

Manuscript Title: The Map of Medicine: a review of evidence for its impact on healthcare

Short Title: Map of Medicine: review of evidence

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Introduction

An understanding of evidence-based medicine and how to implement it into practice has become an essential requirement for all healthcare professionals but keeping current with an ever growing body of new evidence is a challenge ⁽¹⁾. As clinical practice becomes busier, time for reading and reflecting on the medical literature becomes ever more precious and difficult to protect. This is particularly the case for 'generalist' staff or those on-call and working outside their area of expertise.

At the same time, developments in the health sector, in information systems and in health data networks have led to a vast array of information available to clinicians. There are over 20 million medical articles available today with thousands of medical journals being published worldwide every month ⁽¹⁾. Clinicians are estimated to need to read 17 articles per day, every day of the year in order to stay abreast of relevant developments and inform their practice with current research evidence, an impossible task for even the most dedicated and tireless clinician ⁽²⁾. **Alongside primary information sources there are also a vast range of secondary resources such as databases and tertiary resources such as knowledge resources. Knowledge resources synthesize information gained from primary sources and are designed to be more convenient and quicker and easier to use ⁽³⁾.**

Map of Medicine is an evidence-based online clinical knowledge resource that is regularly updated. Using a pathway approach (fig 1) it provides a visual representation of evidence-based practise-informed care journeys covering 390

pathways in 28 medical specialities. The concept of the Map of Medicine was first devised in 2001 by medical entrepreneur Dr Mike Stein and Prof. Owen Epstein, who were part of a development team working to reduce clinic waiting times in the face of increasing referral numbers. The team found that the quality of referrals had a major impact on waiting times and that by making specialist knowledge available to community-based clinicians it improved referrals. Thus the Map of Medicine was born as a tool to make specialist knowledge available to clinicians and improve dialogue between primary and secondary care. The resource was developed as a commercial venture with the financial support of University College London and the Royal Free Hampstead NHS Trust. As demand for the resource grew amongst healthcare communities in the UK, the business was acquired by international publishers Informa plc in June 2005 and then by the Hearst corporation in April 2008.

NHS Connecting for Health a Directorate of the Department of Health created to bring in new systems and services, has purchased the licenses to Map of Medicine on behalf of Local Service Providers at significant cost¹. These licenses enable access to the Map of Medicine through a variety of portals, such as NHS Evidence for NHS staff, a part of National Institute for Health and Clinical Excellence (NICE), which is an electronic portal to high quality electronic clinical and non-clinical evidence and information about health and social care. As well through NHS Choices for patients and public information. It is deployed across the UK by the Strategic Health Authorities in England,

¹ NHS Connecting for Health was created in April 2009 and was a new directorate with the combined responsibility for the delivery of the National Programme for IT and the management of the IT-related functions of the NHS Information Authority (NHSIA) which closed.

and Informing Healthcare, the Welsh-Assembly-funded health IT programme in Wales, with help from Connecting for Health and the Map of Medicine Central Team who supported early adopter NHS organisations to develop specialist clinical pathways. The resource has also been purchased by the National Boards of Health in Sweden and Denmark (4, 5).

Given the investment in the Map of Medicine by the Department of Health in the UK in the development, deployment, funding of the license, and in staff time as well as the investment by healthcare providers in Sweden and Denmark, it is important to establish the beneficial impact that investment has had on healthcare practice and, ultimately, on patient outcomes. Thus, the aim of this study is to conduct a systematic review of the published literature on the Map of Medicine to determine the extent of the evidence for its impact on clinical practice at the current time.

Methods

In order to access the peer reviewed literature relating to Map of Medicine, all of the NHS Evidence healthcare databases (including AMED, BNI, CINAHL, Embase, Health Business Elite, HMIC, MEDLINE, PsycINFO) were searched for articles containing the following search term (“map of medicine”) in the title and text. These databases signpost literature from international journals and across a broad range of healthcare disciplines. Google Scholar which is a more generic academic web search engine was also searched for the same search term anywhere in the article. The searches were restricted to papers written in the English language that had

been published since January 2001 when the Map of Medicine was first developed. The Map of Medicine company website was also searched for additional peer reviewed articles that were not identified through the formal search.

The grey literature was explored by two different routes. In order to assess the types of literature that were discussing the Map of Medicine, the same search term (“map of medicine”) was entered into Google, limiting the findings to between 2001 and the present day. This retrieved 124,000 hits, of which the first 1000 were screened. In addition, the Map of Medicine company website was searched for articles that presented data but had not been published in peer-reviewed journals. All of the searches were performed on the 23rd of February 2010.

Duplicate articles were removed and the remaining articles were screened. The inclusion criteria were that the articles had to be relevant to the research question: “What impact has the Map of Medicine had on clinical practice?” and must present empirical data on this topic.

The final group of articles were read in full and independently by the three authors. Data were extracted separately by each author using a common framework for data extraction. The authors then met to discuss the findings and identify key themes across the articles. The quality of peer-reviewed articles was assessed using the most appropriate tool given the content of the paper.

Results

Literature identified

The literature search identified 133 articles, derived from the NHS Evidence databases (36), Google Scholar (75) and the Map of Medicine website (22). The

Google search yielded mainly documents and websites from **Strategic Health Authorities** and Healthcare Trusts referring to the Map of Medicine and offered no new leads.

There were 16 duplicate items, 16 irrelevant articles and 66 were publications where the Map of Medicine was mentioned only briefly (fig 2). Of the remaining 35 items, 12 of the papers were classified by the researchers as resource descriptions ⁽⁶⁻¹⁷⁾, which contained descriptive information about the Map of Medicine but no evidence of its impact on clinical practice and were thus excluded. Eight newsletters⁽¹⁸⁻²⁵⁾ and four case studies ⁽²⁶⁻²⁹⁾ were excluded for the same reason.

The remaining 11 items, that were relevant to the research question and presented empirical data or statements about key findings, consisted of 1 peer-reviewed journal article presenting primary research ⁽³⁰⁾, 8 case studies ⁽³¹⁻³⁸⁾ and 2 newsletters containing articles which presented empirical data ^(39, 40).

Quality assessment of selected papers

The quality of the one peer-reviewed paper was assessed using the Cochrane Effective Practice and Organisation of Care (EPOC)² Group tool for evaluating interrupted time series designs ⁽⁴¹⁾. The assessment showed that the quality of the paper was sub-optimal, particularly within the analysis and reporting. The use of a time series analysis could have provided good evidence of a “fall in the total number of referrals” but, for this, Automated Regressive Integrated

² This group is a collaborative review group of the Cochrane Collaboration that aims to help people make well-informed decisions about health care by preparing, maintaining, and ensuring the accessibility of systematic reviews of the effects of health care interventions.

Moving Average (ARIMA) or time series regression modelling would have been required. No rationale was provided for the number of data points collected and only two pre-intervention points were presented. Closer inspection suggests the fall could have been part of an ongoing trend, but insufficient data are available to confirm or refute this.

It was not possible to evaluate the quality of the research presented in the case studies or newsletter items due to the limited methodological detail provided.

Evidence of impact

i) Reduced referral to secondary care

The one primary research study investigated the use of the Map of Medicine for assessing chronic kidney disease referrals in Gwent healthcare community in Wales⁽³⁰⁾. The same findings were reported in less detail as a case study⁽³¹⁾. By analysing changes in the number of new referral letters received following the launch of the Map of Medicine-based chronic kidney disease patient referral pathway in November 2007, they found that there was an overall decrease in referrals from approximately 85% in September and October 2007 to approximately 60% between November 2007 and June 2008. By analysing patient referral letters in 6 consecutive months prior to and following the launch of the chronic kidney disease patient referral pathway, they also found that there was a decrease in referrals with inadequate information to secondary care from 23% to 14%. However there was a slight increase in inappropriate referrals from 13% to 16%. Furthermore they found that 62% of all primary care practices in the Gwent healthcare community were

registered with the Map of Medicine after the intervention and that these practices sent a higher proportion of appropriate referrals and were less likely to generate referrals with inadequate information.

Five of the 8 case studies also suggest that the Map of Medicine can lead to a decrease in inappropriate referrals. Newham Local Healthcare Community (LHC) used the Map of Medicine to communicate a new Anticoagulation pathway which resulted in 33% of stable patients being managed in primary care ⁽³³⁾. The number of referrals from primary to secondary care for monitoring almost halved in the months after the pathway was implemented. Similarly, the introduction of a diabetes pathway resulted in a reduction of 14% in the first to follow up³ ratios for Newham University Hospitals Trust, despite an increase in the number of outpatient attendance to secondary care ⁽³⁷⁾. The introduction of a Knee Pain pathway in South Devon resulted in a 70% decrease in referral to secondary care and an increase in appropriate referrals ⁽³⁵⁾. In Western Cheshire LHC the introduction of the Cellulitis pathway reduced hospital admissions by almost half ⁽³⁶⁾. Finally, Wirral Primary Care Trust reported reduced referrals after the introduction of an incontinence and Age-related Macular Degeneration (AMD) pathway (although exact figures were not reported in the case study) ⁽³²⁾.

ii) Cost savings

³ First to follow-up ratios are a type of performance measure usually calculated on a consultant basis to determine the numbers of follow up patients seen in comparison to new patients. As a rule of thumb, the higher the new to follow-up ratio, the more likely a significant proportion of a clinician's time is being taken to for follow-up appointments at the expense of seeing new patients.

Some considerable cost savings were presented in the articles reviewed. For example, introducing the Newham Anticoagulation pathway produced estimated savings of £300,000 for 2009/2010 and up to £500,000 in 2010/2011 ⁽³³⁾; and the Western Cheshire Cellulitis pathway was thought to save at least £2000 per patient ⁽³⁶⁾. South Devon knee pain pathway projects a reduction of in excess of 400 consultant appointments with a saving of at least £60,000 ⁽³⁵⁾. Wirral AMD service reports that it is now delivered at a significantly lower cost than alternative providers with the cost reduction at approximately 20%. Overall savings from the new service at Wirral are reportedly in the order of £200,000 per year with costs reduced in both initial assessment and treatment tariffs ⁽³⁴⁾.

iii) Reduced patient waiting times.

The introduction of the AMD pathway in Wirral led to an improvement in patient waiting times from 10 weeks to 10 days ^(32, 34). The adoption of the knee pain pathway in South Devon also resulted in reduced patient waiting times (although exact figures were not reported in the case study) ⁽³⁵⁾.

iv) Use as a training tool

One of the newsletter articles interviewed 100 senior hospital doctors in England and Wales to find out which one of four key benefits they would find most useful about the Map of Medicine ⁽³⁹⁾. The results indicated that the Map was rated most highly as a knowledge resource for training teams. Similarly a study of the viability of the mobile Map of Medicine found that it showed potential for formal clinical training ⁽⁴⁰⁾. A quote from a GP in one of the case studies also stated that it was a good teaching resource for medical students ⁽³⁷⁾.

v) Other benefits

Other benefits may include reduced wastage from unnecessary pathology testing, greater confidence in dealing with matters outside their own expertise, support for teams seeking alternative diagnoses, better communication between care providers, or a more unified approach to evidence-based care ⁽³⁸⁾.

Discussion

This study presents a systematic review of the literature on the Map of Medicine to determine the extent of the evidence for its impact on clinical practice at the current time. The findings will help individuals and organisations to decide whether to invest in the Map of Medicine, and where and how it can be utilised to make the biggest impact for patients. It will also help policy makers and researchers to set a research agenda that can generate evidence of impact for new initiatives on a timescale that can support policy decisions.

The most important finding of the study is the paucity of evidence available on the impact of the Map of Medicine and the variable quality of that which does exist.

There is only one article published in a peer-reviewed journal that presents empirical data relating to its impact. This seems astonishing, given the high level of financial investment by the Map of Medicine company and healthcare providers in the UK, Sweden and Denmark and highlights a need for more and better research in this area. The paucity of peer-reviewed literature may reflect the time involved in designing and performing rigorous research and this being written up, peer reviewed and published. The Map of Medicine was first developed in 2001 **but** it has only been available in Trusts across England and Wales since 2006 and in Sweden and

Denmark even more recently. If this is the case, we hope that there will be an abundance of literature emerging in the coming months and years.

Many of the studies had multiple aims and presented limited methodological detail. The multiple aims may be expected with interventions that are part of a service redesign project but made it difficult to establish the specific impact of an intervention. The limited detail also made it difficult to establish the specific impact and proved a barrier to using inventories that could measure the quality of the research studies as we had intended ⁽⁴²⁾. Furthermore, there appeared to be some flawed conclusions within the studies. For example, in two of the case studies, the results showed a shorter patient journey but the conclusions reported a better patient experience ^(32, 35). We would argue that, although a shorter patient journey may result in a better patient experience, this is not necessarily the case.

The potential for bias in the literature was high. The case studies were numerically the largest source of evidence for impact but because they were not peer reviewed and were published largely as promotional material on the Map of Medicine website, there is considerable potential for bias or selective publication. In addition, the case studies were written by healthcare communities that participated in the Map of Medicine Early Adopter programme ⁽⁴¹⁾. Early Adopters received free consulting resources and training support and, in return, were required to write a number of case studies. Importantly, there are certain pre-requisite criteria to becoming an Early Adopter (e.g. specific business challenge, specific and measurable outcomes) and this may mean that only those likely to be successful participated.

It is important to be clear that the dearth of quality literature at the current time indicates that we have insufficient evidence about the impact of the Map of Medicine

on clinical practice, rather than that the evidence suggests that there is no impact. Indeed there are some encouraging early indications, particularly for the Map of Medicine as a tool within service redesign, where it seems to be leading to an increase in appropriate referrals, decreased patient waiting times and considerable cost savings. **However, these improvements may have occurred through service redesign intervention that did not involve the Map of Medicine and different study designs are required to attribute any improvement to a specific cause.** The Map of Medicine is also perceived by clinicians as a valuable training tool and, again, evidence of its education impact will be difficult to prove.

One interesting theme emerging from our review was around the changing role for the Map of Medicine within healthcare. The Map of Medicine was initially designed as a knowledge resource to make specialist knowledge available to community-based clinicians and improve dialogue between primary and secondary care. More recently, however, it seems to have found a niche as a service redesign tool. Possible future applications seem to be a role in clinician training. It is interesting to speculate on the reasons for these changes. One case study suggests that anxiety around the Map of Medicine's potential to reduce the need for clinical judgement has formed a barrier to its uptake and usage ⁽²⁷⁾. It could be that the resource has specific uses for different people in different healthcare roles. GPs may find the primary care part of the Map and the crossover to secondary care most beneficial. Healthcare students and educators may find the whole Map useful in providing a visual framework of a complete patient journey. Healthcare managers may find the overview useful to aid service re-design and quality improvement.

Strength and limitations of the study

It is important to consider both the strengths and limitations of our study. The topic is important and the study is timely, given the financial climate in which decisions are having to be made. This systematic review involved a wide ranging literature search. Three different authors read each of the papers in full which ensured rigour in the review and resulted in different perspectives on the literature found. Whilst this paper focuses on the Map of Medicine, it may raise a similar lack of evidence for the impact of other healthcare interventions, particularly e-resources.

A limitation of the study is that despite the wide ranging literature searched, as with all systematic reviews, there may have been some literature missed, including literature published in languages other than English, particularly Danish and Swedish. Furthermore, the search terms used would not have found studies on similar resources with different names, which could have contributed to a full picture. Another possible limitation relates to the potential bias of the authors, who were two academic staff members at a medical school (initials and initials) and an NHS employee in the Strategic Health Authority (initials). We sought to ensure a balanced appraisal of the literature through our structured review process and by ongoing reflection on the process and our own potential bias, and this was a regular agenda item for the research team meetings.

Conclusions

The absence of quality evidence on the impact of the Map of Medicine will make decisions about whether to invest in the Map of Medicine, and where and how it can be utilised to make the biggest impact for patients, more difficult.

Research is urgently needed to answer these important questions and support decision-making.

Further research with rigorous study designs performed by professional researchers are needed. Randomised controlled study designs are unlikely to be possible but well-designed quasi-experimental and qualitative studies will help. We would encourage LHC's to design their evaluations with the rigour required for research publication and incentivise their staff to make them available to a wider audience via the academic literature. This may require partnerships between clinical and academic communities, in line with recent UK healthcare initiatives (e.g. CLAHRCs⁴, HIECs⁵).

Finally, large funded projects need to earmark sufficient resources to enable rigorous evaluation of the impact of the developments to take place and these evaluations need to be planned at the outset, rather than done retrospectively.

Key Messages

Implications for Practice

1. The Map of Medicine has many potential applications in healthcare.

⁴ http://www.nihr.ac.uk/infrastructure/Pages/infrastructure_clahracs.aspx

⁵ http://www.nesc.nhs.uk/about_nesc/hiecs.aspx

2. The Map of Medicine is emerging as a key tool within service redesign, leading to an increase in appropriate referrals to secondary care, decreased patient waiting times and considerable cost savings.
3. The Map of Medicine is perceived by clinicians as a valuable training tool.

Implications for Policy

1. There is a paucity of evidence available on the impact of the Map of Medicine on clinical practice.
2. The evidence which does exist is of variable quality.
3. Further research is needed to provide evidence of the impact of Map of Medicine on clinical practice in order to support policy decisions.

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