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Information in practice

The Ptolemy project: a scalable model for delivering health information in Africa

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How is Africa to build up the medical research it needs? Doctors in African research communities are starved of access to the journals and texts their colleagues in more developed countries regard as fundamental to good practice and research. Isolation, burden of practice, and resource limitations make education and research difficult, but the rapid spread of access to the internet reduces these obstacles and provides an increasingly attractive means to disseminate information and build partnerships in education and research.

The role of electronic health information in building local capacity to find, publish, and implement solutions has been emphasised recently in *Science*,¹ *Nature*,² the *Lancet*,³⁻⁴ and the *BMJ*.⁵ The Global Forum for Health Research gives priority to interventions designed to build research capacity in developing countries and correct the disparity in health research.⁶ The Coalition for Global Health Research (Canada) has recently reported how a major effort now can make a substantial difference.⁷ Access to reliable health information has been described as "the single most cost-effective and achievable strategy for sustainable improvement in health care."⁸ We are interested in helping to build research, teaching, and clinical capacity for neglected yet substantial problems such as injury, which kills 5.1 million people annually.⁹⁻¹¹

Origins of the Ptolemy project

The Ptolemy project was conceived in discussion between a surgeon and a librarian. The surgeon (MB) had recently returned from working in Africa and Afghanistan and was aware how his colleagues there were starved for medical literature. The librarian (WH) is electronic resources coordinator at the University of Toronto Library, the largest academic library in Canada and the third largest in North America, and was interested in expanding access to full text health information in and from developing countries.

Two further partners soon joined the discussion. Bioline International, also housed at our university, provides electronic publication for several scientific journals from developing countries, including the *East African Journal of Medicine* and the *Central African Journal of Medicine*. The Association of Surgeons of East Africa represents the 400 surgeons who care for

Summary points

Ptolemy is a new model for electronic access to medical literature for doctors in developing countries

Surgeons in east Africa become research affiliates of the University of Toronto and have access to the full-text resources of the university library via a secure internet system that monitors and verifies use

By engaging a well defined group of end users in an electronic research community, Ptolemy contributes directly to building research capacity in Africa

Ptolemy is a small project but it has potential for being widely and economically reproduced

a population of 200 million people in eight east African countries. The association already had an informal link with the Office of International Surgery at the University of Toronto, whose mandate is to foster surgical education and research for development.

Starting with the idea that the massive health problems of Africa are most likely to be solved by Africans, who know the right questions to ask in order to get practicable solutions, and believing that access to the medical literature is indispensable for doing the necessary research, we set out to provide our African colleagues with access to it and attempted to measure how they used it. Named after Ptolemy I Sotor (367-283 BC), the general who built the great library in Alexandria that housed the written corpus of the ancient African, Mediterranean, and Middle Eastern worlds, the Ptolemy project links the four institutions (University of Toronto Library, Office of International Surgery, Bioline International, Association of Surgeons of East Africa) in a partnership to build a research community, provide educational resources and clinical information, and investigate whether access to medical literature has a positive effect on surgical research, teaching, and practice in east Africa.



The armorial bearing of the University of Toronto Office of International Surgery (designed by Professor Robert Salter)



Ptolemy I Sotor (367-283 BC), who built the great library of Alexandria

We present a description of the project and an appraisal of what we have learnt.

Development of the project

The University of Toronto Library agreed to make available 100 proxy server accounts for the project, and, in order to conform to subscription agreements with the various publishers, the participants were appointed as “research affiliates” of the university’s Office of International Surgery. All of the library’s 20 000 full text journals, 2538 of them medical journals, and hundreds of medical texts and links to free online health resources are available through Ptolemy (see www.utoronto.ca/ois/). The Bioline International collection (<http://bioline.bdt.org.br/>) is also available free through Ptolemy, and there are tutorials on searching and critical evaluation of the literature. Online help is always available. The small operating cost of Ptolemy, essentially office and travel expenses and one part time research assistant, is achieved by making use of existing university and electronic publishing infrastructure already in place for other purposes.

To be included in the project, participants had to be doctors practising in a country ranked less than 65th on the human development index,¹² they had to have reliable internet access, and that they had to provide informed consent to anonymous monitoring of their internet use while connected to the university’s proxy server. Participants were required to adhere to the same library rules regarding respect for copyright and general behaviour as are other members of the university. Preference was given to members of the Association of Surgeons of East Africa because surgical care in Africa has been so badly neglected for so long by the international community.

The Ptolemy project was introduced at the annual meeting of the Association of Surgeons of East Africa in Lusaka, Zambia, in December 2001. A Canadian research assistant with a background in health information science (KL) spent two months visiting

Ptolemy participants in six of the eight African countries linked with the association in order to ensure that the proxy server account was functioning correctly on their computers and that the participants were familiar with the basics of using the website and various search engines.

We collected basic demographic information from the participants when they signed up, and we asked them to complete an assessment of their basic information needs. Since the project’s inception in December 2001, there have been two surveys (April and August 2002) of Ptolemy participants, who returned positive feedback on the usefulness of the resource. A subgroup of Ptolemy participants is now engaged in a Delphi process to identify the priorities for surgical development in east Africa.

The Ptolemy survey

At the time of the August 2002 survey we had recruited 118 participants since the inception of Ptolemy, and 21 had left the project, primarily because of conflicts between their local area network and the proxy server. Of the remaining 97 Ptolemy participants, 58 were surgeons, 42 were active in research, and 51 taught medical students, interns, and residents. Seventy eight of the participants were in Africa, and 69 were in the eight countries of the Association of Surgeons of East Africa. Seventy two participants were located in their respective capitals, 13 were in provincial capitals, and 25 were in district centres. Of those who reported the location of their internet connection, 62 accessed the internet from home only or from home and work, while only 29 accessed it only from work. Sixty three of the participants paid less than \$50 (£30) a month for their internet service and associated telephone charges.

We excluded 30 participants from the August survey: 13 were trying to resolve computer or internet access problems and had yet to use the resource, six had been using Ptolemy for less than a week, four informed us that they were unavailable during the survey period; and seven had registered but had never returned their consent forms. Of the 67 eligible participants, 53 responded within two weeks for an overall response rate of 79%. All but three respondents were men, and 40 were general and orthopaedic surgeons, although obstetricians, district medical officers, medical librarians, and a neuroanatomist also participated. Forty six spent more than an hour on line each week using Ptolemy, and their median monthly cost of internet access (including telephone charges) was \$36 (£22).

We asked the participants about the impact and relevance of information derived from Ptolemy to three areas of practice—clinical, teaching, and research. Fifty four found Ptolemy was relevant and had positively affected their practice in each of the three areas, but the positive responses were equally strong for the three areas of work. Perhaps surprisingly, most participants (50) found full text journals to be the most valuable resource, with online texts a distant second. This may be related to how almost twice as many respondents found it easy or very easy to access full text journals (34) compared with online texts (17). The most requested journals were the *British Journal of*

Sample comments from Ptolemy participants

"Up until I joined the Ptolemy project, I was only using abstracts for my work. This made life difficult, and my publication record to date is not good. The last good paper I published was in 2000, when I finished my PhD. I certainly regretted going back home to Africa as I thought my academic career was over. I now know that I will be up to date, and I will certainly come up with innovative research proposals." JC (Malawi)

"I am writing my dissertation for a masters in public health, and Ptolemy is assisting me at just the correct time." MS (Tanzania)

"I am very much interested in medical education, especially clinical education. The Ptolemy project helped me to find relevant information about the subject. It should be noted that, due to financial difficulties, we do not subscribe to any medical education journals." PG (Mozambique)

"I do my hernia operations differently just for starters." JB (India)

"Our library is poor in Lusaka, Zambia—no journals or books. Ptolemy opened for me a new world of knowledge. Like a child in a toy shop. It is difficult to stop once you start browsing. Unfortunately internet connection is often very poor, and downloading or opening a page is difficult. That is the time when I stop. Preparing a lecture in wound healing, I performed almost entirely from Ptolemy."

GJ (Zambia)

"I have been able to write my proposal on a burns unit using the information I obtained from Ptolemy." PO (Kenya)

"My research on areas of developmental biology has received a tremendous boost, particularly that one is able to get full articles, as opposed to other sources such as PubMed where only abstracts may be available." RM (Kenya)

"I did not have access to most journal articles full text, and if I needed a paper badly, I would have to ask a colleague from Europe or North America to search, print and fax me the article. It would take forever, and I could not use this method too often. Now if I want a paper I download it off my computer. The only hitch is a slow and unreliable internet link ... and I don't have to go to the library, where services are usually slow and crowded." OK (Uganda)

"The internet access in Gondar College of Medical Sciences, where I work is not good. Since the line is very slow, often I had difficulty of logging into your server. But during the limited time that I was able to access the server of the University of Toronto, I was able to retrieve relevant materials which enabled me to draft a paper, which hopefully will be published in the *Ethiopian Medical Journal*. I am grateful to the Ptolemy project for this." SB (Ethiopia)

"... no digital divide as long as Ptolemy is there. I have been able to access all I need from the library." SKS (Tanzania)

Surgery and the *Lancet*. Fifty eight respondents rated their overall satisfaction with the Ptolemy project as high or very high. The respondents' comments elicited by an open ended question in the survey paint a good picture of the impact Ptolemy is having in Africa (see box).

Appraisal

Ptolemy was designed to provide access to electronic health information and to analyse whether that service had a positive effect on surgical research, teaching, and practice in east Africa. The interaction between information, knowledge, and behaviour is complex and difficult to measure, but some useful observations can be drawn from our early experience with Ptolemy.

Use of online resources

The usefulness of Western medical journals (compared with evidence based texts, systematic reviews,

and the *Cochrane Library*) has been questioned,¹³ and a recent paper has reported that local journals contain information that is most likely to affect the practice of readers in developing countries.¹⁴ Ptolemy provides free access to local, regional, and international journals, major online texts, and the *Cochrane Library*, but our participants clearly preferred journals (75%). In view of debate over the transferability of research findings from the rich world to the poor, it is curious to see that the most requested journals were the *British Journal of Surgery*, and the *Lancet*. Several reasons may contribute to this. Those who search through either PubMed or Ovid are led preferentially to indexed journal articles with abstracts, rather than local journals, text chapters, or Cochrane reviews, and there may be a social aspect whereby doctors enjoy the cachet of quoting to their colleagues and students from well known journals. Efforts are under way to provide electronic publication of the journal of the Association of Surgeons of East Africa, the *East and Central African Journal of Surgery*. Textbooks are more difficult to navigate, particularly for low bandwidth users. This preference for journals may reflect easier access and personal taste rather than their greater usefulness compared with other resources. None of the Ptolemy group reported using the *Cochrane Library*, which may reflect unfamiliarity with that database or the dearth of material they find useful in it. We hope to be able to watch this change over time.

The commonest criticism of the utility of electronic health information in the developing world relates to slow, unreliable, and costly or non-existent internet access.¹⁵ Three quarters of our respondents used Ptolemy from home only or home and work, rather than from work. This may represent a difference between the speed and convenience of private access compared with institutional access. Nearly all our respondents complained about their internet connections, yet 61% browsed Ptolemy for more than an hour a week, and 68% estimated their total combined internet and telephone costs at ≤\$50 a month. This may seem moderate by Western standards, but it is high in relation to physician income in Africa. Although it is costly to the participants personally, many surgeons valued library access from home. Web access is often faster and more reliable from home, and most academic surgeons prepare grants and papers outside working hours because they are occupied with clinical matters during the day.

There is a waiting list to join Ptolemy, and periodic reviews identify idle accounts, which are transferred to people on the waiting list. Regular use of the medical literature is only a weak surrogate measure of intellectual leadership, but, by slowly refining the membership in Ptolemy, we aim to select those individuals who are or will become the opinion leaders in the east African surgical community. Beyond providing access to the literature, Ptolemy draws them into an electronic community linked by medical curiosity which can identify priorities and find solutions to regional surgical problems. Building surgical research capacity in east Africa requires far more than mere access to the literature, it involves drawing individuals into the larger project of solving problems. Ptolemy participants are presently involved in the East African

Comparison of electronic health information sources Ptolemy and the World Health Organization's HINARI

Characteristic	Ptolemy	HINARI
Size	100 individuals (all active)	438 institutions (100 active) ¹⁶
Target group	East African surgeons	Health workers world wide
Delivery system	Access from home and work	Access through institutional library only
Resources	Library based: full text access to international, regional, and local journals; online texts, Bioline International; <i>Cochrane Library</i>	Publisher based: 1200 full text journals
Information flow	North to South, South to North, South to South	North to South
Cost of project	\$20 000 (£12 500) to date, \$12 000 (£7500) annually	Not known
Cost to participants	May pay for own internet connection	Free to institutions in poorest countries; \$1000/year in middle income countries
Evaluation	User surveys and URL analysis	Not known
Growth potential	Replication	Expansion

Surgical Initiative-Delphi ("EASI-Delphi") process to identify priorities for surgical development in the region.

Comparison with other information sources

We were not able to compare Ptolemy with other electronic health information sources such as the World Health Organization's HINARI, because no Ptolemy participants have yet been able to use it. The table lists the features that distinguish Ptolemy and HINARI. Essentially, Ptolemy links a large university library and a well defined community of end users and provides convenient access to a broad resource collection and assesses how they use the it. HINARI links WHO, publishers, and institutions in a collaboration to make a less broad selection of resources available in institutions all over the developing world. We do not yet know how much of that information is reaching the doctors who need it.

Expanding Ptolemy

Helping 100 surgeons to be better equipped for research, teaching, and clinical practice is a useful end in itself, but can the Ptolemy project grow? Part of the strength of Ptolemy comes from the fact that there are only about 400 surgeons in the countries of the Association of Surgeons of East Africa, so that even such a small project may have considerable leverage. Although our respondents represent a substantial portion of the active academic surgical community there, their 100 proxy server accounts comprise only 0.2% of the University of Toronto's 50 000 proxy server library accounts. The cost of running Ptolemy lies mostly in its evaluation mechanisms.

Large university libraries have the technical capability to establish remote access at minimal extra cost, and mechanisms to monitor and validate user access in order to prevent violation of intellectual property rights. From a technical perspective, therefore, expansion is straightforward. The obstacle is largely one of administration: how many research affiliates is a fair number in the eyes of publishers? Five per cent? Scientific and medical publishers are deeply involved in efforts to expand access to their publications in developing countries, and they should lose no revenue by doing so, as poor countries are unlikely to be able to afford their own subscriptions in the foreseeable future. So long as this use does not threaten the intended use and relationships of the existing infrastructure (a parasite killing its host), there will be the opportunity to provide something

of great value to the developing world without a large specific operation or budget dedicated to maintaining it.

Expanding access to health information in the developing world is likely to involve a mosaic of complementary approaches. Ptolemy provides both access for a well defined group of end users and a mechanism for evaluating their response. It may help foster the kind of partnerships that contribute directly to building the research, teaching, and clinical capacity so badly needed in Africa. Might this model, of a large university incorporating designated researcher partners from the developing world within its library community, provide a practical and cost effective means of delivering access to the medical literature for doctors in countries that could not otherwise afford it? University libraries, the publishers' principal clients, should work towards enshrining access for research affiliates from the developing world in the licence agreements they negotiate. If other universities formed partnerships similar to that in the Ptolemy project it would be an effective and economical way to build essential health research capacity in Africa.

Competing interests: None declared.

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composition, ranging from lone consultant nurses to multiprofessional teams, and in their working patterns and activity.⁹ Some outreach teams follow up patients as described in our study, whereas others attend once patients show early warning criteria (see box). The results of our study are therefore not transferable.

Limitations

Our study design could have confounded the results; before and after studies are retrospective, therefore variables cannot be controlled. In our study a concomitant innovation in the hospital could have produced the same results. Patients were, however, discharged from critical care to different areas of the hospital, and at the time of the study there was no other innovation that could have had an effect on patients. The median predicted probability of mortality was 16.1% compared with 20.4% in the historical cohort. Although this was not statistically significant, part or all of the effect seen might be explained by this difference. Several authors have, however, questioned the ability of the tool to predict mortality and it is currently the subject of further investigation by the Intensive Care National Audit Research Centre. The tool therefore might explain some of the variation in outcome but not all of it.

Before and after studies may also show a lack of equivalence between comparators, and interventions may vary. Both our groups had similar risk factors. These were chosen for their association with mortality and readmission and seemed to be appropriate for the purposes of our study. The interventions undertaken by team members did vary, possibly owing to length of time available for the intervention or the manner in which the intervention was undertaken by the individual and on a particular day. It is unlikely, however, that one individual or one intervention can be associated with the findings. Rather, the combined effect of the interventions seems to have had a beneficial effect on outcomes.

The use of routine audit data, rather than specific data collected for research purposes, may also have produced erroneous results. The database was examined on a random basis for reliability and seemed sound.

If the innovation described here had not been introduced so hastily, owing to political imperative, we could have conducted a prospective randomised controlled trial. Evidence for innovation in service delivery will always be prone to limitations where evaluation is not undertaken before wholesale application. Policy makers should consider testing health service innovation using cluster randomised controlled trials with the hospital as the sampling unit. An example of this is the medical early response intervention and therapy study currently being undertaken in Australia to assess medical emergency teams.¹⁰

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Competing interests: None declared.

Ethical approval: Permission from the local ethics committee was not sought as the study involved secondary analysis of audit data collected on a routine basis.

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What is already known on this topic

The management of patients on the ward at risk of critical illness is suboptimal

Substantial sums have been invested in the development of critical care outreach teams

Outreach teams were hastily created and their effect on readmission to critical care or survival to hospital discharge was unclear

What this study adds

Critical care outreach teams seem to improve survival to discharge from hospital and may reduce readmission rates to critical care

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Corrections and clarifications

Retraction of paper on maternal diabetes

The table in this letter by Gillian Hawthorne and colleagues contained an error introduced by us when we reformatted the submitted table (18 October, p 929). In the first section (perinatal mortality), the number of mothers with diabetes in northeast England should read 101 516 [not 181 132]. Additionally, we confused authors' affiliations. Narve Moe is affiliated to the department of obstetrics and gynaecology, National Hospital, Oslo, and Lorentz M Irgens and Rolv T Lie are affiliated to the Medical Birth Registry of Norway, the Norwegian Institute of Public Health, and the University of Bergen.

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A URL that appeared in this Information in Practice article by Massey Beveridge and colleagues (4 October, pp 790-3) changed after the article was prepared for press. In the first paragraph of the section "Development of the project" the Bioline International collection is mentioned, but the web address given (<http://bioline.bdt.org.br/>) is no longer active. Instead, interested readers should go to www.bioline.org.br/

Helicobacter pylori in gastro-oesophageal reflux disease needs comparator

In this letter by Grigoris I Leontiadis and colleagues (*BMJ* 2003;326:1460), we placed Savvas Kadis as the second author to keep to our style of grouping together all authors from the same institution to save space. However, the authors want us to point out that their intended order was to have Dr Kadis as the final author.