**Review**

# Electronic medical portfolio as a tool in formative assessment: a literature review

*Portafolio médico electrónico como una herramienta en la evaluación formativa: revisión de la literatura*

Iving E. Alvarado-Carías[a,b,1], José Gabriel Milla Mejía[a,c], Nubia Hadanary Molina Baide[a,c], Elena M. Gonzales Bardales[a], Ginalizia Murillo Castro[a,d], Wendy Carolina Mejía[a,b], José M. Madrid[a,b], Cristina M. Thiebaud[a], Juan Fernando Suazo[a,e], Jhiamluka Solano[a,f]

[a]*Asociación de Educación Médica Hondureña, AEMH, Tegucigalpa, Honduras*
[b]*Hospital Zafiro, Tegucigalpa, Honduras*
[c]*Facultad de Ciencias de la Salud, Universidad Tecnológica Centroamericana, UNITEC, Tegucigalpa, Honduras*
[d] *Facultad de Ciencias Médicas, Universidad Nacional Autónoma de Honduras, UNAH, Tegucigalpa, Honduras*
[e]*Departamento de Ortopedia, Chelsea and Westminster NHS Foundation Trust, Londres, Reino Unido*
[f]*Departamento de Medicina Interna, Salford Royal Hospital, Manchester, Reino Unido*

**ABSTRACT. Introduction.** The electronic medical portfolio is part of the formative evaluation that allows the educator to adapt their didactic process to the needs of their students. It also promotes effective formative feedback that helps create horizontal relationships between educators and students. The aim of this review was to describe the use of medical portfolios and their impact on medical training. **Methods**. A review of the literature in PubMed and Scielo was carried out, including articles and studies on the topic, published in English and Spanish, ranging from 2012 to 2022. **Discussion**. Medical Education in Latin America, especially in Honduras, relies heavily on summative assessment as a prevalent evaluation method. In countries like the United States and some in Europe where the student portfolio is used, it has thrived and been accepted by both educators and students, generating a positive impact on their learning. **Conclusion**. The implementation of the medical portfolio in Honduras is a viable and an appropriate process that will allow the pre-existing traditional academic culture to be innovated. Its multiple advantages such as encouraging a complete evaluation through feedback from superiors and peers, in addition to ongoing training and improvement of the student's practical skills, place it as an essential tool for medical education.

**RESUMEN. Introducción**. El portafolio médico electrónico forma parte de la evaluación formativa. Permite al docente adaptar su proceso didáctico a las necesidades de sus estudiantes. También, promueve la retroalimentación formativa efectiva. Esto ayuda a crear relaciones horizontales entre docentes y estudiantes. El objetivo de la revisión fue describir el uso de los portafolios médicos y su impacto en la formación médica. **Métodos**. Se llevó a cabo una revisión de la literatura en PubMed y Scielo. Se incluyeron artículos y estudios publicados sobre el tema en inglés y español, desde el año 2012 hasta el 2022. **Desarrollo**. La Educación Médica en Latinoamérica, especialmente en Honduras, depende en gran medida de la evaluación sumativa como método de evaluación prevalente. En países como Estados Unidos y algunos de Europa, donde se utiliza el portafolio estudiantil ha prosperado y ha sido aceptado por ambos docentes y estudiantes; generando una repercusión positiva en el aprendizaje de los mismos. **Conclusión**. La implementación del portafolio médico en Honduras es un proceso viable y apropiado. Permitirá innovar la cultura académica tradicional preexistente. Sus múltiples ventajas, tales como fomentar una evaluación completa a través de la retroalimentación por parte de superiores y pares, además de la formación permanente y mejoría de habilidades prácticas del estudiante, lo colocan como una herramienta esencial para la educación médica.

## 1. Introduction

Medical education has evolved rapidly during the last two decades, due to new scientific evidence supporting innovative teaching and evaluation methodologies. This leaves behind traditional teaching that has been losing effectiveness or has become obsolete because of

globalization (Talanquer, 2015). There are multiple definitions for the term electronic medical portfolio. The most outstanding elements include an instrument that stores evidence of skills that students develop and shows how they acquire skills throughout their training (Agostini, 2015; Celis-Aguilar & Ruiz-Xicoténcatl, 2018). Medical portfolios play an important role for formative assessment. Their purpose is for students to obtain feedback on their learning process and to be able to recognize aspects to improve through self-regulated learning (Wood, 2018).

With the feedback obtained, the interaction between students and academic tutors improves, being a constant and more accessible monitoring process. This encourages horizontal communication, nurturing a favorable environment for the student's academic development and the educator´s pedagogical development (Yoo et al., 2020). The portfolio allows the monitoring and recording of the clinical and non-clinical skills developed, serving as evidence to verify them. It enables the development of ethical competencies at different stages, as well as the construction of professionalism of future doctors (Joshi et al., 2015; Heeneman & Driessen, 2017).

In Honduras, the Faculty of Medical Sciences (FCM) of Universidad Nacional Autónoma de Honduras (UNAH) was founded on February 14, 1882, by lawyer Marco Aurelio Soto. Since February 26, 1882, up until now, the FCM is the only public institution that offers education and certification of Doctor in Medicine and Surgery and Bachelor of Nursing to the population (Aguilar Paz, 2004). In 1999, Universidad Católica de Honduras (UNICAH) began offering the Medicine and Surgery Career and Universidad Tecnológica Centroamericana (UNITEC) in 2012, both private institutions (Bermúdez-Madriz et al., 2011).

The medical education in the different university faculties has followed a traditional model focused on summative evaluation. Currently, according to our research, no university in the country that trains doctors use fully structured formative assessment methodologies, much less a medical portfolio in physical or electronic format. This may be because they are unfamiliar with it or lack the resources for its implementation (Haldane, 2014).

A review of the literature was done to analyze aspects that may be included in the construction of an electronic medical portfolio and the impact this methodology may have on the medical training process in Honduras. This review will provide elements that can be used by the different universities as part of a national effort to improve medical training, directly impacting the quality of care received by the Honduran population and, in turn, enriching the academic and professional profile of the Honduran population that graduates from the Medicine and Surgery educational program.

## 2. Methods

The literature review was carried out in PubMed and Scielo, including articles and studies published in English and Spanish on the use of medical portfolios and their impact on medical training from 2012 to 2022. Except for the publications by Snadden Mary Thomas (1998), Miller (1990), Aguilar Paz (2004), Atkin et al. (2005) and Bermúdez-Madriz et al. (2011), for their historical relevance. Articles were also consulted that serve as a practical guide for implementing the electronic medical portfolio in Honduras. Opinion articles and letters to the editor were excluded. Key terms such as "medical portfolio", "formative assessment", "feedback", "medical education" and "clinical competencies" were used.

## 3. Discussion

In 1990, Miller described in his book "The Assessment of Clinical Skills/Competence/Performance" means to assess the skills, competencies, and knowledge during undergraduate and postgraduate training in medical education. However, he concluded that these are not legitimate predictors of how well medical doctors would perform when faced with real-life situations (Miller, 1990). Portfolios commonly used in arts and architecture offer a space to collect non-standardized information that helps assess students' performance in an individualised manner, when it cannot be reached by summative assessment (Agostini, 2015; Alcaraz Salarirche, 2016). To fill this gap, higher education started adapting and transforming portfolios as assessment tools (Driessen & Tartwijk, 2014), later joining medical education.

Despite these efforts, the traditional approach prevails in Latin America, where summative models take precedence (Acosta Silva & Cruz Galvis, 2015). The principal methodology consists of measuring the achievements of a course's previously established learning objectives. However, the student's feedback is null, avoiding guidance for the enrichment of their current and future performance (Cilliers et al., 2012). Formative assessment refers to a cyclical process in which educators analyze their students and collect information to implement changes that meet their needs. This process promotes creating horizontal relationships between students and educators, overcoming the traditional teacher-centered model, and moving to a more student-centered one. The above supports the use of methodologies such as problem-based or team-based learning (Dole et al., 2016).

For formative assessment to be successful, educators must implement efficient strategies that allow them to get to know and motivate their students and provide them with all necessary tools to regulate their learning autonomously (Mendes dos Santos & Fischer da Silveira Kroeff, 2018). This evaluation is not intended to give students a passing or failing grade or to measure their knowledge or memory, even though a score may be

awarded. Formative evaluation provides elements to determine whether the students have developed new skills or competencies that will allow them to become better professionals. These elements are mainly developed through feedback, the central axis of formative assessment (Kornegay et al., 2017). Effective feedback offers an ideal space for critical thinking that leads to clinical reflection, which is necessary to develop and strengthen their self-directed learning processes (Agostini, 2015). Self-directed learning is vital for professional development. It offers students a starting point to know their limitations and errors and enables them to plan how to improve their performance with the support of their educator (Yoo et al., 2020).

Some studies suggest that educator exposed to portfolios as tools for self-assessment and reflection consider that they represent a fundamental role in generating awareness of educators' impact and promoting personal growth. Additionally, portfolios allow educators to identify their deficiencies and generate methods that help improve pedagogical strategies (Arbesú García & Gutiérrez Martínez, 2014; Patel & Shah, 2021). Regarding the challenges that educators encounter when using formative evaluation, the following can be stated: 1) the demand for solid knowledge in the discipline that they teach, 2) the constant attention to the perceptions of their students, 3) the recognition of common learning challenges faced by students and 4) knowing different teaching and evaluation methodologies that respond to different student needs (Atkin et al. 2005). To understand and identify these needs, educators must be able to ask the right questions that will assess the student's understanding and limitations and, in turn, make decisions to promote effective learning.

Student's perception and acceptance to introduction of new assessment processes through portfolios have been documented, demonstrating that there is a considerable commitment, and the success of its application is following the importance given to their perspectives and expectations (Chertoff et al., 2016; Oudkerk Pool et al., 2020). In the medical field, the portfolio assesses clinical and academic skills in real-time, therefore providing stimulus for personal growth (Snadden Mary Thomas, 1998; Kanfi et al., 2021). However, it is essential to emphasise that some types of portfolios may have disadvantages compared to others, either because they do not allow development in a linear visualisation or because their use is too complex for students or educators.

### 3.1. Types of portfolios

Portfolios may vary in content or purpose; some of their goals may be reflection, evaluation, and professional development (Table 1) (Babaee, 2020). Reflective portfolios allow the user to keep a diary, leading to self-assessment and the setting of academic and personal goals, which in turn, leads them to educate themselves as introspective and self-critical professionals; at the same time, they offer a space to receive feedback from peers and record meetings with academic tutors (Pereira Stelet et al., 2016).

Evaluation portfolios keep a record of learning goals with essential evidence of the user's practice; they include forms for medical procedures, clinical case discussions and performance patient physical examinations (Rodríguez Cardenas et al., 2020).

Professional development portfolios focus on recording personal goals and accomplishments, including academic presentations, publications, facilitated classes, attended courses, or other similar projects. They all need an environment that provides learning opportunities (access to patients or procedure simulations) and, at the same time, that offers supervision and feedback from trained personnel (Driessen & Tartwijk, 2014; Chertoff et al., 2016).

A portfolio can be oriented towards personal growth, where it is suggested to apply a checking and motivational system for its users, in which a series of questions are answered (Figure 1) (Driessen & Tartwijk, 2014). As the students develop their portfolios, progress can be observed through evidence that supports the strengths and achievements obtained in a certain time period and the resolution of difficulties encountered (Sidhu, 2015).

Depending on the content and structure, portfolios are classified as open or free and closed or structured (Table 2).

**Table 1**

Classification of portfolios according to their purpose.

| Reflexive | Evaluative | Professional Development |
|---|---|---|
| <ul><li>Diary-style format</li><li>Allows self-assessment and goal setting</li><li>Allows record-keeping of feedback from peers and tutors[a]</li></ul> | <ul><li>Fill-in format</li><li>Stores evidence of clinical practice using various forms[b]</li></ul> | <ul><li>Records personal goals and accomplishment throughout time</li><li>Requires access to patients, simulations and other learning opportunities[c, d]</li></ul> |

*Feedback and supervisión from experienced personnel are essential in every type. [a]Stelet et al. (2016), [b]Rodriguez et al. (2020), [c]Driessen & Tartwijk (2014), [d]Chertoff et al. (2016).
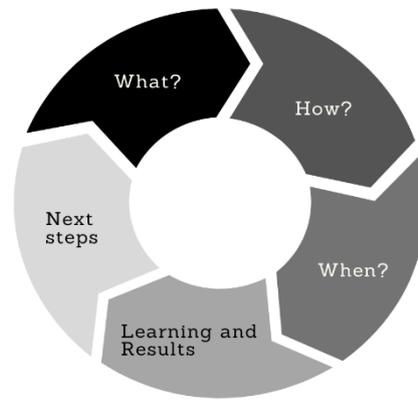
**Figure 1.** Questions answered in the forms of an electronic medical portfolio. Adapted from Driessen & Tartwijk (2014).

Open portfolios provide the user with freedom in terms of structure and include open-ended questions, where they turn the tool into something that identifies them. It can collect information on the stages of personal and professional development over time. However, they require considerably more time and effort than closed portfolios. Devotion to the tool is essential to obtaining optimal long-term results.

Closed portfolios are highly structured; they use a pre-established format where users follow clear and concise instructions to fill out the forms (Muñoz Palacios, 2017). These are easier to teach to first-time users. However, they do not provide room for creativity in deciding what and how to capture content; therefore, their use has shown negative results in some of its users (Chertoff et al., 2016). A combination of both modalities is a semi-structured portfolio, being the most used in universities due to its good qualities, i.e., flexibility and ease of use.

Often the medical portfolio tends to be similar to the Curriculum Vitae (CV). However, a CV doesn't show its user's continuous growth or the skills they have obtained and improved throughout their career. Each activity is recorded in the portfolio to observe the changes and efforts that students make to acquire new skills and develop over time, while learning and improving techniques through feedback obtained from their educator (Chamblee et al., 2015). The main aspect to consider which type of portfolio to use should be the desired scope.

### 3.2. Tools for designing an electronical medical portfolio

The tools available for constructing an electronic medical portfolio are based on the educator and students' needs, usefulness, and apprehension; multiple digital platforms offer different strategies, costs, and academic benefits, among others. For a correct tool choice, it is necessary to have a common objective between the platform, tutors, and students (Ramírez-López & Sánchez-Meza, 2013).

Prior to deciding on the portfolio database in which it will be created, the orientation type must be determined to define the methodological bases considering the following (Trejo González, 2019): (1) if the platform will be used to provide resources that support the student's training (including videos, books or study guides) (2) if bilateral feedback between educator and student will be allowed; and (3) if peer review would be allowed to improve peer communication and teamwork.

Among the tools for the medical portfolio construction, we can list Microsoft Office editing programs and others that allow the creation of an original tool from scratch; the most generic are: Google Drive, Google Sites, Wikis, blogs, websites (Weebly, Yola and Webnode) in which the activities carried out by the student will be recorded online and include educational files to obtain different types of evidence (Murillo Sancho, 2012; Ramírez-López & Sánchez-Meza, 2013; Trejo González, 2019). In the case of Wikis, there is more of a group approach, unlike blogs with a more interactive platform. However, their contents are created individually, and their formality is less than a personalised document.

For the creation of electronic portfolios, web editors are also required, with a purpose to create interactive spaces for the placement of relevant evidence for the protagonist, who is the student (Quesada, 2013). Predesigned platforms provide the portfolio experience, such as Edu-portfolio, Mahara and MyStuff. The first two work together and are integrated into a learning platform called Moodle (Murillo, 2012; Ramírez-López & Sanchez-Meza, 2013). In recent years, the Moodle platform has had a greater scope and use due to its facilities and advantages both in the university environment and in the distance learning modality (Reis de Góes Monteiro Antonio et al., 2020).

In the context of a portfolio, Moodle allows to build a learning framework in which the tutor and learner are in constant communication, with the possibility to implement other characteristics of a medical portfolio (Oproiu, 2015; Gamage et al., 2022).

**Table 2**
Classification of portfolios according to their structure.

| Open or free | Closed or structured | Semi-structured |
|---|---|---|
| • The user has the freedom of deciding what to record and in what way they should do it<br>• Includes open ended questions[a]<br>• Requires a significant amount of commitment and time on behalf of the user | • It utilizes a preestablished format with closed questions<br>• Provides no room for creativity<br>• It is easier to teach to first time users[b] | • Constitutes a combination of open and closed portofolios<br>• It is the most popular type due to its flexibility and user-friendliness |

[a]Chertoff et al. (2016), [b]Muñoz (2017), [c]Ramírez-López & Sánchez-Meza (2013).

### 3.3. Promotion strategies

Implementing an electronic medical portfolio must entail important planning that includes strategies to promote its use by educators and students, as well as the evaluation of its impact and constant improvement (Díaz Plasencia, 2016). The Kotter model aims to manage and provide strategies for the changes that are developed within an entity, allowing this process to be faster and more effective over time, including new teaching evaluation methods (Torres Herrera, 2019). This model has 8 stages, which can be grouped into 3 main ones: the creation of the climate of change, commitment, and training for the organization and third, implementation and maintenance of the change (Keyser Wentworth et al., 2020). In the first stage, spaces must be provided to facilitate an introduction to the tool for educators and students. All those involved must become familiar with the portfolio format. It is recommended to carry out training with practical examples, such as simulations of the goals expected to be met daily using the tool, so that its use is fully demonstrated.

Second, the integration of the portfolio into the curriculum must be planned, based on the regulations of each one provided by the universities, considering a flexible format that allows its incorporation into teaching (López López et al., 2020). An electronic portfolio is a tool that can be used even in environments that do not have access to high financial resources, since it has free electronic platforms with a high-quality margin (García-Carpintero, 2017).

In the tool implementation phase, form overload and high levels of ambition may occur especially in undergraduate students, these are commonly known as classic errors (Gómez-Urrutia & Arellano Faúndez, 2019). To avoid them, efforts should be made to create a system that specializes in educator-student interactions or mentoring, providing didactic benefits (Canga Alonso, 2013). There is an excellent benefit behind creating training for educators on how to give feedback and promoting that each activity carried out by students is done under the supervision of someone with more

experience, creating an adaptive process. It is essential to consider possible challenges and solutions during implementation, such as technological problems (Driessen & Tartwijk, 2014).

To measure long-term impact there's the Kirkpatrick levels; it is a model applied in medical education created in 1967, that divides learning into 4 levels: reaction, learning, transfer, and results (Reyes et al., 2019) (Figure 2). The first level, reaction, is where students subjectively evaluate the program based on their experience. At the second level, learning occurs when there is a new acquisition of knowledge or practical skills. The third level, transfer, refers to how new knowledge is applied and how it leads to changing behaviors in a real work environment. The fourth level, results, are where the real impact of training and its final effects on the clinical environment and patients are evaluated (Johnston et al., 2018).

The medical portfolio has been useful for multiple countries worldwide such as Spain, the United States, Canada, Mexico, Cuba, Chile, Norway and the United Kingdom, the latter being the pioneer. This high-level teaching tool can generate greater learning and closer relationships between educators and students. Creating a database of this level does not require major complications since multiple electronic tools facilitate its process (García Fraile & Rojas Aguilera, 2018).

For an effective portfolio implementation, it's advisable to take the Kotter model as a strategy guide due to its positive impact in the field of change management. With three main stages, the first one aims to create the necessary climate for change by developing an induction program and explaining concretely the portfolio as an educational tool.

The second stage introduces the portfolio and generates results in a short term. Finally, it consolidates the tool by modifying settings as needed based on the feedback provided by educators and students, thus giving way for constant improvement.
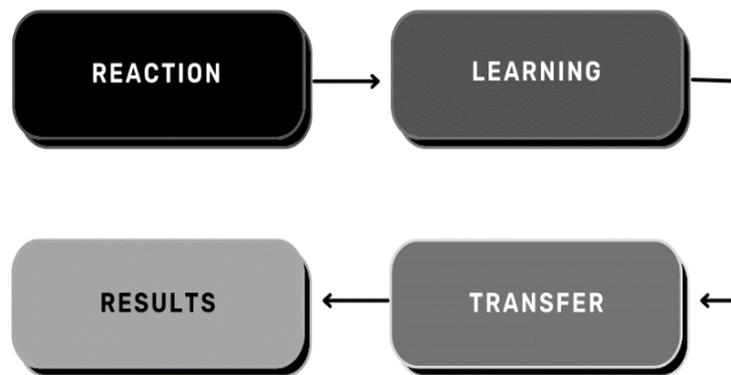
**Figure 2.** The 4 levels of Kirkpatrick. Adapted from Reyes et al. (2019).

## 4. Conclusion

Implementing a medical portfolio in Honduras represents a critical challenge due to the academic and cultural characteristics that predominate in traditional medical training. However, the portfolio could foster standardized learning and development of clinical skills for students, through actions and data collection during their training process. The portfolio's introduction may help identify training deficiencies in the different training institutions, helping decision-makers design interventions that will improve future professionals' performance and positively impact the quality of care patients receive. The strengths (identified) can be expanded, and existing methodologies can be standardised.

There are different types of portfolios that vary according to their objective and structure. The portfolios may be reflective, evaluative or for personal development. The first ones are essentially diaries that encourage the user to be introspective, set their own goals, and record feedback from peers or tutors. Evaluative portfolios are essential to record evidence of practice through pre-established forms. Personal development portfolios record both goals and achievements but rely on an environment that provides opportunities and offers supervision and feedback from knowledgeable tutors. The portfolio design may be structured, free or semi-structured. Structured designs have established tasks and documentation. The students give results or reports, and, in the end, it allows a simplification of the academic evaluation. Free designs allow students to oversee decisions on what to do and document, for a subsequent verification of skills and abilities acquired. Finally, semi-structured designs are most popular among students since they have characteristics of both free and structured designs.

## 5. Author Contributions

JS and EMG conceptualised the study. IEAC coordinated the literature review with EMG. All authors carried out the literature review and wrote the manuscript. All authors have read and approved the final version of the manuscript.

## 6. Acknowledgements

## 7. Conflicts of Interest

The authors declare no conflict of interest.

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