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SCD-EPA: A methodology to develop and implement a profesional training program

DCU-APROC: Una metodología para desarrollar e implementar un programa de formación profesional

Jimmie Leppink [1]*, Marisol Holanda Peña [2], Elena Rojo Santos [3], Héctor Alonso Valle [4], Juan Manuel Odriozola Feu [5], Ignacio del Moral [6], Roberto Ballestero Diego [7], Cristian Suárez Ruiz [8], José Maria Maestre [9]

[1] Valdecilla Virtual Hospital; jleppink@hvvaldecilla.es, https://orcid.org/0000-0002-8713-1374
[2] Marqués de Valdecilla University Hospital ; msoledad.holanda@scsalud.es, https://orcid.org/0000-0001-8868-8601
[3] Valdecilla Virtual Hospital & Marqués de Valdecilla University Hospital ; erojo@hvvaldecilla.es
[4] Marqués de Valdecilla University Hospital ; hector.alonso@scsalud.es
[5] Marqués de Valdecilla University Hospital ; juanmanuel.odriozola@scsalud.es
[6] Virtual Hospital Valdecilla; idelmoral@hvvaldecilla.es, https://orcid.org/0000-0002-4065-8304
[7] Marqués de Valdecilla University Hospital ; rbdballestero@yahoo.es, https://orcid.org/0000-0001-5963-7995
[8] Virtual Hospital Valdecilla; csuarez@hvvaldecilla.es, https://orcid.org/0000-0003-3658-926X
[9] Valdecilla Virtual Hospital & Marqués de Valdecilla University Hospital ; jmmastre@hvvaldecilla.es, https://orcid.org/0000-0002-6343-5445
* Correspondence: jleppink@hvvaldecilla.es

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Abstract: The goal of training programs in healthcare is to facilitate the development of knowledge, techniques, skills, attitudes and/or experience which professionals need to successfully do their job. This includes profession-specific activities as well as common transversal activities with which they contribute to the best healthcare possible. A key feature of this 'development' is that it requires time, and therefore, to facilitate that development, we need an approach that accounts for this longitudinal factor. Besides, the healthcare system is a complex and dynamic environment, designed fundamentally for the clinical care of patients, in which professionals must be prepared to demonstrate a high performance in a wide variety of situations. This article reviews the most important literature on longitudinal approaches to professional training and types of designs with a scientific rigor that allow us to draw valid conclusions regarding the development of interest. The result of this review is a methodology that integrates the most important principles of a type of design called single case design (SCD) and the framework of entrustable professional activities (EPAs) which helps us to define professional activities and to design training interventions to prepare professionals for these professional activities. We propose to call this methodology SCD-EPA, uniting the names of the design and framework that are integrated. Through examples, this article demonstrates that SCD-EPA can be used for both profession-specific and transversal themes and for combinations of activities as well as for a single activity.

Keywords: professional training; single case design; entrustable professional activities

Resumen: El objetivo de los programas de formación en salud es facilitar el desarrollo de conocimientos, técnicas, habilidades, actitudes y/o experiencia que el personal profesional necesita para desempeñar con éxito su labor profesional. Incluyen actividades específicas de sus profesiones y también aquellas actividades transversales comunes con las que contribuyen a ofrecer el mejor servicio sanitario posible. Una característica clave de este 'desarrollo' es que requiere tiempo y, por lo tanto, para facilitarlo se necesita un enfoque que tenga en cuenta este factor longitudinal. Además, el sistema sanitario es un

entorno complejo y dinámico, diseñado fundamentalmente para el cuidado clínico de los pacientes, en el que el personal profesional tiene que estar preparado para demostrar un alto rendimiento en una variedad amplia de situaciones. Este artículo realiza una revisión sobre la literatura más importante que versa sobre los enfoques longitudinales en la formación profesional y los diseños metodológicos que permiten llegar a conclusiones científicamente rigurosas sobre este objeto de estudio. El resultado de esta revisión es una metodología que integra los principios más importantes del denominado diseño de caso único (DCU) y el marco de las actividades profesionales confiables (APROCs) el cual nos ayuda a definir las actividades profesionales y a diseñar las intervenciones de formación con las que preparar a los profesionales para estas actividades. En este artículo, se propone llamar esta metodología DCU-APROC, uniendo los nombres del diseño y del marco en el que están integrados. A través de ejemplos, en este artículo se muestra cómo DCU-APROC puede ser utilizado para actividades específicas de una profesión y actividades transversales comunes, y tanto para combinaciones de actividades como para una sola actividad.

Palabras clave: formación profesional; diseño de caso único; actividades profesionales confiables

1. Introduction

The healthcare system is a complex and dynamic environment that requires a team of professionals willing to offer the best possible service and to develop the knowledge, techniques, skills, attitudes and experience they need to achieve it. This development occurs through the combination of a series of training activities with practice, which facilitates the preparation of personnel for a wide variety of situations, both habitual (typical) and unusual, and that are properly planned and reviewed throughout over time. Therefore, to facilitate this development we need two types of tools: on the one hand, a framework that helps us not only to understand the needs of the service and its professionals, but also to design training activities and, on the other hand, a type of methodological design that has sufficient scientific rigor to monitor the progress of professionals in training and review activities based on this progress. This article reviews key literature on these two types of tools and concludes with a methodology that integrates important principles from both. Through examples, this article shows that this methodology, resulting from the review, is applicable to specific activities of a profession and common transversal activities, as well as to combinations of activities or to a single activity.

2. Tools (i.): understand the needs of the service and its professionals

There are at least four types of sources to understand the needs of the health service and its professionals: (i.) competency frameworks or professional activities; (ii.) legal frameworks; (iii.) connect directly with health service priorities *and patient outcomes* ; and (iv.) research results.

2.1. Professional skills and activities

An example of an internationally known competency framework is found in the Canadian framework called *CanMEDS* (1), a framework that identifies and describes the skills that physicians require to effectively meet the health care needs of the people they care for. These skills are grouped thematically into seven roles: medical expert (the integrative role), communicator, collaborator, leader, health advocate, scholar, and practitioner. There are frameworks similar to the CanMEDS in different countries and

regions in the world, such as the World Health Organization (WHO) competency framework for public health in the European region (2).

While some frameworks focus on competencies, there are also frameworks focused on professional activities (3) with the idea that a competency is often important for a variety of professional activities and, simultaneously, different professional activities partially require different combinations of competencies (4, 5). For example, although active listening and empathy are important both when consulting with patients and when working with other professionals, being prepared to communicate warmly and effectively with a patient does not mean that one is also prepared to communicate effectively. and warmly with colleagues or vice versa. Therefore, the philosophy behind the framework of trustworthy professional activities (EPAs), or in English *entrustable professional activities* (EPAs) (3-5) is to define the essential activities that professionals have to carry out and then select the competencies that a professional must carry out. professional need for each activity. Once the competencies and professional activities have been identified, the next step is to design training and evaluation activities for the development of competencies and performance in professional activities of interest. In the framework of the EPAs, both training and evaluation are focused on professional activities (6), and both an activity and the skills required to carry out said activity can be evaluated on one or more scales (7).

In order to design the training and evaluation as well as possible, in the framework of the EPAs it is recommended to first define each EPA using the following categories: (i.) title of the EPA; (ii.) specification and limitations of the EPA; (iii.) the preparation plans, which include the most relevant domains of competencies, the key situations in which to apply them, and the continuous development of individuals, teams, and the work system itself; (iv.) experience requirements, knowledge, skills, attitudes and behaviors; (v.) types of evaluation to monitor progress and support decisions; (vi.) decide on entrustability; and (vii.) revalidation. In **Table 1,** a clinical example can be seen.

Table 1. Example of an EPA: Assessment and initial management of the most common obstetric emergencies.

<table>
<tr><td colspan="3">1. Title: Assessment and initial management of the most common obstetric emergencies.</td></tr>
<tr><td colspan="3">2. Specifications and Limitations: Includes triage, evaluation, and initial management of emergency presentations including gestational hypertension, urinary tract infections, antepartum hemorrhage, and reduced fetal movement. Premature rupture of membranes, amniotic fluid embolism, or trauma (eg, motor vehicle collision) are not included.</td></tr>
<tr><td colspan="3">3. Preparation plan:</td></tr>
<tr><td>Core Competencies</td><td>Applying competencies to key situations</td><td>Continuous development with teams and systems</td></tr>
<tr><td>• Completion of an obstetric clinical history (anamnesis and physical examination)
• Understanding antihypertensive drugs
• Knowledge of echoanatomy of the genito-urinary system
• Demonstrate communication skills with patients and loved ones…</td><td>• Assessment and management of hypertension during the first, second and third trimesters of pregnancy
• Assessment and management of hypertension during labor
• Urinary infection
• gestational bleeding
• Peripartum hemorrhage
• …</td><td>• Structured conversations about performance in real situations
• Structured conversations about performance in on-site simulations with (potentially) real teams
• …</td></tr>
<tr><td colspan="3">4. Reference standards used:
• Consensus document of the Spanish Society of Gynecology and Obstetrics on the</td></tr>
</table>

management of gestational preeclampsia and eclampsia. • *name of hospital*] massive hemorrhage management protocol . • …
5. **Evaluation**: Performance in real situations under indirect supervision (ie: not present but available if necessary).
6. **Entrustability**: In the case of satisfactory performance under indirect supervision, it is entrustable to work without supervision (ie: distant supervision, not directly available).
7. **Revalidation**: Updating training activities every three years. **

** The revalidation field is optional and depends on the specific EPA.

For a training program, such a table can be developed for each EPA.

2.2. Legal frameworks

In addition to competency frameworks or professional activities, a second source for understanding the needs of the health service and its professionals are the legal frameworks that define the training requirements in the field of health. A good example in the specialized health training system in Spain is *Royal Decree 183/2008, of February* 8 (8), "by which the specialties in Health Sciences are determined and classified and certain aspects of the system are developed. of specialized health training" (p. 1). Among others, this Royal Decree clearly defines the concept of teaching units (Chapter II), the figure of the tutor (Articles 11-12), and principles of supervision (Chapter V) and evaluation (Chapter VI).

2.3. Connect directly with health service priorities and patient outcomes

A common way of understanding needs is to connect directly with the priorities of the health organization and the patient's results based on the information obtained through hospital commissions (quality, safety, mortality, etc.), conversations with professionals (new diagnosis and treatment methods, adverse events, staff welfare, etc.), the view of management teams, claims reports from patients and insurance companies, etc.

2.4. Research results

In addition to the frameworks mentioned above, research activities can facilitate the development and/or implementation of a vocational training program in at least three ways. First, empirical studies and literature reviews published in journals and books contribute to theoretical and practical frameworks for the development and/or implementation of training activities or programs. Second, in terms of program development, a better understanding of the needs in the local setting can be gained through interviews or other qualitative research methods. For example, in a homogeneous population of professionals (such as a hospital), 80% of the topics related to the question(s) can be captured with only six interviews (9). Third, to facilitate the implementation and evaluation of a program and monitor the progress of program participants, there are methodologies that allow integrating research into training (7), as presented below.

3. Tools (ii.): integrate research in training for better training

Although competencies and EPAs are different concepts, they have in common that their development requires repeated practice over time. Furthermore, an advantage of integrating assessment and training is that repeated measures of the same competencies and EPAs can be taken over a defined period of time. For example, in a medical degree program or a five-year residency program, assessment events can be planned 2-3 times a year to monitor progress on defined EPAs and competencies over time. There are many types of designs for longitudinal evaluation, some of which require large samples or

populations of participants, while others can also be carried out with small groups or even single participants (7).

One type of design that is applicable regardless of the number of participants is the so-called *single case design* (SCD) (7, 10-12). This type of design, in which training activities and other events are part of time series in which measurements are taken before and after these events, makes it possible to study changes in variables of interest over time in large and small groups. as well as at the individual level. An example of this type of design published in this journal a year ago is a series of weekly assessments of the quality of the tutor-resident relationship from the perspective of the tutor and/or resident before and after a training activity (13). In the context of training, compared to randomized experiments and other types of studies involving groups of participants, the SCD methodology has four important advantages (14): (i.) it respects the dynamic nature of learning; (ii.) does not require more resources than necessary; (iii.) can help bridge the gap between research and practice; and (iv.) facilitates the appreciation of diversity and action accordingly.

3.1. Learning is a dynamic process

An important limitation in traditional randomized experiments and in the vast majority of studies that compare groups of people is that there are observations of variables of interest only once or twice in time and, therefore, they do not allow us to understand the variation in said variables. of interest over time. In addition, the main objective of the vast majority of studies that compare groups of people is to generalize the results to people who have not participated in it. Although this generalization can be an objective of studies that use the SCD methodology, with this system it is also possible to answer questions such as 'what is the level of competence A of resident staff B at time (or season) X?' and 'does this simulation activity, C, contribute to more effective communication at Hospital D?' (14). There are measurement systems to analyze the data obtained with a SCD both for quantitative variables (10, 13, 15) and for qualitative variables (15-17) and with both types of metrics data can be analyzed at the individual level and, in studies that include several participants, at group level (7, 10, 15).

Even in contexts where the content to be learned does not really change over time – linear algebra, for example – learning is not a static process but rather a dynamic one, with seasons of more and seasons of less growth. In addition, in high-risk professions – such as health professions and also aviation, security and engineering – the environment and, therefore, the content changes over time (18), and the SCD methodology allows studying changes of this type across different units of study: individual, team, situation or environment (14).

3.2. It is imperative to minimize the resources used

Traditional types of studies, including randomized experiments comparing two or more groups of people, often need more than 100 participants to detect effects of interest. This has to be a problem in studies with cohorts of hundreds of students who fill out a survey or complete some tasks on paper or on a computer, but in a context of high-risk professions, such as professions in the healthcare system, it is usually neither realistic or necessary. Especially in a sector such as health, it is imperative to use as few resources as possible, firstly so as not to contribute to further pressure on a system that has already been under excessive pressure (and even more so since the arrival of the pandemic in March 2020)., and second because many of the questions of interest – such as 'what is the skill level A of resident staff B at time (or season) X?' and 'does this simulation activity, C,

contribute to more effective communication at Hospital D?' (14) – do not require a large number of participants.

3.3. Bridging the gap between research and practice

In the vast majority of randomized experiments and other comparative studies, part of the participants does not receive a potentially beneficial intervention (the control group), while in the SCD methodology the question is not *if*, but *when* a participant receives an intervention. Since in a skydiving study there would never be a control group in which the parachute cannot be opened, in a training setting omitting crucial activities does not make sense (14); rather, the question is *when to* introduce these activities.

A common belief regarding the SCD methodology is that SCDs do not count as experimental studies and therefore do not have the same value. However, there are SCDs that meet the criteria to classify a study as an experimental study (7, 10, 14): manipulation and random assignment. In these experimental SCDs, manipulation is found in seasons before and after an intervention, while what is randomly assigned is *when* a participant is presented with an intervention.

The objective of all training activities in our healthcare system is to facilitate the development of knowledge, techniques, skills, attitudes and/or experience that professionals need to successfully carry out the specific activities of their professions and those transversal activities with which they contribute. to the best health service possible. In this context, questions such as 'what is the impact of training activities on the participants, on the environment in which the participants work, and on the healthcare system of which they are a part?' and 'Are we training good professionals?' These are questions that imply a translation from training and research to practice (19, 20) and form the core of training and research on this training. SCDs allow us to study precisely these key questions.

3.4. Appreciate diversity and act accordingly

A very important characteristic of high-risk professions is that not only are the environments in which professionals work dynamic and ever-changing (18), but there are also many differences between environments in how they function at a defined moment and how they develop over time. weather. This is important, because at the end of the day each healthcare system has to direct its activities to the existing needs in its local environment (20). The SCD methodology helps to study local needs and the effects of activities focused on these needs and – as the results of different studies using this research design are likely to be combined through a meta-analysis (10, 12, 15) – to investigate differences and commonalities between settings and to develop theory and research focused on these differences and commonalities.

4. Synthesis (i. and ii.) through a transversal example: establish, maintain and improve relationships

The SCD-EPA methodology, which results from a synthesis of the EPAs framework and the SCD methodology, integrates (i.) the context and content of the health professions and (ii.) a methodology with designs and metrics that It allows us to monitor progress and assess the impact of training activities on professionals and the environment in which they work. This section presents the SCD-EPA methodology through a transversal example: establishing, maintaining and improving relationships with other people in the healthcare system (colleagues, residents, students, patients, relatives) based on empathy. As the example shows, the SCD-EPA methodology has four phases: (i.) theoretical and practical

basis; (ii.) preparation plan (iii.) indicators, design and measurement systems; and (iv.) implementation and evaluation.

4.1. Phase 1: theoretical and practical base

A key cross-curricular skill is developing and maintaining good relationships with colleagues and with patients and their loved ones, and two critical components to this skill are communication and the ability to show empathy. A recently published systematic scoping review (21) summarizes that having a medical staff that has a better ability to show empathy is linked to better relationships between the medical staff and their patients (22, 23), better clinical outcomes for patients (24, 25), greater patient and/or family satisfaction (23, 26), increased professional satisfaction (27, 28), improved clinical competence (29, 30), and reduced professional burnout (31, 32). However, during the training period, both university and resident staff, the training of students and resident staff in the development and management of empathy continues to be a pending issue that is difficult to measure or evaluate (33-35) and also difficult to teach (33, 36-39). For example, in an exam with real patients or actors, students may show empathy because they know that showing empathy usually results in a better assessment, rather than an intention to improve the clinical results of the patient (35).

Since there is no universal consensus on the definition of empathy, it is considered necessary to analyze the concept to which this term refers. To begin with, the kind of work involved in giving a truly empathic response is largely a primarily cognitive (mental) task, not an emotional one, although it is understood that such a task may be motivated by compassion and reinforced by intrapersonal awareness (40). . Thus, for purposes of preparation (training) and evaluation, the empathic process is considered to be: (i.) a conscious and energetic mental effort to clarify the expression of a patient's experience using an interpretation of his or her story; (ii.) distill or connect feelings and meanings that are associated with a person's experience (colleague, resident, student, patient, or loved one of a patient); and (iii.) simultaneously identifying, isolating, and repressing that person's own reactions and experience. Furthermore, the empathic process is *not* : (i.) a basic listening skill, but rather a master listening skill (more learned and elaborated); (ii.) compassion in the face of suffering that motivates people towards altruism, but rather allows for self-understanding; (iii.) sympathy in which one professional's feelings toward others are revealed (“sorry to hear about…”), but rather the process by which one professional identifies his or her feelings and then hides those feelings from the other; or (iv.) putting yourself in another's shoes, because putting yourself in another's shoes does not necessarily mean that you will understand the other, since each of us can live the same experience in a different way.

In addition to the shared theoretical considerations, in order to understand the motivations, needs and challenges of the professional health personnel for whom we want to prepare a training program, a sample of professionals can be interviewed about these questions and related issues. This step can increase not only the content of the training program but also the motivation of the professional health personnel who are going to participate in the training, because they feel heard and perceive that their participation in the program can help them work on their needs and challenges and thus improve its performance. As previously mentioned, in a homogeneous population of professionals (such as from the same hospital) 80% of the topics can be captured with only six interviews (9).

4.2. Phase 2: preparation plan

In the first phase of SCD-EPA, the basis for defining an EPA-style preparedness plan is established as in **Table 2** .

Table 2. Preparation plan: establish and maintain relationships based on empathy.

1. **Title**: Establish and maintain relationships based on empathy.		
2. **Specifications and limitations**: [*a summary of 2-3 lines resulting from the first phase*]		
3. **Preparation plan**:		
Core Competencies	**Applying competencies to key situations**	**Continuous development with teams and systems**
• Show respect for people through the *basic principle,* which considers that people (i.) are capable, intelligent and concerned about doing their job well and improving (*professionals*) or participating in their own care (*patients and loved ones*) and (ii.) can reflect and discuss the reasons and reasoning in their decision making • Caring for others by helping them reveal their motives and reasoning by showing curiosity with patients, loved ones and other professionals • Show strength by combining argumentation and inquiry in conversation to create shared understanding • Understand the different forms of listening and show listening skills to understand the perspective of others • Recognize the expression of emotions as a sign of strength • …	• Create a relationship of trust around (i.) teamwork, (ii.) residents' learning journey, and (iii.) caring for patients and their loved ones • Recognize and manage complex situations of the type (i.) conflicts or tensions between people, (ii.) communication in difficult times, and (iii.) professional burnout • …	• Structured conversations about performance in real situations • Structured conversations about performance in on-*site simulations* with (potentially) real teams • …
4. **Reference standards used**: [*here for example 2-3 references from a systematic review of systematic scope*]		
5. **Evaluation**: Weekly surveys for a few weeks before and after the training activities on this topic, with the participant and with at least one colleague and/or resident who works with the participant during this season.		
6. **Entrustability**: [*depends on the experience of the participant*]		
7. **Revalidation**: Updating training activities every three years. **		

** It can be a question in interviews with future participants and/or their colleagues.

This preparation plan facilitates the design of training activities and evaluation content, based on the experience of the participant (41).

4.3. Phase 3: indicators, design and measurement systems

In **Table 2,** the evaluation is defined as a weekly survey with the person who participates in the training and with at least one colleague and/or resident who works with them during this season. This survey may combine questions that require an

assessment on some type of scale (35), questions that require a dichotomous response or a choice between qualitative options (16-17), and/or open-ended questions that invite the respondent to share sensitive narrative information. to be analyzed either by qualitative techniques or to be codifiable for quantitative analysis. An example of the latter is found in the question 'How would you describe the relationship with [*person X*]?', which usually results in positive or *facilitating terms* (examples: *good relationship, respect, empathy, trust*) and negative or *non-facilitating terms* (examples: *agree with the other to avoid conflict*). In this context, a possible quantitative variable is *valence* as the difference between the sum of positive terms and the sum of negative terms, with more positive values indicating a better relationship and more negative values indicating a worse relationship. For example, if there are three answers – A: 3 facilitators – 0 non-facilitators = 3; B: 3 facilitators – 1 non-facilitator = 2; C: 0 enablers – 1 non-enabler = -1 – the first response (A) indicates the best relationship and the third response (C) the worst relationship of these three (according to this metric).

Regarding the planning of measures, this depends on the planning of the training activities and the logistics of the local environment. However, in order to generate the impact of the training at the level of the individual participant, a good guideline is to have at least five measurements (in this case, five surveys) before and after the training (10, 15-17). Therefore, in a program consisting of a package of activities that can be organized within a week, about 2 (*phases*) x 5 (*measurements per phase*) = 10 measurements (*total*) per participant are needed (10, 15), while in the case of two packages of activities that are organized with a distance between packages of, for example, six weeks, about 3 (*phases*) x 5 (*measurements per phase*) = 15 measurements (*in total*) are needed per participant (16).

4.4. Phase 4: implementation and evaluation

To simplify the example, there is a training program for tutors consisting of three training days – organized on Tuesday, Wednesday and Thursday in week '5' – and a weekly Resident Q survey every Monday during weeks '1 ' to '10', and the variable of interest is the valence as presented in the previous paragraph. Figure **1** presents the results of the implementation and evaluation, using a moving average regression model (11) in the *nlme package* (42) within the Open Source *R program environment* (43) with the data obtained from Residente Q.

Monday in week '5' is the last measurement before training and Monday in week '10' is the last measurement; the difference between these two measurements, as indicated by the model (the red line), shows the effect of training: $B = 2.247$, $SE = 0.327$, $p < 0.001$, with a 95% confidence interval of [1.448; 3.046]. This difference is statistically significant and indicates the *positive effect* of the training (an improvement in the relationship perceived by this resident).

If valence were a qualitative variable (nominal or ordinal) or the trajectory of valuations did not allow the use of a linear model, a metric called *Bayesian Percentage of All Non-overlapping Data* (PAND-B) could be used. : a Bayesian metric of the percentage of all non-overlapping data) (7, 15-17). This metric is a function of the percentage of all data that would have to be removed or phased (here, from before to after or vice versa) to get perfect separation between phases.

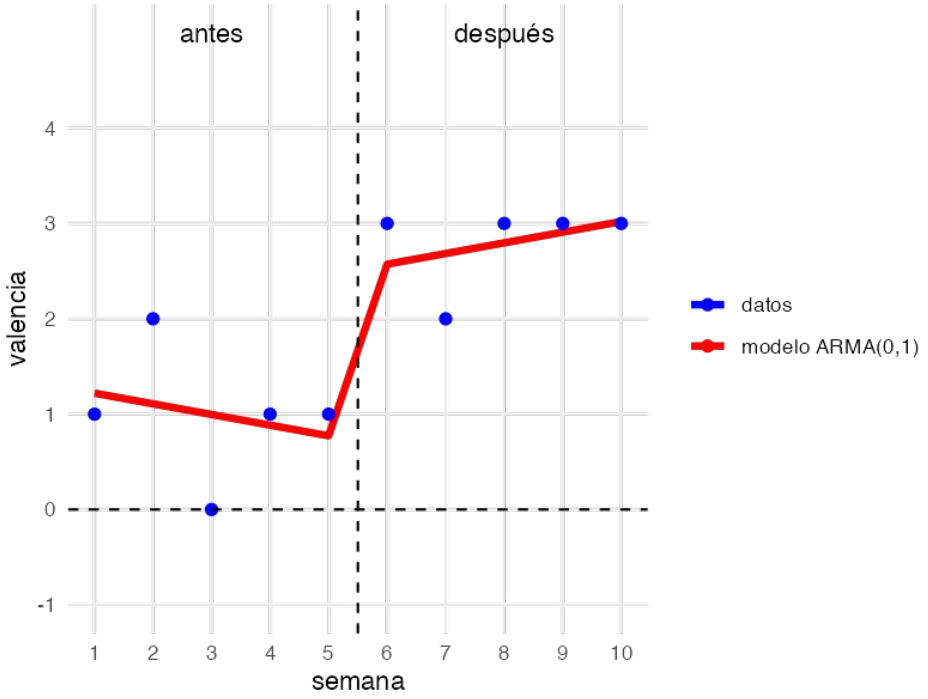

Figure 1. Graphic representation of the impact of the establishment of a training activity for tutors on the relationship between the resident and the tutor perceived by the resident: the weekly valence (data, blue) and a moving average regression model (red).).

In this case, only one observation would have to be removed or changed, be it the observation of week '2' or the observation of week '7'. To arrive at PAND-B, we express this result as 9 successful observations and 1 unsuccessful observation, and these numbers result in a binomial distribution of 'B(9,1)'. In Bayesian statistics, the data is used to update the prior distribution (before the data) to obtain the *posterior distribution* (after the data):

$$a\ priori + \text{data} = a\ posteriori\ .$$

The *prior distribution* is usually a 'B(1,1)' distribution – giving 'success' and 'no success' the same probability), and therefore the *posterior distribution* is:

$$B(1,1) + B(9,1) = B(10,2).$$

This is a distribution with a median of 0.852 and a 95% credible interval of [0.587; 0.977]. This range is fully above 0.500 and thus provides evidence of a positive effect of formation (a range fully below 0.500 would indicate a negative effect).

5. Discussion

The SCD-EPA integrates a very established framework in the world of training in health professions and a methodology with designs and measurement systems that reinforce the characteristics of said framework (SCD), respects the dynamics of learning and of the healthcare system, and treats research as part of training. In this way, it facilitates bridging the gap between research and practice, helps to minimize the resources used for research, and encourages appreciation of the needs of the local environment and the variation of these needs between different sites and between different seasons. . This

section presents a series of important considerations to take into account in the application of the SCD-EPA: (i.) formulate and review competencies and EPAs; (ii.) the number of observations and missing data; and (iii.) assumptions and limitations of the metrics.

5.1. Formulate and review competencies and EPAs

A first important consideration is the formulation and revision of the competencies and EPAs (3-6). On the one hand, with formulations that are too narrow, there is a risk of needing too many EPAs, and even not being able to distinguish between an EPA and a competition. On the other hand, with formulations that are too broad, a major risk is not being able to develop training activities that are effective. The number of EPAs that can be handled in a training program depends on the amount of time you have to train and to achieve your goals.

5.2. The number of observations and missing data

Although SCDs have clear advantages over other types of research, data loss caused by non-response is a very common phenomenon in SCDs, especially in the case of longer series. Therefore, an issue to consider is the number of measurements per participant and per season or phase. As previously stated, a minimum of five measurements per participant in each phase is a good guide. Both the regression models and the Bayesian model of the PAND-B work well with five or more measurements per participant in each phase. Even if you miss one response per phase and thus are left with four measurements per phase for a participant, both types of models can work well. However, fewer measurements also means less power to detect effects of interest, and with only four or five observations per season a fairly large effect at the level of a participant is needed to detect it. On the other hand, using too large a number of measurements (a series of many surveys) also runs the risk of losing a lot of data, for example due to respondent fatigue.

In this context, a related question is the size of each measurement, that is: how much effort does each measurement require? For example, in the case of weekly self-assessments (such as every Monday or Friday), a 3-question multiple-choice survey using some sort of scale is likely to take little time, while a much longer survey takes more time and as This increases the risk of high data loss.

5.3. Assumptions and limitations of the metrics

The two types of metrics presented in this article have in common that they both require at least four and, better, five observations per participant in each phase and, in examples such as the one shown in **Figure 1,** they can be used in combination. However, it is important to know some assumptions and limitations of each type of measure.

Regression models are valid when the variables of interest are quantitative. With numbers of observations as in the example in **Figure 1,** an important limitation is that there are only enough observations for linear models; if you want to investigate more complex relationships, longer series are needed (7). Also, a danger with regression models is extreme observations; for example, if the observation of '0' in **Figure 1** were a '-5', the regression model used in this example would lose validity and in this case the PAND-B model would be more appropriate. In any case, working with quantitative variables that do meet the requirements of regression models, one advantage of these models relative to the PAND-B model is the possibility of modeling trends and assessing the size of differences based on training activities already that the PAND-B constitutes a non-parametric metric using frequencies.

Although the PAND-B does not provide any type of information on trends or sizes of differences, it can be an interesting complement in combination with a regression model when within each season there is very little trend (more or less horizontal movements) and/or the difference between seasons (in the example in **Figure 1,** the difference between 'before' and 'after') is relatively small. Furthermore, an important advantage of PAND-B over regression models is that it often provides a valid solution where regression models are not valid; The only limitation of the PAND-B in this type of case is that in some very particular situations of great difference between seasons in terms of the number of observations (for example: three observations before and ten observations after a training activity) it can have a limited validity, but the probability of this type of situation occurring can be minimized at the design stage.

6. Conclusion: SCD-EPA in five points:

- integrates a framework for curriculum design and evaluation that is well established in the world of training for health professions (EPA) and a methodology with designs and measurement systems that allow the characteristics of said framework to be taken into account (SCD);
- respects the dynamics of learning and the healthcare system;
- treats research as part of training and thus facilitates bridging the gap between research and practice;
- helps minimize the resources used for research; and
- it facilitates appreciation of the needs of the local environment and the variation in these needs between different sites and between different seasons.

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