BMJ Best Practice

Reinventing medical information for the digital age

Chris Wroe and David Iddon, BMJ | Susan Crean, 67 Bricks
started as a medical journal 175 years ago

James Simpson reports the discovery of chloroform.

Link between Anopheles mosquito and malaria published.

Feature Richard Doll and Bradford Hill’s first report on smoking and lung cancer.
- 10 years
- Quick answers at the point of care
- Over 1000 conditions
- 30 medical specialties
- Always digital
- Continuously updated
- Translations

Evidence based
Independent
 lots of trusted content

- Quick answers from this long form text?
2016

- Knowledge and insights buried in monolithic documents
- Losing market share
- Weighed down in technical debt
- Unhappy users
- Excessive manual work
- Product development stalled
Unstable and useless

“Still bugged by Keyes89
The new format is appealing and faster in performance. However the navigation from searching is too complicated- why search by chapter or subheading. The biggest issue is that of content stability - frequently the topics unsubscribe then need to re install; seemingly taking half a day. What point is a quick reference that is not quick at all? Beyond that and now there is an appalling flaw that is the lack of resources. I have a full subscription and only 866 topics are available. For Gods sake is your IT department just trolling the general public here? GET IT TOGETHER.”

“GET IT TOGETHER”

“Unstable and useless”

“GET IT TOGETHER”
BMJ Best Practice

- Move to user centred design and product development process
- Revolution not evolution
The User Centred Design Process

- **Research**: Develop an understanding of our customers and users
- **Define**: Compile the research and identify users’ problems
- **Hypothesise**: Generate ideas with anticipated outcomes
- **Prototype**: Build real, tactile representations of our hypotheses
- **Test**: Observe what users do on the prototypes - **iterate**
- **Implement**: Launch the product and then repeat the process
What our users needed from BMJ Best Practice

Quick answers at the point of care

Embedded seamlessly into workflow

Trusted and accurate

Latest evidence and information

Enriched and structured

Searchable
"...will be the number one CDS tool for all healthcare professionals, seamlessly integrated into the clinical workflow. Used daily, it will be easy to access providing quick, actionable answers wherever and whenever they are needed."
Solutions

Latest evidence and information

Update specific recommendations

Move from monographs to more granular chunks of content

Quick answers at the point of care

More directive structured content

Capability to evolve our bespoke XML content structure

Journal article standards

Technical manual standards
Solutions

Embedded seamlessly into workflow

Semantically enriched

APIs available for integration into hospital systems
What was important to us

- Retain control
- Be flexible
- Move quickly
Co-development

- Trusted partnership
- Common goal
- Agile working methodology
- Strong prioritisation
- Prototyping and testing with real users
- Knowledge transfer
Data maturity pyramid

- **Insights** (predictive and prescriptive)
- **Knowledge** (what has happened)
- **Personalisation** (personalised search and discovery experience)
- **Smart ‘granular’ content** (improved search and discovery)
- **Raw content assets** (document based storage and access)
Updating the Technical Architecture

Terminology and Tagging APIs
Health Language®

Configurable Web Based Editor

BMJ Specific Services
- Enrichment Service
- Delivery Service
- Editorial Service
- Content Service

Modern XML Database
MarkLogic

6ricks

Translation Platform
SMARTLING
A new content model

Before

Asthma in children
Theory p4-6
Diagnosis p7-15
Treatment p17-43
Follow up p43-48

One large document

After

Asthma in children
Asthma Metadata
Asthma Epidemiology
Asthma Case History
Asthma Diagnostic Factors
Asthma Investigations
Asthma Treatment Approach
Asthma Treatment Algorithm
Asthma Guidelines
Asthma Monitoring
Asthma Complications

Reusable fragments

Inhaler Video

~40 fragments docked into topic container

Reinvented data and content model
The aim of asthma management is achieving control of the disease, such that the child has no daytime symptoms or night-time awakening, no need for rescue medication, minimal exacerbations (and no severe exacerbations), no limitations on activity, and normal lung function (in practical terms FEV1 and/or peak expiratory flow [PEF] >80% predicted or best) with minimal pharmacological adverse effects. Benefits achieved during continuous treatment with asthma preventer medication do not persist after treatment is discontinued. Good control of asthma and prevention of exacerbations is important. New data suggest that severe asthma exacerbations are associated with a more rapid decline in lung function in children, but not in adolescents, and that treatment with low doses of inhaled corticosteroids is associated with an attenuation of the decline.

In clinical practice a balance between these aims and potential adverse effects, such as impact on growth or inconvenience of taking medication, may be necessary. For example, while other aspects of good control are achievable in the majority of children, a significant number will continue to have viral-induced exacerbations despite good control. A study highlighted the heterogeneity in treatment response seen in paediatric asthma in children at step 2 of the management guidelines, and compared the three options for treatment at this step on the ladder: high-dose inhaled corticosteroids (ICS), ICS plus leukotriene receptor antagonists (LTRAs), ICS plus long-acting beta agonists (LABAs). Determining which child would respond best to which treatment option was not possible; this emphasised the need for physicians to evaluate treatment changes made in asthmatic children with suboptimal asthma control by reviewing response to treatment and, if no evidence of benefit is seen, to cease and evaluate alternate options.

Education is fundamental to paediatric asthma management and should include training in the optimal use of medications, inhaler technique review (including spacers in young children), and individualised written asthma management plans.

### Inhaled corticosteroids

The beneficial effect of inhaled corticosteroids (ICS) has been long established. A number of different ICS medications are available, and appropriate dosing varies between them. This is due in part to the particle size generated and subsequent drug deposition. Local adverse effects can be avoided, particularly if delivered via a spacer, limiting oropharyngeal deposition. Cataracts have been reported in 15% to 35% of children receiving oral corticosteroids for more than 1 year, but follow-up of the Childhood Asthma Management Program (CAMP) study cohort has shown that no increased risk exists for those children treated with low to moderate doses of ICS as maintenance therapy. When starting therapy with corticosteroids, initial low dose is as effective as initial high dose and subsequent down-titration is recommended. At medium doses of inhaled corticosteroids, the main adverse effects seen are local (e.g., candidiasis) or a transient slowing of growth. Monitoring of growth should be performed in all children. Unlike in adults, increased respiratory infection has not been found to be associated with use of ICS in children. There are concerns over systemic adverse effects of inhaled corticosteroids, particularly at higher doses. Oral corticosteroid bursts have been shown to decrease bone mineral density and increase the risk of osteopenia. Common adverse events related to oral corticosteroid use of 514 days' duration were vomiting, behaviour changes, and sleep disturbances (incidence of 5.4%, 4.7%, and 4.3%, respectively). The systematic review also reported that other less common but serious adverse events were infection (incidence of 0.9%), increased blood pressure (39%), hypothalamic-pituitary axis suppression (81%), and weight gain (28%).

<table>
<thead>
<tr>
<th>ONGOING</th>
<th>age 0 to 4 years</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>step 1 (intermittent and exercise-induced asthma)</td>
</tr>
<tr>
<td></td>
<td>1st line short-acting beta-2 agonist when required + education</td>
</tr>
<tr>
<td></td>
<td>step 2 (persistent)</td>
</tr>
<tr>
<td></td>
<td>1st line low-dose inhaled corticosteroid</td>
</tr>
<tr>
<td></td>
<td>Plus short-acting beta-2 agonist when required + education</td>
</tr>
<tr>
<td></td>
<td>2nd line montelukast</td>
</tr>
<tr>
<td></td>
<td>Plus short-acting beta-2 agonist when required + education</td>
</tr>
<tr>
<td></td>
<td>step 3 (persistent)</td>
</tr>
<tr>
<td></td>
<td>1st line medium-dose inhaled corticosteroid</td>
</tr>
<tr>
<td></td>
<td>Plus short-acting beta-2 agonist when required + education</td>
</tr>
<tr>
<td></td>
<td>step 4 (persistent)</td>
</tr>
<tr>
<td></td>
<td>1st line medium-dose inhaled corticosteroid + montelukast</td>
</tr>
<tr>
<td></td>
<td>Plus short-acting beta-2 agonist when required + education</td>
</tr>
<tr>
<td></td>
<td>step 5 (persistent)</td>
</tr>
</tbody>
</table>
New systems

First-generation antihistamines are often a secondary option due to their side effects, many patients are unable to tolerate these drugs, even in low doses. Furthermore, their pharmacokinetics often necessitates 3 or 4 times daily dosing, which makes compliance more difficult. If used, physicians should start at a low dose and titrate to a clinically effective dose. Tricyclic antidepressants also have potent H1 blockade and have been shown to be effective in the treatment of urticaria. Doxepin provides the additional benefit of a longer half-life, allowing for once-nightly dosing. Therapy must be dictated by individual variations in response, efficacy and side-effect profile.

Regimen (tier: 1)

Component: loratadine
Dosage: 10 mg orally once daily (modifier: unset)
New APIs, websites and app
Increased production capacity and faster update turnaround

Focussed updating with a wider team

Improved reach

New features: Update alerts, practical videos

Hospital system integration enabled - seamlessly into the clinical workflow

BMJ Best Practice
New Approach
202% growth in traffic

Over 1m users a month

95% customer renewal rate

From 2 to 4.8 app store rating

80k+ downloads of the app

Relaunched BMJ Best Practice

Digital Experience Awards
2 prizes 2018

Academy of Interactive and Visual Arts
2 silvers 2018

3 prizes 2019
Deeper hospital integration (SMART Apps)

Patient Data

Patient Specific Recommendations
2016

- Years of research and user feedback not being actioned
- Product development stalled
- Excessive manual work

2019

- Clear technical debt
- Increase production capacity
- Exciting new product development projects and partnerships
- 96% say it helps them improve patient care
"Unstable and useless"

Danny Cyclone 10 March 2015

So unstable. Awesome app. When it works. Which is never. Slow, and when you actually manage to search a topic, it'll either freeze it crash. Useless.

Alfred Wong 16 February 2015

Keeps crashing Managed to download all subscribe topics but keeps crashing upon restarting the app. Had uninstalled & re-downloaded the topics but to no avail. Please fix. Xperia Z1

Still bugged by Keyes89

The new format is appealing and faster in performance. However the navigation from searching is too complicated- why search by chapter or subheading. The biggest issue is that of content stability - frequently the topics unsubscribe then need to re install; seemingly taking half a day. What point is a quick reference that is not quick at all!? Beyond that and now there is an appalling flaw that is the lack of resources I have a full subscription and only 866 topics are available. For Gods sake is your IT department just trolling the general public here? GET IT TOGETHER.
The best thing ever created. Fantastic format for learning about all the different conditions, presentations, examinations and management.
Thank you

Chris Wroe
Health Informatician
cwroe@bmj.com

David Iddon
Head of UX
diddon@bmj.com

Susan Crean
Business Development Consultant
susan.crean@67bricks.com