




SHORT REPORT



Virtual patient simulation platforms challenging traditional CME: Identification of gaps in knowledge in the management of Type 2 diabetes and Hyperlipidaemia

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ABSTRACT

As any other aspect of contemporary life, an old and established field of CME undergoes a transformation into a “digital age.” Virtual patient simulation (VPS) has shown to be an interactive and efficient way of engaging healthcare professionals (HCP) in continuing medical education. VPS can identify gaps in knowledge and improve competence, using engaging, online tools. The Edocate VPS Platform has been developed by a group of physicians, education experts, and computer specialists. In this communication, we report the experience of several hundreds of HCP using the Edocate VPS application in the fields of type 2 diabetes (T2DM) and hyperlipidemia. The Edocate VPS application, displaying both simple and complex clinical situations, was presented to an international group of HCPs who had the task to perform physical exams, order lab and imaging tests, update the medical record with the right diagnoses, prescribe medications, and perform long-term follow-up through multiple visits. The HCPs received personalized, guideline-based, feedback on their actions. The analytical capabilities of the Edocate VPS platform run very deep and allow in-depth analysis of learners’ competence in achieving the best outcomes, while teaching to apply a personalized approach, avoiding side effects of medications, and providing instantaneous access to the most current references in the field. The data collected from the program has shown significant gaps in knowledge and adherence to guidelines in the areas of management of T2DM and hyperlipidemia. Only about 50% of all participants achieved guideline-compatible glycemic control – namely HbA1c below 7%. Furthermore, only 41% of practicing physicians and 23% of family medicine residents achieved levels of LDL below 70 mg/dl in their virtual patients. In conclusion, the data presented in this communication strongly suggests that this novel simulation platform can enable medical organizations to create immersive VPS cases for their primary educational and CME efforts.

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Introduction

As any other aspect of contemporary life, an old and established field of CME undergoes a transformation into a “digital age”. Many medical education providers are attempting to disrupt a traditional approach of a case review followed by multiple-choice questions with virtual simulation [1–7]. This new approach, albeit a more interactive and efficient way of engaging the learner, identifying gaps in knowledge, and improving competence [8], is much more difficult to develop as regular medical faculty are not equipped to create digitalised complex virtual cases. This task falls into the hands of programmers who can translate the dry text of a case into an interactive digital encounter.

Lack of these skills and the necessity of engaging another party into programme development is what keeps most CME providers from embracing digital

platforms much more eagerly, and they therefore usually resort to presenting lecture material in an online format. However, changes in the business and education world introduced by the COVID pandemic demand much greater utilisation of virtual meetings, conferences, and CME events.

Even with the greater introduction of patient simulation platforms into regular education and the CME world, not all digital approaches are equally sophisticated or engaging. In this communication, we report on the development of a Virtual Patient Simulation (VPS) application (App) which can be accessed on mobile devices and desktop browsers, where the learner (a healthcare professional or a student) selects patients from the virtual waiting room.

The Edocate VPS Platform has been developed by a group of physicians, education experts, and computer

specialists. It is available as a Software as a Service (SaaS) “White Labeled” platform, meaning that each implementation is branded by the commissioning organisation, that creates the content through a content management tool and presents the education as their own.

This paper describes the educational approach of the VPS App and focuses on the results of the first version that was implemented in a collaboration with the American Diabetes Association (ADA), the American Heart Association (AHA), in the educational programme known as “Know Diabetes by Heart” or KDBH. The Edocate VPS App, called “A1CVD Pro”, was first presented to learners at the annual ADA and AHA meetings and was available from the <https://www.knowdiabetesbyheart.org/professional/clinical-support/a1cvd-pro-app/> website as a year-long educational activity.

Methods

Description of the App

The App can be custom-built for specific educational events and programmes. Most of the implementations

are aimed at Primary Care Practitioners (PCP), but certain educational programmes are being created for specialists like endocrinologists, cardiologists, rheumatologists, pulmonary physicians, as well as for an inter-professional setting.

The KDBH Program and Edocate VPS App: The American Heart Association (AHA) and the American Diabetes Association (ADA) have identified a need for education of their members about cardiovascular complications of diabetes and the application of new therapeutic strategies to prevent and treat cardiovascular sequelae of diabetes. ADA and AHA have joined forces with the goal to reduce cardiovascular death, heart attack, stroke, and heart failure in people living with type 2 diabetes (T2DM) [9]. This combined effort of both organisations resulted in the development of a highly successful educational programme – KDBH, with Edocate VPS App being an integral part of this programme. As such, the programme provides a set of tools, most of them digital, to support patients and healthcare professionals. Developing the App was a collaborative approach, the scientific content is based on published ADA and AHA guidelines and has been vetted by the group of diabetologists

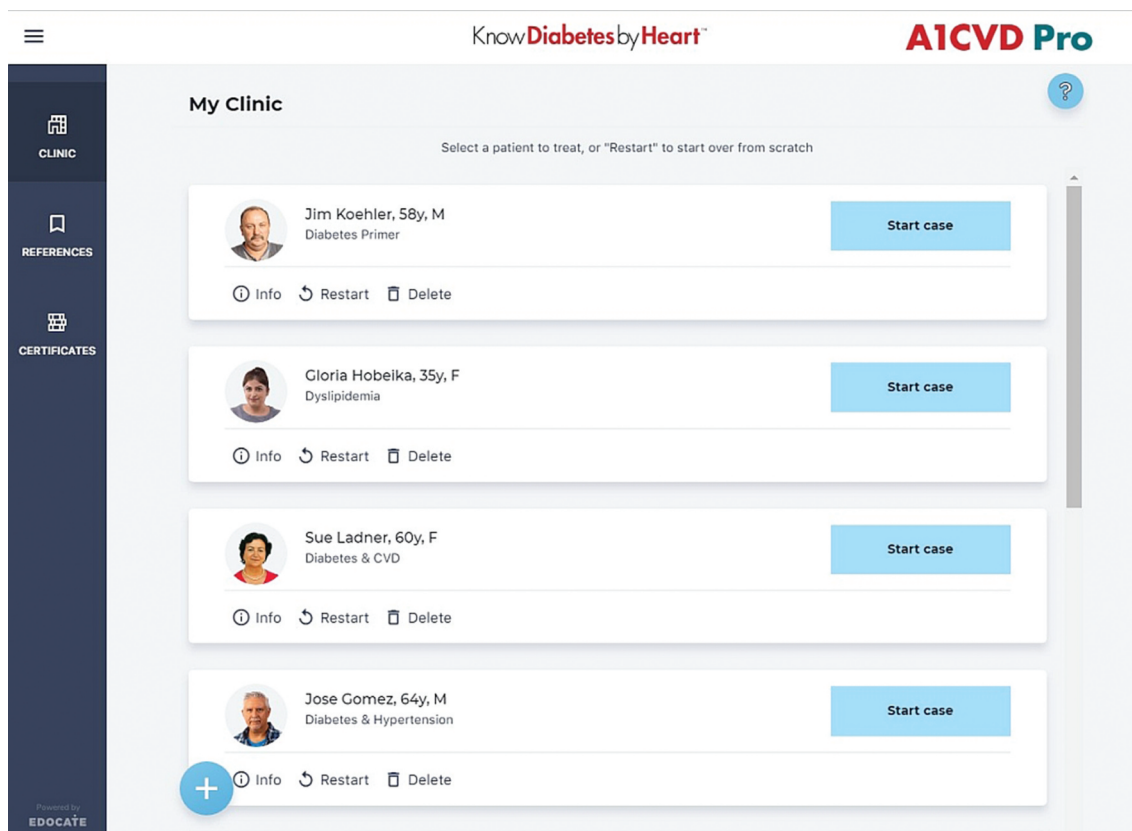


Figure 1. Opening page of the Edocate virtual clinic developed for the KDBH A1CVD Pro activity, displaying a sample of virtual patients.

selected by the ADA. The App was customised and branded as “A1CVD Pro” and was offered to any healthcare professional accessing the KDBH website. From the KDBH point of view, the programme sought to gain a better understanding of how professionals adhere to published guidelines and monitor the change of competence skills while managing patients with T2DM.

The learner registers on the system according to the requirements of data protection legislation such as GDPR in the European Union and CCPA in California. Personal information is kept secure to confirm activity for organisational and CME purposes, otherwise broader analysis is carried out using anonymised data to study opinions, practices, and trends by country or region.

Eight patients are in the waiting room and the learner can select any one of them to begin the educational activity (Figure 1). The learner can spend as much or as little time as circumstances allow – the responses are always saved automatically, and the App is ready for continuation as it opens next time. Ideally, each encounter is designed as one visit at which time the learner schedules “a next virtual visit” that can commence at any time.

Once the visit is open, the learner goes through a physical exam, ordering laboratory analyses and imaging studies, making a diagnosis, changing and or ordering medications, and referring a patient to various specialists. The results are immediately available and dictate the further steps. At the end of the encounter, the learner receives personalised feedback for this particular encounter while at the end of the case (several encounters), the learner receives detailed feedback about their overall performance and how this performance relates to those of their peers.

The analytical data collected by the App in real-time include completeness of physical exam, diagnostic considerations, medication prescribing patterns, timeliness and appropriateness of laboratory and imaging investigation, referral pattern and appropriateness, adherence to guidelines and best practices, identification of gaps in knowledge, and anonymous comparison with other learners. The latter two pieces of information are designed to encourage self-reflection and to take steps to improve performance.

Like in real life, many cases have overlapping or similar problems, thus allowing the learners to demonstrate their improved performance without repeating the same case. Upon successful completion of each case, the learner gets a certificate of participation.

Results

Over 5700 healthcare professionals in the USA, UK and Israel have used the Edocate VPS App, at in-person and virtual meetings as well during post-meeting activities. Even though the App presents virtual patient simulation in many therapeutic areas, like diabetes, obesity, atopic dermatitis, chronic obstructive pulmonary disease, atrial fibrillation, osteoarthritis, and others, in this communication we describe and analyse the experience of health care providers (HCP) with the management of Type 2 diabetes and hyperlipidaemia as an example of this App’s capabilities. The data was collected automatically using the App’s internal recording system, where each of the participants’ actions is recorded and then analysed. The participants’ actions were evaluated against published guidelines of the ADA: Standards of Medical Care in Diabetes – 2020 and 2021 editions [10].

Identification of Gaps in Knowledge in the Management of Type 2 Diabetes (T2DM)

461 Health Care Providers (HCP) {247 MD or DO (Doctor of Osteopathic Medicine), and 214 nurse practitioners} downloaded and used the Edocate VPS App to treat their virtual patients over multiple visits as a part of the Type 2 diabetes management study. All patients presented with poorly controlled T2DM, hypertension, and hyperlipidaemia. HCP chose the first, second, and third lines of medications, made diagnostic adjustments, initiated appropriate referrals to specialists, and ordered laboratory tests of their choice. Based on their selections, the App simulated the course of diabetes and its complications, requiring diverse management decisions on the subsequent virtual visits.

In the virtual clinic, only 53% of HCPs achieved good glycaemic control (HbA1c < 7%), 41% achieved blood pressure control (<130/80 mmHg), and 66% prescribed high-intensity statins. Only 48% of HCP checked microalbuminuria, 54% ordered creatinine and 55% ordered LDL. Interestingly, nurse practitioners specialising in T2DM had the best guideline-recommended approach to therapy, followed by practicing MD/DO.

Prescription Patterns in Type 2 Diabetes

Seventy-nine percent of HCPs either kept or started metformin as the first-line medication. The most commonly ordered second-line medication for glycaemic

Case Authoring Tools for teachers

- Easy to use, versatile, Case Builder & Validator
- Clinical databases (drugs, references, diagnoses)

Web and Mobile App for learners

- Full control of branding and customization
- Full Virtual EMR with customized feedback
- Pathophysiological simulator Engine
- Feedback on actions with annotated references

Dashboard for the organization

- Analytics capturing user & system behavior
- User management

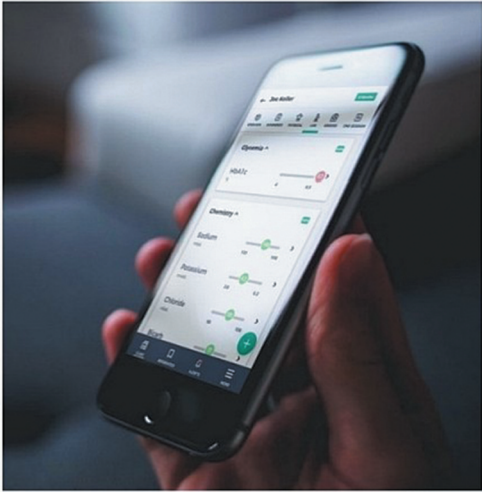


Figure 2. Implementing the Edocate VPS App.

control was either GLP-1 receptor agonists (39%) or SGLT2 inhibitors (36%), while 23% of HCPs kept their patients on or added sulfonylurea or basal insulin (11%).

Identification of Gaps in Knowledge in the Management of Hyperlipidaemia

Management of hyperlipidaemia in patients with T2DM is constantly discussed and under review with many international and national guidelines developed to guide the healthcare professional, but the real-life competency is difficult to evaluate. By using the App, it was possible to analyse the real-life knowledge and competence of 894 HCP in the management of hyperlipidaemia in patients with T2DM. The HCP were managing between 1 and 3 patients with T2DM and hyperlipidaemia in their virtual clinic.

While 73% of practicing physicians (n = 434) achieved LDL levels below 100 mg/dl, only 52% of family medicine residents (n = 78) achieved this goal. Furthermore, only 41% of practicing physicians and 23% of family medicine residents achieved levels of LDL below 70 mg/dl in their virtual patients.

Prescription Patterns in Hyperlipidaemia Patients

Around 90% of learners in both groups prescribed high-intensity statins, but only 37% added ezetimibe and 22% PCSK9 inhibitors.

Discussion

Virtual Patient Simulation (VPS) is at the technological forefront of healthcare workforce professional

development, applicable to medical and nursing schools, postgraduate education, as well as lifelong learning in continuing medical education (CME) and continuing professional development (CPD) settings.

VPS offers the learner real-life situations and assesses the real-life behaviour of the learner. It offers the possibility to explore, make mistakes and learn from them – a critical element of self-reflection with the hope of translating improved knowledge into real-life encounters [7]. The application of various VPS programmes has been shown to result in better outcomes, behaviour change, and better long-term retention [7].

Even though the Edocate VPS Platform addresses various medical disciplines, we have elected to report in this communication the results from Type 2 diabetes and hyperlipidaemia because these patients are most commonly treated by primary care physicians. Although the analytical tools of the App allow a much deeper and much more expansive data mining, for this communication we concentrated on the apparent gaps in knowledge and prescription patterns of the learners.

As presented herein, the App effectively revealed significant gaps in learners' knowledge and competence in the main target areas. Only about one-half of all participants achieved glycaemic control compatible with the guidelines – namely HbA1c below 7%. Even fewer achieved good control of hypertension – namely blood pressure below 130/80 mmHg. Thus, despite the extensive efforts in diabetes education and guideline implementation, T2DM management remains suboptimal and underscores the need for more effective education.

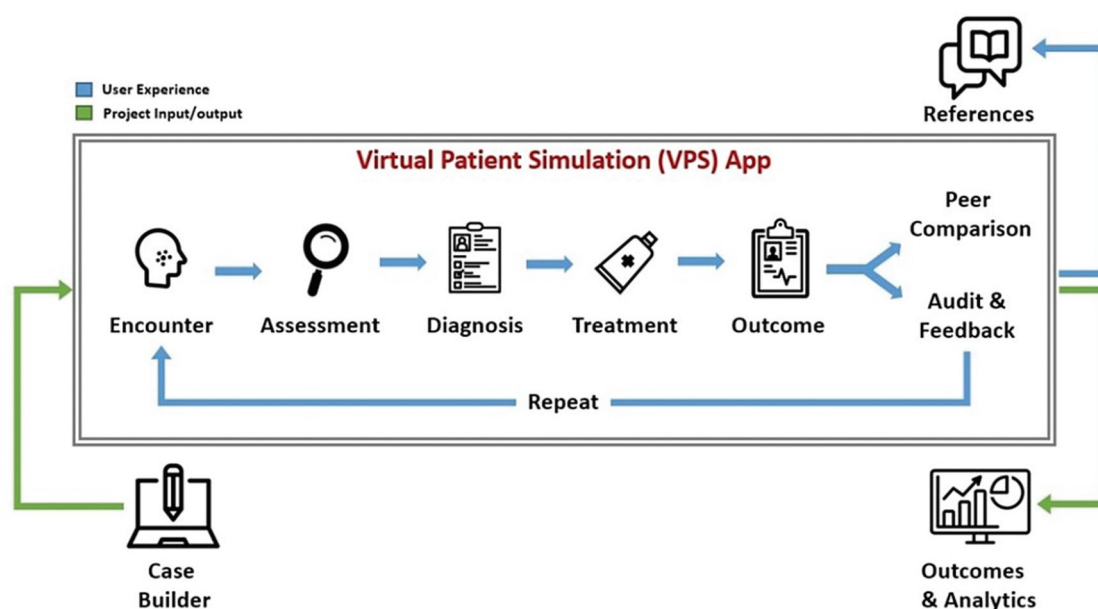


Figure 3. Flow of mimicking a real-life provider-patient encounter. After the case has been authored, the learner is exposed to several virtual cases on which learner<->patient visits take place. For each visit, specific feedback is provided. At every point, the learner can consult with the furnished references. Once the case is done, additional feedback is provided as well as optional credit.

The App also revealed adequate but far from perfect hyperlipidaemia management skills of PCP. Overall, intensive therapy achieving LDL levels below 50 or even 70 mg/dl remains elusive.

The data analysis revealed pre-identified shortcomings in clinicians' competence in managing T2DM and hyperlipidaemia. The number of practitioners achieving outcomes compatible with standards of care and guidelines was much lower than expected. Thus, the ADA and AHA have a priority to address this challenge and to direct their effort to better understand the existing barriers their members are facing by using the App. As a measure of confidence, the App remained a critical part of the KDBH educational effort for the second year with a possible extension for the third year.

The analytical capabilities of the Edocate VPS platform are very deep. In addition to identifying learners' competence in achieving the best outcomes, it teaches to apply a personalised approach, avoid side effects of medications, and provides instantaneous access to the most current references in the field.

The Edocate VPS App differs from the existing VPS on the market (Figure 2). As illustrated by the KDBH trial, it is designed around the foundation that seeing the consequences of decisions, learning from mistakes, and receiving personalised feedback are the best ways to retain knowledge. In addition to the learner finding the right diagnosis, the App gives feedback on how they have performed against their peers and presents back the

impact of their decisions by simulating patient reactions to various treatments, side effects of medications, and even non-medical events (Figure 3). The simulation is not a set of pre-determined scenarios, but a full framework with almost endless possible outcomes.

Another important advantage of the Edocate VPS App is that the learner can spend as little as a few minutes or as long as hours working with the App. The learner can come back to where they stopped at any time for as long as their available time allows.

The platform on which the Edocate VPS App is built is based on research on how adults learn: it leverages repeated and spaced learning, personalised debriefing, and reflection, as well as optional comparison with peers. The platform provides modern, cost-effective, and easy-to-use theory-to-practice learning tools. It includes case-authoring tools for teachers, a mobile application for interaction with virtual patients, and backend tools for organisations to track progress and extract indicators.

In conclusion, we present these data with full confidence to suggest that platforms like the one described in this report enable medical organisations to create immersive VPS cases for their primary educational and CME efforts.

Disclosure Statement

No potential conflict of interest was reported by the author(s).

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