Development of educational tools for doctors in training on inpatient diabetes management

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**Abstract**
The prevalence of diabetes among inpatients is increasing. The National Diabetes Inpatient Audit in 2015 showed that 17% of inpatients have diabetes of whom about 36% are on insulin therapy. The audit highlighted sub-optimal care quality, with harm resulting from inpatient care across several areas of diabetes care. The National Diabetes Mortality and Morbidity project was set up to understand factors contributing to inpatient diabetes harm. The key recommendation arising from this project is mandatory education on inpatient diabetes for all staff. It is critical to take widespread action to improve training and education in inpatient diabetes care in order to reduce and avoid serious diabetes harms occurring in the future.

This paper describes educational tools we have developed for staff who care for inpatients with diabetes. IDEA (Inpatient Diabetes Education through Animation) is a novel, effective, unique and appealing model which we have developed, piloted and evaluated in the inpatient diabetes care setting. The INDIE web portal (INPatient DIabetes Education tool for doctors in training) provides easy access to educational resources (knowledge self-assessment, links to educational material, guidelines, guidance and IDEA videos). Around 94% of doctors in training (n=19) rated IDEA videos as relevant and 83% have rated them as useful and will change their practice. Likewise 94% of pharmacists (n=17) rated IDEA videos useful and relevant and 76% rated that the videos would change their practice. Copyright © 2017 John Wiley & Sons.

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Diabetes is an escalating problem with the rising prevalence of type 2 diabetes fuelled by the pandemic of obesity and an ageing population. Of particular concern is also the number of inpatients with diabetes who are often on complex treatment regimens. In the UK, the National Diabetes Inpatient Audit (NaDIA) in 2015 showed that around 17% of inpatients have diabetes of whom ~36% are on insulin therapy. For the majority (>90%) of these admissions diabetes is a secondary diagnosis and not the primary reason for admission. These patients are often cared for by non-diabetes specialty teams. NaDIA 2015 highlighted sub-optimal care quality across several areas of inpatient diabetes care with 38% of inpatient drug charts reviewed having at least one diabetes medication error in the previous seven days. When looking specifically at insulin errors (i.e. prescription errors and/or management errors) 23% of inpatient drug charts had one or more insulin errors. Around 20% of patients reported hypoglycaemia during their inpatient stay. There is a lack of confidence and knowledge among trainee doctors in managing inpatients with diabetes. The National Diabetes Mortality and Morbidity project was initiated to understand factors contributing to inpatient diabetes harm and has recommended mandatory education on inpatient diabetes for all staff. It is critical to take widespread action to improve education and training for staff who care for inpatients with diabetes in order to reduce and avoid serious harms occurring in the future. However, reaching all trainee doctors and staff who care for patients with diabetes across different specialties is challenging.

We have therefore developed animation videos and hosted them on platforms such as YouTube, Twitter and Vimeo for wider reach. Educational videos are a novel yet simple and effective way to convey key patient safety messages and educate effectively in an entertaining and memorable way to health care professionals, compared to more...
traditional methods such as emails, newsletters, group discussions and e-learning resources.\textsuperscript{7,8}

**Methodology**

**Inpatient diabetes errors**

Datix, a web-based incident reporting and risk management software, was used to collect data related to inpatient diabetes care using the search words ‘insulin’ or ‘diabetes/diabetic’ for the period November 2013 to October 2014 at University Hospitals of Leicester NHS Trust. There were 252 errors in this category. Among the medical errors reported (n=164), the most common errors were related to variable rate intravenous insulin infusion (VRIII) use (30.5%, n=50), insulin management (accidental or deliberate insulin dose omission, delays in administration; 25.6%, n=42), insulin prescription (wrong insulin, wrong time or wrong dose; 15.8%, n=26), harm from inpatient care (instance foot ulcers, inpatient diabetic ketoacidosis [DKA], hypo/hyperglycaemia; 22%, n=36), and insulin dispensing (6.1%, n=10). (Figure 1.) In addition to Datix analysis, in a separate exercise, as a part of a National Diabetes Mortality and Morbidity project, root cause analysis was undertaken for six cases of severe inpatient diabetes harm, which generated key learning and action points.

**Knowledge gaps in inpatient diabetes care**

A web-based knowledge survey of sub-consultant grade trainees, using a modified pre-validated questionnaire, was undertaken to identify knowledge and training gaps. Fifty-seven sub-consultant trainees were surveyed according to the following groups: Group 1 – foundation year FY1 20%; Group 2 – FY2, core trainees, specialty trainees (STs) STs 1/2 and GPs Vocational Training Scheme 61%; Group 3 – ST3 and above 19%. The mean total score for the knowledge areas tested (insulin prescription, management, glycaemic control, VRIII use) was sub-optimal across all grades: Group 1 66.3%; Group 2 64.8%; Group 3 67%. The knowledge was particularly poor for insulin prescription: Group 1 50%; Group 2 47%; Group 3 55%. (Table 1.)
Following on from the above work, we identified the need to develop an effective teaching tool to disseminate learning outcomes and key safety messages to address training and education gaps in all staff groups but particularly for trainee doctors.

Developing the intervention

We have developed short (3–4 minutes) animated videos, based on frequently reported errors and cases of significant harm, as an adjuvant teaching tool for doctors in training and other staff members, to improve quality of care for inpatients with diabetes. The videos are based on real-life scenarios, with a focus on the safe use of insulin and have top tips with key educational messages. These videos are hosted on YouTube channel IDEA (Inpatient Diabetes Education through Animation). (Figure 2.) IDEA videos are free of charge and can be accessed by trainee doctors and staff both locally and nationally.

INDIE (INpatient Diabetes Educational tool for doctors in training) forms the basis for a blended inpatient diabetes educational tool that includes a web-based educational resource (including knowledge survey, links to educational material and guidance) and IDEA videos (Figure 3).

INDIE provides a platform for trainee knowledge assessment and learning. By using a modified pre-validated questionnaire to identifying gaps in knowledge, trainees are guided to appropriate modules for further learning. This web portal can also serve as a standalone platform for quick access to guidance, educational videos and top tips for reference.

IDEA videos are available on YouTube and Vimeo. In addition to the above platforms, IDEA videos also feature on the trust home page, the social media platform Twitter (@IDEA_UHL), and are a part of a PowerPoint presentation during mandatory trainee teaching on insulin safety; they are also included in the information given to doctors at induction. In addition, they have been used for ad-hoc promotions, e.g. during the 2015 National Hypo Awareness Week; the IDEA video on hypoglycaemia management was embedded on the trust webpage attracting over 220 views.

Evaluation

IDEA was evaluated in the ‘real world’ setting as a teaching tool during trainee teaching sessions on insulin safety and inpatient diabetes care. In the teaching sessions, IDEA videos were used to explain topics alongside conventional teaching tools like PowerPoint or Prezi slides/frames.

The evaluation was undertaken with groups of FY1s and specialist registrars (ST3 and above). Around 98% of specialist registrars (n=41) rated the content of the teaching session 4 or higher on a scale of 1–5 (1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree), a rating which was over and above that for the co-presenters who delivered teaching at the time but without the use of IDEA videos.

Pharmacists (n=17) rated IDEA useful and relevant (94%) and would change their practice (76%).

Piloting

The aim of a pilot was to examine whether IDEA was relevant and useful. We also asked the viewers, trainee doctors and staff, if it would change their practice. The piloting procedure allowed the makers of the videos to go through a PDSA (plan, do, study, act) process of quality improvement to refine the content and platforms to ensure the model was ‘fit for purpose’.

The pilot took place between August 2015 and November 2015. A selection of IDEA videos was shown to the group of doctors and pharmacists. Feedback was very positive with 89% of respondents scoring 4 or higher (range: 1 = poor to 5 = excellent) in evaluation. Around 94% of doctors in training (n=19) rated IDEA relevant, and 83% rated it useful and would change practice.

Pharmacists (n=17) rated IDEA useful and relevant (94%) and would change their practice (76%).

List of IDEA videos:
- Insulin safety: Insulin prescribing standards
- Peri-operative management of diabetes
- Insulin titration
- Insulin safety: VRIII (sliding scale) to SC insulin
- Insulin safety: Safe discontinuation of FRIII
- Insulin safety: Insulin regimens
- Insulin safety: Hypoglycaemia
- Safe use of VRIII (sliding scale)
- Pregnancy and type 1 diabetes

Figure 2. List of IDEA video titles, and screenshot of the IDEA video on ‘Insulin safety: VRIII (sliding scale) to SC insulin’ shown on YouTube

Figure 3. Screenshot showing INDIE web portal modules available
the content of teaching with IDEA videos 4 or higher on the same scale of 1–5, with 100% of FY1s rating the teaching to be relevant.

Impact
IDEA videos have over 11 000 view counts to date (Figure 4).

IDEA was a finalist at the 2016 Quality in Care Diabetes Awards in the digital and technology solutions category. Judges commended the project, calling it a ‘great, simple idea’. They said: ‘We loved the fact that untoward incident data were used to focus on what mattered most. This is fresh, different and has potential.’

IDEA has national endorsement by the Joint British Diabetes Societies (JBDS) for Inpatient Care Group; the group has supported publicity of IDEA on major national diabetes platforms – i.e. that of the Association of British Clinical Diabetologists, and Diabetes UK's website where IDEA is also included in the e-learning resource section on inpatient diabetes care.9,10

IDEA has been presented at national meetings such as Diabetes UK, included in the diabetes mortality and morbity project session, and at the 2016 National Inpatient Diabetes Conference.

Several articles/news stories on IDEA with excellent coverage were published in March 2016 in Leicester Mercury, Mercury Extra and The Diabetes Times.11

IDEA videos feature on our trust intra-net (UHL INsite). For instance, a link on the management of hypoglycaemia was posted on UHL INsite and UHL Twitter as a part of the October 2015 Hypo Awareness Week and was watched by staff members.

IDEA videos posted on Twitter @IDEA_UHL for wider dissemination had several hundred view counts with excellent response.

IDEA appeals to the current generation of trainees who are training in a culture of technology and bite-size information delivery. The animations are easily viewed on smartphone, tablet or PC. The rating we have received from medical and other staff members on the usefulness and relevance of these videos is excellent.

Figure 4. Screenshot showing view counts for IDEA

Service improvement
Interest has been expressed for the use of IDEA videos as a part of induction for trainee doctors and staff. IDEA videos are being used as an adjuvant teaching tool on insulin safety for trainee doctors across grades. In addition, IDEA is embedded into a blended education programme alongside more traditional teaching methods. It is still early days to assess the impact of IDEA on service improvement and to measure patient outcomes. There are, however, several early reports which indicate the wider impact of IDEA videos. For instance, a lead midwife who saw the IDEA video on type 1 diabetes and pregnancy wrote: ‘I have shared it with our practice development midwives. My colleagues here have watched it and agree it is easy to follow with an important message. I will use the animation at the next teaching session. Some of my colleagues will be unaware of the risk of development of DKA so quickly in pregnancy and it will certainly provide a good basis for discussion.’

An anaesthetic trainee who watched the IDEA video on perioperative management of diabetes wrote: ‘This is such a great idea. The video is excellent. I will definitely use the video at the trainee induction as an intervention to improve care.’ The next step expressed by the trainee is to audit the perioperative management of diabetes before and after IDEA intervention. This video was also presented at the Association of Anaesthetists and was shared at an international event, the Annual Congress of the College of Anaesthesiologists and Intensivists.

The pre- and post-INDEE knowledge assessment undertaken by trainee doctors showed a significant improvement (~20%) in knowledge after visiting INDIE modules with embedded IDEA videos, guidance and guidelines. A trainee who undertook knowledge assessment and reviewed modules on INDIE wrote: ‘INDIE is an excellent tool. I was not aware of the indications for the use of VRIII and FRIII [fixed rate intravenous insulin infusion]. This was very helpful.’

Following successful pilot on wider dissemination of the IDEA video on hypoglycaemia management as part of the October 2015 National Hypo Awareness week, two trusts (University Hospitals of Leicester and Northampton General Hospital) are currently working towards wider dissemination of all the IDEA videos to staff members in promotional on-line events and hosted on their patient safety portals. For instance, at both the trusts, IDEA videos based on various inpatient diabetes management areas (e.g. insulin titration, insulin prescribing standards, safe use of sliding scale/VRIII) with key top tips and learning points will be posted on the hospital trust homepage on a weekly basis.
and work towards generating awareness among staff to accessing the video to help with their training. This will have a huge impact, as our pilot suggests that ~80% of viewers report that IDEA would change their practice. This initiative will also show that IDEA can be easily adopted by more than one trust. There has been wider interest in the use of IDEA as several other trusts have requested consent to post the video links on their trust websites.

**Development and design costs**

IDEA is a sustainable educational tool developed using the animation software Go Animate. This software is easy to purchase (£210 per year) and takes about 16 hours to learn to use. A video can be developed within one to two weeks depending on the duration and content. IDEA, however, is unique in its content. It is difficult to replicate IDEA without the extensive background analysis of inpatient diabetes error patterns and knowledge gaps. IDEA can be placed on multiple well-established platforms like YouTube, Vimeo, Twitter, web portals, PowerPoint slides as MP4 and Prezi both on-line and offline. Once uploaded onto the platform, limited input is required to sustain the resource. Videos can easily be updated when necessary depending on the evidence base or guideline revisions. To update the videos the annual licence needs to be renewed to retain access to the original videos and hence will incur additional costs. However, IDEA can be easily accessed by individuals or health care organisations at cost obviating the need for teams to create their own videos.

INDIE was developed with the support of the diabetes clinical team, an experienced educational strategist and a small team of web designers who worked on the functionality and design. This tool was developed at a cost of ~£1300 and has basic functionality. INDIE can be easily adapted to wider use with added functionality. This would incur additional costs. INDIE will require ongoing costs for regular maintenance, which would be made possible by embedding it into existing educational strategies with a planned forecasted financial commitment.

**Discussion**

Both IDEA and INDIE are unique, appealing and effective educational tools which allow easy dissemination of focused and memorable safety messages to large numbers of staff. Further evaluation is required with respect to: widespread dissemination strategies, sustainability models, and acquisition and retention of knowledge. We strongly believe that exploring innovative tools for delivery of educational safety messages is key to engaging staff in training and learning.

**Testimonials**

‘What really struck home was the high quality focused information that junior doctors would gain from watching one of your animations. There was something very memorable about “Bobby” and his trials trying to offer appropriate care to his patient. I think this project has great potential to educate our junior doctors and improve the care of our patients.’ (Assistant Clinical Director, Diabetes and Endocrinology.)

‘Many thanks for agreeing to share the link for your excellent educational animated video series. I am hoping to encourage juniors on diabetes rotation to view and reflect on this. I hope this excellent resource is available for use in other trusts.’ (Consultant, Diabetes and Endocrinology.)

‘Very good use of videos!’ (FY1 feedback.)

‘Very good explanations of insulin and regimes.’ (FY1 feedback.)

‘Nice use of videos to illustrate learning points.’ (FY1 feedback.)

‘Very relevant and clear. Should be a mandatory e-learning module as I would have found this extremely useful when I started.’ (FY1 feedback.)

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**Declaration of interests**

There are no conflicts of interest declared.

**References**


