySQL);
- Simple and user-friendly web interface, multilingual;
- Integration of various file formats, e.g. documents (DOC, PDF, etc.), images (JPG, DICOM, etc.), audio and video files;
- Integration of application-specific case forms for standardized acquisition of clinical data;
- Automated e-mail alerts;
- Easily accessible and growing with demand;
- Low hardware requirements and compatibility with most operating systems and web browsers;
- No license fees.

IV. TECHNICAL ASPECTS

Technically, iPath is an open source web application written in PHP scripting language and storing the data in MySQL database. The code is freely available and can be downloaded from sourceforge.net.

Installation and operation of iPath requires a typical web server environment (Apache/MySQL/PHP) and some expertise in web server management.

Functionally, iPath is somewhere between a content management system (CMS) and a groupware tool.

iPath is designed for asynchronous (store-and-forward) telemedicine, it does not require the simultaneous availa-

bility of all parties for real-time communication.

This results also in very low requirements to the hardware and bandwidth for the clients (teleconsulting network members): they need neither broadband connectivity for live media streaming, nor high-performance hardware for good-quality real-time video processing.

Requirements to the central iPath server are also quite modest: it may not be necessary to have a dedicated server.

V. OPERATION

Clinical cases and comments can be submitted to an iPath server either in the online mode (via the web interface), or via e-mail. Submission by e-mail is a very useful function of iPath, particularly for areas with limited resources. For e-mail submission, users send cases to iPath as an ordinary e-mail message from any e-mail client, with case title entered as message subject, clinical description as main text, and images as file attachments. Then, cases are automatically imported by iPath and posted to the web site.

All users are organized into a number of discussion groups related to specific health topics, e.g. clinical specialties (Mother & Child Health, Radiology), Public Health, Health Technology Management, etc. Each discussion group has at least one moderator who can control membership of users in this group and delete improper items. Thus, the system does not need to be administered centrally as every group is self-administrating.

Within each discussion group the group members can:

- present and discuss cases in order to exchange information, experiences and expert opinions;
- organize consultation services where group members present cases to experts who provide their expertise as a second opinion;
- collect structured data with customized forms for further analysis;
- build up a library (e.g. clinical cases for case-based learning, lectures, and other learning materials);
- prepare and conduct distant lectures for remote participants.

Users can register on the iPath server on their own, but after that they need to confirm their registration by e-mail, and to receive appropriate permissions to participate in specific groups from their administrators.

VI. TEMPLATE FOR CLINICAL CASE PRESENTATION AND DISCUSSION

Fig.1 shows an example of clinical case submitted to the iPath platform.

- **Header:** this area is for information about the date of submission, case title, type, and author.
- **Body:** for detailed description of the case. It should contain adequate clinical information and clearly formulated questions for discussion.
- **Attachments gallery:** additionally, the case can be illustrated by images, documents, and other relevant files to be displayed in the Gallery area. To provide complete and properly structured information about the case, authors are encouraged to fill specially designed standard forms, such as general Case evaluation form, Obstetric case form, Neonatal case form,

and so on.

- **Annotations:** for opinions, questions, and comments by other members of the group (experts).

The authors are responsible for proper presentation of their cases, for answering the questions that may be asked by the experts, and must not publish any information or images that may disclose the identity or infringe privacy of the patients.

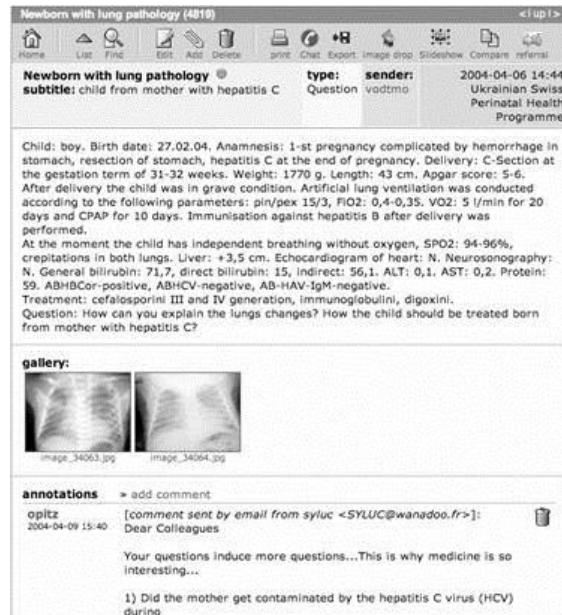


Fig.1. Example of clinical case presentation in iPath

VII. IPATH IMPLEMENTATION IN UKRAINE

Implementation of the iPath telemedicine platform in Ukraine started in 2003 as part of the Ukraine-Swiss perinatal health project [7]. The pilot institutions were Ivano-Frankivsk Oblast Children Hospital (see Fig.2) and Institute of Pediatrics, Obstetrics and Gynecology (Kyiv). The doctors appointed to coordinate participation of these institutions in the project were trained to use digital cameras and to work with Basel University's iPath server.



Fig.2. Telemedicine workplace at the Perinatal Center in Ivano-Frankivsk, Ukraine (photo: M. Blunier)

For some period of time, the Ukrainian iPath community was using a server installed at the National University of Kyiv-Mohyla Academy.

Since 2009, the Ukrainian iPath platform has been running on a server in Donetsk hosted and maintained by

Association for Ukrainian Telemedicine and eHealth Development (see Fig.3).

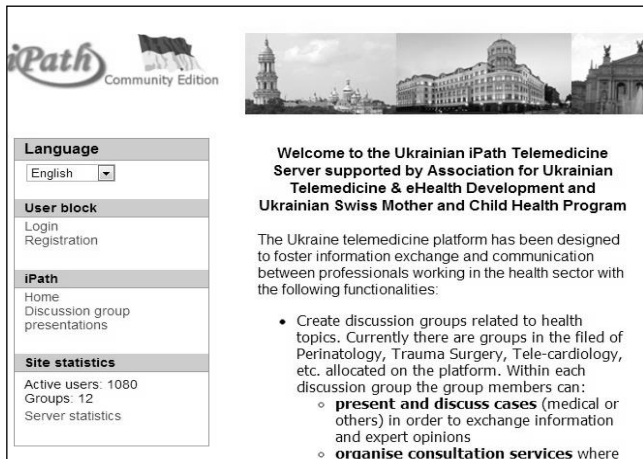


Fig.3. Web site of the Ukrainian iPath Telemedicine Server (front page, English version)

By 2012, this server has more than 1,000 users in 12 groups. More than 1,000 clinical cases have been posted.

As part of the Ukrainian-Swiss Mother and Child Health Programme, the iPath platform is used by more than 80 medical institutions in 4 partner regions of the Programme: Volyn, Vinnytsia, Ivano-Frankivsk oblasts and the Autonomous Republic of Crimea (see Fig.4). In Volyn oblast, all rayon hospitals became involved in this project.



Fig.4. iPath training in Crimea (2012)

In 2009, implementation of the iPath telemedicine platform started also in Moldova [8]. Currently, the Moldovan iPath community uses a server installed in Switzerland.

VIII. IMPLEMENTATION PROCEDURE

Based on the experience of employing the iPath telemedicine platform in Ukraine by the Ukrainian-Swiss Mother and Child Health Programme, there are several important steps required for successful implementation [9]:

1. **Introduction:** the concept, principles, and advantages of the telemedicine platform should be presented to health care administrators, chief physicians, and doctors to gain their support for the

project.

2. **Administrative support:** health care departments and medical institutions participating in the project should issue appropriate orders and other documents that support the project, appoint responsible persons, and provide adequate conditions for staff training and work.
3. **Technical basis:** workplaces should be adequately equipped with computers, Internet access, digital cameras, scanners, and appropriate diagnostic instruments; staff should be trained.
4. **Regulations:** each medical institution should prepare protocols that regulate the procedure of using the telemedicine platform (who can use it, when, how, and for what purposes).

As a result, each partner hospital obtained at least one fully equipped workplace and staff trained to use the iPath platform.

Also, regional expert groups involving specialists from oblast-level medical institutions were organized in the partner regions in order to provide consultations and other support to rayon hospitals. This resulted both in increasing the number of experts participating in teleconsultations, and in improving coordination of efforts between the oblast-level and rayon-level health care facilities.

An important step to build up the iPath community was organizing training-of-trainers (ToT) workshops for regional teams. Intergated training modules were developed, including trainer's manual and student's manual.

IX. PROBLEMS, LIMITATIONS, AND CHALLENGES

Analysis of iPath implementation in Ukraine (based on a survey of 260 doctors from 22 rayon-level and 5 oblast-level medical institutions [9]) showed that most important factors slowing down the process were human rather than technical issues. The majority of participants in the telemedicine network were using iPath only for reading information about clinical cases, without making any comments or posting their own cases. The main factors restraining them from more active involvement in teleconsultations (ranged by importance) were:

1. insufficient computer skills;
2. lack of permanent access to a telemedicine workplace;
3. fear to demonstrate one's own incompetence;
4. lack of time.

The participants pointed out the need for further training:

1. training on medical information searching on the Internet (~60%);
2. iPath training (~54%);
3. computer skills training (~45%).

As already mentioned, the iPath platform poses very low requirements to client's hardware and bandwidth. Availability of computers and Internet access is becoming more and more common today. However, human-related factors still impose very essential restrictions on the use of telemedicine even in the absence of serious technical

limitations.

- Doctors still fear to demonstrate their incompetence in the medical issues discussed. This factor is most typical for doctors working at rayon hospitals – who, at the same time, are in most acute need for access to up-to-date medical information, and thus should become more actively involved in teleconsultations.
- There is a need to increase the number of experts actively participating in the consultations, so that it would be possible to discuss different opinions instead of only one, and critically assess the options proposed.
- Participation of experts is also limited by the *language barrier*. Most doctors have a very limited command of foreign languages, so it is difficult to enlist international experts for active participation in the discussions. Thus, many cases are discussed only within a relatively small circle.
- Only a small share of comments is substantiated by references to any *evidence-based sources*. This indicates the lack of skills for searching, analyzing, and assessing medical information on the Internet (further complicated by the already mentioned lack of foreign language skills).
- It is very discouraging for doctors when they do not receive any expert opinions at all in reply to the cases they post. As a result, they are losing motivation to spend their time and efforts on teleconsultation attempts. Thus, it is very important to monitor consultation requests, contact and push experts when necessary, and try to make sure that all requests are answered.
- By design, iPath is a tool for asynchronous telemedicine, and is not intended for urgent consultations. However, in many cases it is critical for doctors to get answers to their questions within a sufficiently short period of time to make appropriate medical decisions.
- On the other hand, post factum discussions of clinical cases can be a valuable educational tool. Actually, some cases posted to the iPath platform are not consultation requests – they are intended to share experience with colleagues, inform them of interesting cases or new approaches.

To improve the quality of teleconsultations, it is important to promote among the members of the iPath network principles of evidence-based medicine, and to provide appropriate trainings when possible.

X. ONLINE RESOURCES

- iPath Community platform on the Swiss Centre's for International Health server
<http://www.ipath-network.com/scih/>
- Ukrainian iPath Telemedicine server:
<http://telemet-ipath.org.ua>
- iPath Moldova Telemedicine platform:
<http://www.ipath-network.com/moldova/>
- iPath project downloads:
<http://sourceforge.net/projects/ipath/>
- Swiss TPH eHealth Toolbox
<http://www.swisstph.ch/services/ehealth/ehealth-toolbox.html>

- Ukrainian-Swiss Mother and Child Health Programme <http://motherandchild.org.ua>

XI. CONCLUSIONS

The experience of iPath implementation in Ukraine facilitated by the Ukrainian-Swiss Mother and Child Health Programme demonstrated its effectiveness and viability as an asynchronous telemedicine tool that can be employed in low resource settings. To improve and maintain its impact and efficiency, it is very important to provide not only technical support but also to take appropriate administrative actions and make persistent efforts to overcome a number of barriers and limitations caused by human issues.

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