# Evaluation of the effectiveness and staff acceptance of education strategies to improve medication safety

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## Abstract

**Background:** The pharmacy department at the study site provides ongoing education on medication safety to the hospital staff through a variety of means. **Objectives:** The study aimed to evaluate and compare various forms of education and the clinical impact and satisfaction reported by staff. **Methods:** A survey was disseminated to staff across the hospital, and 81 responses were collected. **Results:** Staff preferred learning through a combination of teaching methods rather than individual modalities. The majority of respondents stated that they felt their knowledge of medication safety improved after education and that the content was actionable. Most staff also agreed or strongly agreed that education positively impacted their clinical practice. Staff preferences regarding education were also themed around different learning modalities, quick and concise messages, topics of medication updates, and relevance to practice. Preferences of the hospital staff will be aligned with education strategies based on this evaluation.

## Introduction

Medication-related problems (MRPs), including medication errors and adverse drug reactions (ADRs) in hospitals, are a considerable burden on healthcare systems (Roughead, Semple & Rosenfeld, 2016). The World Health Organisation (WHO) has highlighted the importance of improving learning systems as a means to reduce MRPs and improve the safety of patient care (World Health Organisation, 2014). Safe practice for individual healthcare professionals can be supported by well-designed medication systems, standard operating procedures, and education and training programmes (World Health Organisation, 2014).

Teaching in a clinical environment is challenging with issues including cost, logistics, and determining the optimum staff-engaging method (McNamara, Rafferty & Fitzpatrick, 2016). Traditional teaching approaches, such as face-to-face teaching, have been used historically for clinical skills education (Farahani *et al.,* 2020). In a face-to-face environment, the audience has the benefit of interacting with the presenter, but the quality and content of face-to-face teaching can vary between different instructors (Farahani *et al.,* 2020). Traditional

teaching methods also allow participants to provide more meaningful feedback that is not limited to prefabricated, non-specific content (Bakkum *et al.,* 2019). Competing workload priorities and escalating requirements for clinical staff to acquire both profession-specific and interprofessional competencies present a barrier to face-to-face education (Tolks *et al.,* 2016; Teoh & Lebedevs, 2018).

Self-directed online learning, or eLearning, has become increasingly popular in recent years. This is because it is time and cost-effective, flexible in scheduling, has consistent delivery, and gives the opportunity to reach those remotely located and shift workers (Lu and Lemonde, 2013; Teoh & Lebedevs, 2018; Vaona *et al.,* 2018; Farahani *et al.,* 2020; Gallegos *et al.,* 2021; May, Young & Gillman, 2021). It has been referred to as the 'anytime-anywhere' aspect of online learning, which is identified throughout the literature as one of the most prominent advantages of this form of learning (Bakkum *et al.,* 2019). Research into the favourability and efficacy of online learning is essential due to its increasing prevalence in education worldwide (Vaona *et al.,* 2018). Online learning is found to be both beneficial and

disadvantageous with regard to time demand. Often, eLearning modules can allow for self-directed pace, which, in turn, allows for flexibility in the schedules of busy healthcare staff. Conversely, it is also reported that eLearning impinges on personal time, which can cause additional motivational issues (Bakkum *et al.,* 2019).

Existing research into both traditional and online learning details specific recommendations that can be made to improve outcomes. The inclusion of interactive elements, such as quizzes, allows for increased stimulation and self-assessment of further learning needs (Cook *et al.,* 2008; Bakkrum *et al.,* 2019; Lehane *et al.,* 2019; Enderby *et al.,* 2021). Content of learning is best received when it is relevant to practice and has predefined learning objectives (Brooks *et al.,* 2016; Bakkrum *et al.,* 2019). Information is best delivered in 'bite-sized chunks' to allow participants to process and assimilate it into practice more effectively (Cook *et al.,* 2008; Bakkrum *et al.,* 2019; Lehane *et al.,* 2019). Previous studies also indicate that education should be easily accessible and visually appealing, as outdated aesthetics and technological issues serve as deterrents (Bakkrum *et al.,* 2019). Additionally, the use of variable multimedia (e.g., podcasts, videos, animations) and web links to other resources are considered helpful; however, different individuals are reported to prefer different learning styles (Bakkrum *et al.,* 2019). It was also suggested that the provision of protected education time would mean greater capacity and motivation to complete learning (Brooks *et al.,* 2016; Bakkrum *et al.,* 2019). While online learning (Lu & Lemonde, 2013; Ryan *et al.,* 2007) and video learning (George, 2019) have been shown to be as effective as a traditional face-to-face approach, several surveys have indicated a preference for mixed modalities or blended learning (Efferth, 2011).

The pharmacy department in the study hospital provides ongoing education on medication safety, particularly to highlight issues on MRPs throughout the health service. Clinical incidents, including near misses, are reported via the state-wide Clinical Incident Management System (CIMS). Medication incidents are analysed, and common trends of incidents and lessons learnt are presented to staff in different means of education to promote reflective learning. Pharmacists deliver weekly medication safety updates to the clinical staff in the neonatal directorate and monthly medication safety updates to obstetrics wards, the perinatal mental health ward, and medical staff via Postgraduate Medical Education sessions. A total of 43 presentations were provided over the 2019-20 period (Pharmacy Department, 2020). Most presentations were undertaken face-to-face; others were provided online as e-learning packages (Teoh and Lebedevs, 2018) and 5-minute microlearning online education presentations (Take 5) (May, Young & Gillman, 2021). Additional means of medication safety education included quarterly Pharmacy Newsletters and printed information such as posters or leaflets. Medication safety educational interventions are challenging, with mixed reviews on effective strategies for delivering the education (Ryan *et al.,* 2007; Lu & Lemonde, 2013; McNamara, Rafferty & Fitzpatrick, 2016; George *et al.,* 2019; Farahani *et al.,* 2020). Understanding appropriate means of education is essential for future education planning in the organisation to improve patient safety.

This project aimed to determine if pharmacy education around medication safety provides essential learning opportunities for the clinical staff. It also aimed to evaluate and compare the various means of education on the clinical impact and satisfaction reported by staff. An appropriate means of education is vital for future education planning in the organisation.

## Methods

The clinical staff members, including medical and nursing/midwifery staff, were invited to complete an online satisfaction survey via Microsoft Forms or a paper-based questionnaire. The questionnaire was divided into three topics, i.e., format of learning, content of learning, and impact on clinical practice. Questions were based on themes of data obtained from previous research in the same area of study (Teoh & Lebedevs, 2018). The aim was to collect 80 responses over a 2-month period.

The population of this study involved only medical and nursing/midwifery staff so that results can be compared with previous studies completed at this site. Additionally, the education methods analysed are targeted towards the stakeholders surveyed. Pharmacy education provided to other hospital staff is disseminated and reviewed via different, often less formal avenues.

Medical and nursing/midwifery staff, who worked at the study hospital for more than two months during the survey period, were included. Non-clinical staff and new staff employed at the site for less than two months were excluded. The data were collated and statistical analyses performed using Microsoft Excel.

This clinical audit was reviewed by the hospital Research Screening Group and was deemed to not require full Human Research Ethics Committee review on the basis that it was a quality activity. The audit was entered into the State Health Governance, Evidence, Knowledge, Outcomes (GEKO) system (Quality Activity 40202).

## Results

### Staff preference

A total of 81 responses were recorded, comprising 24 medical officers, 52 nurses/midwives, and 5 others. Clinical staff preferred learning through a combination of teaching methods rather than individual modalities (66%, 47/71). Across both disciplines, Take 5 presentations were the preferred online education method (69%, 48/70), whereas newsletters (24%, 17/70) and 'how-to' videos (27%, 19/70) were less popular, as shown in Figure 1. Regarding face-to-face education, medical officers favoured Post-Graduate Medical Education (PGME) presentations (77%, 17/22) and all nurses/midwives preferred Medication Safety presentations (100%, 46/46), as seen in Figures 1-6 (Percentage selection of different types of education broken up by discipline and format).
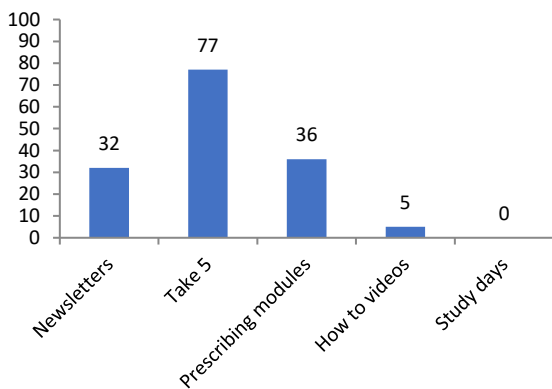
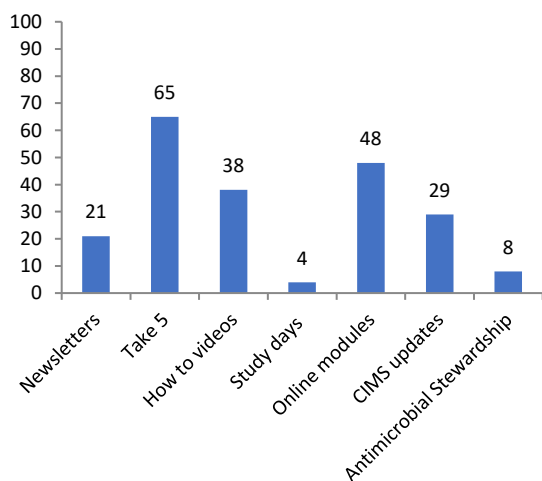**Figure 1: Online learning types offered to medical officers**

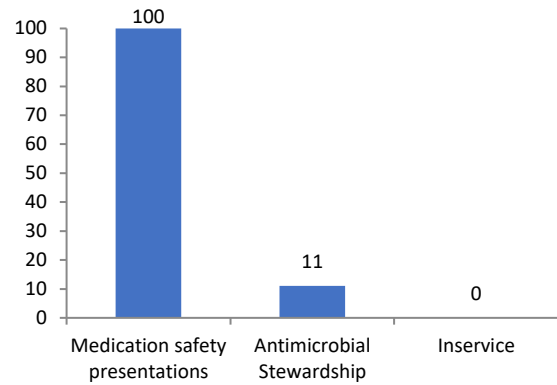**Figure 2: Online learning types offered to nurses/midwives**

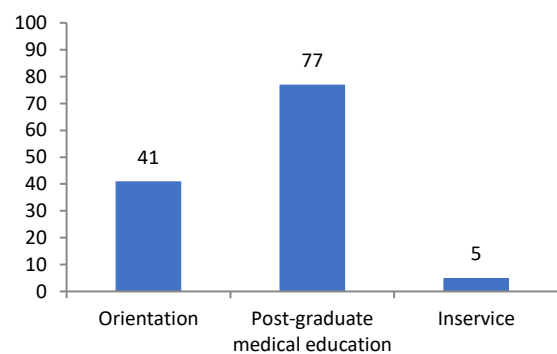**Figure 3: Face-to-face education offered to nurses/midwives**

**Figure 4: Face-to-face education offered to medical officers**
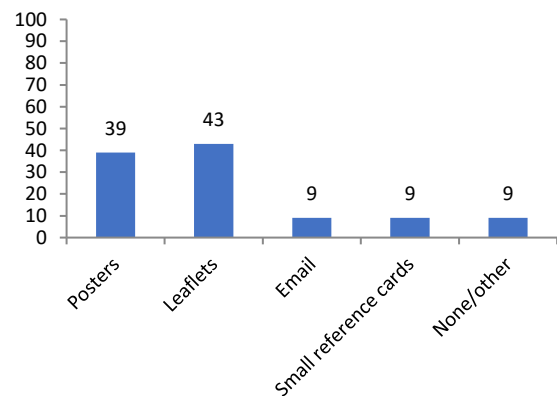
**Figure 5: Printed education offered to medical officers**

No respondent selected printed information as the preferred learning method; however, when specifying types, nurses/midwives selected posters (67%, 31/46) while medical officers chose leaflets (43%, 10/23). Some staff expressed that no printed information is their preference (8.7%, 6/69), a response unique to this format.
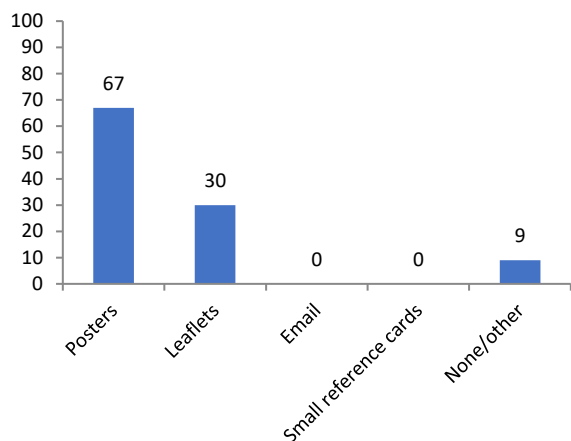
**Figure 6: Printed education offered to nurses/midwives**

### Clinical impact of staff education

The majority of respondents stated that their knowledge surrounding medication safety improved after education (85%, 60/71) and that the content was actionable (77%, 55/71). Most staff indicated that post-education, they had a better awareness of medication-related incidents in their workplace (81%, 54/67) and that they are more careful when administering or prescribing medications (78%, 52/67). Less selected outcomes included realising the importance of adequate documentation (62%, 42/67), understanding medication-related processes (51% 34/67), and awareness of medication order and calculations (48%, 32/67). These data are presented in Table I.

**Table I: Measured outcomes of pharmacy education on clinical practice represented as percentage of selection based on number of responses**

| Outcomes of education | Total selections | Selection/response (%) |
|---|---|---|
| Better awareness of common medication-related incidents in my workplace | 54 | 81 |
| More careful when administering/prescribing medication | 52 | 78 |
| Realise importance of adequate documentation | 42 | 63 |
| Greater understanding of medication-related process | 24 | 51 |
| Better awareness of medication order and calculations | 32 | 48 |
| Total response | 67 | 100 |

### Likert scale

Using a Likert scale, staff responded to different elements of satisfaction. Most respondents either agreed or strongly agreed that the information and language were easy to understand (89%, 64/72), learning was relevant to practice (88%, 63/72), maintained interest (82%, 59/72), contained adequate information regarding medication safety (79%, 57/72), and had a clear and achievable objective (75%, 53/71), as shown in Figure 7. On a scale of 0-10, respondents selected a number they felt reflected their opinion on the user-friendliness, accessibility, and time available for pharmacy education. Responses were divided into a promoter (5-10) or detractor (0-4) response. Most medical officers (82%, 19/23) and nurses/midwives (69%, 34/49) responded between 5 and 10 for user-friendliness. Answers to the accessibility of all three formats of education were separated; however, more than half of medical officers (59%, 42/71) and nurses/midwives (51%, 78/153) selected a value between 5-10. Regarding time availability, there was a more even spread for medical officers, where most

(57%, 13/23) indicated they did not have time for education, with fewer (43%, 10/23) answering they did have time. A higher number of nurses/midwives (82%, 40/49) indicated that they did not have time during a workday for education.

### Further feedback and suggestion

Staff were also given the opportunity to express their opinion regarding pharmacy education using free-text answers. The responses were grouped into common themes regarding the format of learning, the most useful aspects of pharmacy education, and any suggested improvements to education. The format of learning was themed into a preference for multiple learning modalities and quick and concise forms of education. The most useful aspects of pharmacy education were grouped into medication updates and changes to practice, relevance to practice, and an appreciation of Take 5 presentations. The main improvement suggested was an increased frequency and availability of pharmacy education for clinical staff.
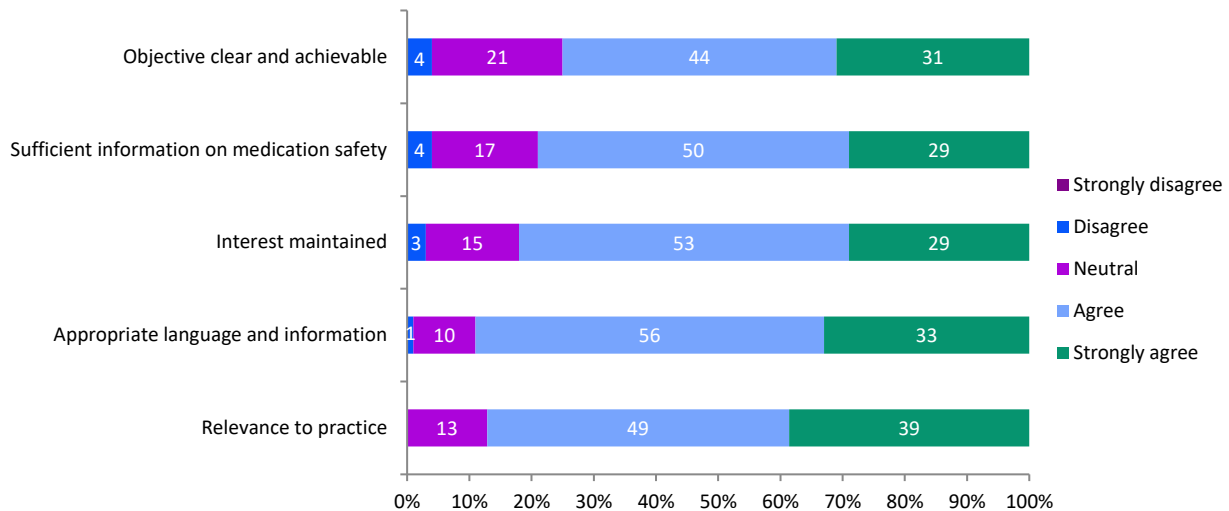
**Note:** Data obtained using a Likert scale and displayed as percentage of total responses.

**Figure 7: Measured outcomes assessing staff satisfaction with pharmacy education**

## Discussion

Delivering targeted and effective education to address medication-related problems in a time-pressed clinical setting is challenging. However, such education should be provided to improve medication safety, pertinent to clinical areas. Education was evaluated through questions regarding learning formats and impact on clinical practice. Measured outcomes included overall effectiveness and individual elements of medication safety to determine areas of strength and improvement. Staff satisfaction was also evaluated using questions that assessed overall agreement with pharmacy education. Additionally, respondents rated various aspects of education, such as content, relevance, and clarity.

Results showed that medical and midwifery/nursing staff preferred quick, concise microlearning provided as a combination of face-to-face, online, and printed information. No respondent selected posters and leaflets as the preferred format of education, but both formats were appreciated because they offer summaries that can be referred to when needed. Across both disciplines, the least frequently selected measures of clinical impact were an understanding of medication-related processes, documentation, and awareness of medication order/calculations. This finding suggests that there would be a benefit to addressing these topics more clearly in education or alerting staff to the availability of pre-existing resources and making them easier to access. Respondents were more satisfied with education that was relevant to practice and contained information about medication changes and practice updates. Staff indicated that

pharmacy education needs a clear and achievable objective and adequate information regarding medication safety. Furthermore, there appears to be a demand for more accessible pharmacy education. Better promotion through "Staff Development Nurse/Midwife" and direction to the Pharmacy Hub are ways to mitigate this perceived limitation in the future.

Nursing/midwifery staff expressed disapproval with the education that focused on errors, as evidenced by only 29% of respondents selecting CIMS updates as the preferred education method and other written feedback, e.g., "There is typically a focus on what is being done wrong, i.e., CIMS, which can get staff a bit down about themselves." There was a preference for an increased scope of education, including higher frequency and expansion to other areas of the hospital. For example, the gynaecology/oncology ward requested more face-to-face in-services and theatre staff expressed the desire to receive pharmacy education during their weekly allocated time.

For medical officers, the provision of a variety of learning modalities is favoured for future sessions. They demonstrated a preference for Take 5 presentations, PGME, and leaflets. Whilst most medical officers indicated they lack time for education, a lower percentage observed for nurses/midwives is likely due to weekly protected teaching time. Their preference selection for the type of education is a reflection of the availability of this protected time. Overall, responses from clinical staff indicate that pharmacy education is beneficial and well-received concerning medication safety.

These findings are concurrent with those previously reported throughout the literature. More specifically, education provided in "bite-sized chunks", such as the microlearning identified in this study, is both favourable and effective (Cook *et al.,* 2008; Bakkrum *et al.,* 2019; Lehane *et al.,* 2019). Content that is authentic and relevant is more beneficial to participants, as demonstrated by both previous literature and the results of this study (Brooks *et al.,* 2016; Bakkrum *et al.,* 2019; Lehane *et al.,* 2019). Other studies suggest that education requires clear learning goals and must be accessible to both participants and educators (Kim *et al.,* 2017; Bakkrum *et al.,* 2019; Enderby et al., 2021). These findings are consistent with data collected from this study, which implies an area of improvement for current pharmacy education. To address the time barrier, access to protected teaching time would allow staff to work through learning at a self-directed pace without impinging on personal time (Brooks *et al.,* 2016; Bakkrum *et al.,* 2019). Clinical staff at the study hospital indicated a preference for a combination of both online and face-to-face teaching (i.e., blended learning), which has been associated with better engagement and academic achievement than traditional teaching alone (Efferth, 2011; Brooks *et al.,* 2016; Balakrishnan *et al.,* 2021; Gallegos et al., 2021).

Other studies have also examined the clinical impact of education, namely improvement in attitudes, behaviour, skills, and knowledge (Flores-Mateo & Argimon, 2007). Much of the pre-existing literature is based on small sample sizes reflective of a specific population. Often, the questionnaires of these studies only examined short-term learning outcomes (Flores-Mateo & Argimon, 2007). While other literature reports have found some improvements in knowledge and skills after education, it has been conceded that the behaviours and attitudes of clinical staff are more difficult to measure (Flores-Mateo & Argimon, 2007). As per these findings, the specific outcomes of education measured in this study fall under the category of knowledge or skill. Other data suggest that the most likely method of impacting clinical practice is using more interactive and clinically integrative education (Lehane *et al.,* 2019).

The potential benefits of learning via preferred models include ease of delivery for pharmacy staff, better participation from clinical staff, and reduced medication-related errors due to an improved understanding of medication safety. A focus on quick and concise microlearning in a combination of accessible face-to-face, online, and printed formats would allow clinical staff to engage in education despite busy workdays and perceived lack of accessibility.

Unlike data from other studies, the findings of this study did not indicate that clinical staff at this site preferred the integration of multimedia into their learning. The same can be deduced for the inclusion of interactive elements and links to external resources. The lack of data for these aspects of education may be attributed to the lack of targeted questions in the survey; therefore, these should be assessed in future research. This study did not yield suggestions for the future direction or potential innovations for education. One proposal for the future direction of blended learning involves an "inverted classroom model". This approach uses online learning for 'remembering and understanding' phases and face-to-face learning for 'applying, analysing, evaluating, and creating' phases (Tolks *et al.,* 2016), thus allowing the self-directed aspect of eLearning to process factual knowledge in a way that suits the individual learner. Then, the face-to-face element would help the learner assimilate the knowledge more actively through discussion and reflection (Tolks *et al.,* 2016). Another direction for education in the future surrounds the concept of virtual reality. This concept has already been implemented in some facets of pharmacy education and is expected to create a more immersive and stimulating online learning environment (Coyne *et al.,* 2019). At present, it involves a 2D virtual space that imitates the real world to form scenarios that the health professional is likely to encounter (Coyne *et al.,* 2019). These educational options are worth examining in future studies to determine suitability for clinical staff.

Pharmacy should ensure that MRPs education is sustainable and deliverable by expanding access to all relevant faculties of the hospital. Interest and engagement must be maintained by clinical staff by ensuring that the content presented is relevant and up-to-date. The involvement of other areas of the hospital will result in greater acceptance of information surrounding medication safety and thus fewer medication-related problems. This expansion must also be balanced by a manageable workload for those curating and delivering the education. In addition to being well-received by clinical staff, quick and concise forms of microlearning are likely the most sustainable and deliverable method of education in the future.

### Limitation

One of the limitations of this project was the use of free-text questions to evoke ideas of future direction from respondents. Suggestions of improvements provided in a selection format might have prompted higher responses due to the limited time available to complete the survey. For example, there were no suggestions of innovation to education, such as podcasts, but if this had been provided as an option, it

might have gained interest. Additionally, exclusion criteria pertaining to the cohort, e.g., only medical officers and nurses/midwives, meant that some disciplines of the hospital that currently receive pharmacy education were not able to participate in the study, particularly pharmacists and anaesthetic technicians.

## Conclusion

Pharmacy staff can apply the results of this evaluation to develop, expand, and improve medication safety education. Learning should be optimised to align with the preferences of hospital clinicians and address gaps in delivery and staff knowledge in any future education planning. The provision of medication safety education through well-accepted formats, e.g., the microlearning platform, Take 5, and face-to-face presentations supplemented with posters and leaflets, would ensure the sustainability of this service. Continued staff feedback and suggestions on innovative education strategies are required to augment and reinforce medication safety and maintain staff engagement. The authors believe that this multifaceted approach can be used as a model for other health service providers.

## Conflict of interest

The authors declare no conflict of interest.

## References

Bakkum, M. J., Tichelaar, J., Wellink, A., Richir, M. C., & van Agtmael, M. A. (2019). Digital Learning to Improve Safe and Effective Prescribing: A Systematic Review. *Clinical pharmacology and therapeutics*, **106**(6), 1236–1245. https://doi.org/10.1002/cpt.1549

Balakrishnan, A., Puthean, S., Satheesh, G., M K, U., Rashid, M., Nair, S., & Thunga, G. (2021). Effectiveness of blended learning in pharmacy education: A systematic review and meta-analysis. *PloS one*, **16**(6), e0252461. https://doi.org/10.1371/journal.pone.0252461

Brooks, H. L., Pontefract, S. K., Vallance, H. K., Hirsch, C. A., Hughes, E., Ferner, R. E., Marriott, J. F., & Coleman, J. J. (2016). Perceptions and Impact of Mandatory eLearning for Foundation Trainee Doctors: A Qualitative Evaluation. *PloS one*, **11**(12), e0168558. https://doi.org/10.1371

Cook, D. A., Levinson, A. J., Garside, S., Dupras, D. M., Erwin, P. J., & Montori, V. M. (2008). Internet-based learning in the health professions: a meta-analysis. *JAMA*, **300**(10), 1181–1196. https://doi.org/10.1001/jama.300.10.1181

Coyne, L., Merritt, T. A., Parmentier, B. L., Sharpton, R. A., & Takemoto, J. K. (2019). The Past, Present, and Future of Virtual Reality in Pharmacy Education. *American journal of pharmaceutical education*, **83**(3), 7456. https://doi.org/10.5688/ajpe7456

Efferth, T. (2011) E-Learning in Pharmacology and Pharmacy. *Education Sciences,* **1**(1), 4-14. https://doi.org/10.3390/educ1010004

Enderby, C. Y., Davis, S., Sincak, C. A., & Shaw, B. (2021). Health-system pharmacist preceptor development and educational needs for accessible resources. *Currents in pharmacy teaching & learning*, **13**(9), 1110–1120. https://doi.org/10.1016/j.cptl.2021.06.042

Farahani, S., Farahani, I., Burckhardt, B. B., Schwender, H., & Laeer, S. (2020). Self-Instruction Video Versus Face-to-Face Instruction of Pharmacy Students' Skills in Blood Pressure Measurement. *Pharmacy (Basel, Switzerland)*, **8**(4), 217. https://doi.org/10.3390/pharmacy8040217

Flores-Mateo, G., & Argimon, J. M. (2007). Evidence based practice in postgraduate healthcare education: a systematic review. *BMC health services research*, **7,** 119. https://doi.org/10.1186/1472-6963-7-119

Gallegos, P. J., Mistry, B., Freshwater, D., & Mullen, C. (2021). Continued professional development: A comparison of online vs. in-person workshops. *Currents in pharmacy teaching & learning*, **13**(7), 770–775. https://doi.org/10.1016/j.cptl.2021.03.019

George, A., Blaauw, D., Green-Thompson, L., Hajinicolaou, C., Lala, N., Parbhoo, K., Rodda, J., Velaphi, S., Kala, U., Vallabh, P. and Dangor, Z., 2019. (2019). Comparison of video demonstrations and bedside tutorials for teaching paediatric clinical skills to large groups of medical students in resource-constrained settings. *International Journal of Educational Technology in Higher Education,* **16**(1), 1–16. https://doi.org/10.1186/s41239-019-0164-z

Kim, K. J., Kang, Y., & Kim, G. (2017). The gap between medical faculty's perceptions and use of e-learning resources. *Medical education online*, **22**(1), 1338504. https://doi.org/10.1080/10872981.2017.1338504

Lehane, E., Leahy-Warren, P., O'Riordan, C., Savage, E., Drennan, J., O'Tuathaigh, C., O'Connor, M., Corrigan, M., Burke, F., Hayes, M., Lynch, H., Sahm, L., Heffernan, E., O'Keeffe, E., Blake, C., Horgan, F., & Hegarty, J. (2019). Evidence-based practice education for healthcare professions: an expert view. *BMJ evidence-based medicine*, **24**(3), 103–108. https://doi.org/10.1136/bmjebm-2018-111019

Lu, F., & Lemonde, M. (2013). A comparison of online versus face-to-face teaching delivery in statistics instruction for undergraduate health science students. *Advances in health sciences education: theory and practice*, **18**(5), 963–973. https://doi.org/10.1007/s10459-012-9435-3

May, N., Young, J., & Gillman, L. (2021). Take 5: Designing and evaluating 5-minute eLearning for busy hospital staff. *Focus on Health Professional Education: A Multi-disciplinary Journal,* **22**(2), 60-71. https://doi.org/10.11157/fohpe.v22i2.505

McNamara, D. A., Rafferty, P., & Fitzpatrick, F. (2016). An improvement model to optimise hospital interdisciplinary learning. *International journal of health care quality assurance*, **29**(5), 550–558. https://doi.org/10.1108/IJHCQA-10-2015-0131

Pharmacy Department. (2020). Annual Report presented at Clinical Governance Committee. Women and Newborn Health Services Western Australia

Roughead, E. E., Semple, S. J., & Rosenfeld, E. (2016). The extent of medication errors and adverse drug reactions throughout the patient journey in acute care in Australia. *International journal of evidence-based healthcare*, **14**(3), 113–122. https://doi.org/10.1097/XEB.0000000000000075

Ryan, G., Lyon, P., Kumar, K., Bell, J., Barnet, S., & Shaw, T. (2007). Online CME: an effective alternative to face-to-face delivery. *Medical teacher*, **29**(8), e251–e257. https://doi.org/10.1080/01421590701551698

Teoh, S. W., & Lebedevs, T. (2018). Using e-learning and lightning presentations to communicate medication-related problems. *Journal of Pharmacy Practice and Research,* **48**(2), 173-175. https://doi.org/10.1002/jppr.1348

Tolks, D., Schäfer, C., Raupach, T., Kruse, L., Sarikas, A., Gerhardt-Szép, S., Kllauer, G., Lemos, M., Fischer, M. R., Eichner, B., Sostmann, K., & Hege, I. (2016). An Introduction to the Inverted/Flipped Classroom Model in Education and Advanced Training in Medicine and in the Healthcare Professions. *GMS journal for medical education*, **33**(3), Doc46. https://doi.org/10.3205/zma001045

Vaona, A., Banzi, R., Kwag, K. H., Rigon, G., Cereda, D., Pecoraro, V., Tramacere, I., & Moja, L. (2018). E-learning for health professionals. *The Cochrane database of systematic reviews*, **1**(1), CD011736. https://doi.org/10.1002/14651858.CD011736.pub2

World Health Organization. (2014, February 22).  Reporting and learning systems for medication errors; the role of pharmacovigilance centres. 2014. https://www.who.int/publications/i/item/9789241507943