Supplementary materials

Basic considerations of the program

The design of the intervention plan, we took into account the following considerations:

1. The interaction between individual, social and residency program-specific factors determines the success of the intervention.
2. Close communication between the resident and a mentor/teacher facilitates the process of remediation.
3. Process-oriented and goal-oriented indicators must be used to monitor the remediation program.
4. Cooperation between the Remediation Committee, mentors, faculty and the residents are necessary to achieve the intervention goals.
5. The remediation strategies must be student-centered and be tailored to the learning approaches of each resident.

Intervention team

The intervention staff included the Program Director, Associate Program Director and two faculty members who integrated the Remediation Committee, in addition to an individual anesthesiologist who served as a mentor for each individual case. The intervention team was selected based on years of educational experience and positive resident evaluations. The mentors had to be flexible, open-minded and open to constant dialogue with the resident and the committee. The mentors reported progress in the implementation of the remediation program to the Remediation Committee once a week, and when a problem with progress or implementation was noted. The committee met with the mentor to discuss the strategies necessary to correct the problem.

Psychological and social dimension

During an initial interview conducted by the mentor, the resident was asked about psychological aspects including academic motivation, efficient use of time, perceived social support, identification with the residency program and the institution. Healthy habits including exercise, nutrition and sleep were explored in the interview. The social dimension focused on the effect of stress on academic consequences. This dimension was analyzed in terms of interference between study and social domains and social support from family, friends and fellow residents. The evaluation of such social factors was subjective. Data gathering after the interview allowed the mentor to identify presence or absence of stressors in the psychological factors described above. If at least one stressor was present, a psychology counselor was invited to take part in the MRP for the resident. All residents in the study required participation of a counselor. The role of the counselor included provision of advice to navigate through the educational plan offered by MRP, recommendations for time management and use of stress-reducing techniques, and identification of learning approaches. The counselor met with the resident once a week and made recommendations to the mentor when deemed appropriate.

Identification of learning approaches

An initial assessment of the learning approach specific to each resident was conducted by the mentors by means of observation and/or application of structured questionnaires (14). All residents in our study were administered the Revised Two-Factor Study Process Questionnaire (R-SPQ-2F). The R-SPQ-2F instrument consists of twenty items evaluating two scales, each one composed of ten items, evaluating either the superficial or the deep approach to learning. Additionally, the scales can be subdivided into two subscales of five items each, which reveal the strategies and motivations underlying the learning approaches. Responses to each item are categorized according to a 5-point Likert scale The individual's approach to learning was considered superficial when the resident relied mainly on memorization of contents and saw

passing the test as the only goal, whereas the resident was deemed a deep learner when he/she tried to find meaning within the texts and saw knowledge acquisition as a higher goal than passing the test *per se*. The type of learning oriented the mentor in regards to the strategies to be utilized for test preparation, being able to choose from the different strategies offered by MRP.

Medical knowledge gaps and strategies

After determination of the resident's learning approach, the mentor and the resident worked together to plan a schedule of encounters and activities based on a list of resources/strategies offered by MRP. All the strategies were used in every resident, and time and intensity dedicated to each one depended on the resident's specific learning approach.

The first strategy consisted of identification of weak keywords as per the ABA exam feedback. The keywords were displayed on a board and organized by affinities based on major anesthesia topics (e.g. anesthetic pharmacology, systems physiology, biostatistics). The mentor generated a list of book chapters and review articles that covered the broad topics addressed by keywords. A goal of individual reading of two chapters per week was established. During the weekly meeting with the resident, the chapter was discussed in a format that allowed the resident to present the topic in an informal way, without audiovisual aids. The expectation was that for resident to be able to "tell a story" based on understanding rather than memorization. Then, the mentor added detail to the presented information and answered resident's questions. Finally, the mentor emphasized the specific aspects that might be potential targets in a structured test such as ABA basic exam.

Two sources of question banks were used by MRP: Truelearn™ platform and Anesthesiology Continuing Education (ACE) questions. During a first session, mentor and resident sat together

to answer a block of 50 questions. During this session, a technique was taught consisting of three steps:

1. Reading the stem question neglecting the multiple choices. The goal was twofold; trying to answer the question directly and brainstorm to generate a list of aspects related to the topics presented in the question. For instance, if the question addressed the use of succinylcholine in a pediatric patient, the list of aspects would include hyperkalemia, malignant hyperthermia, muscular dystrophy, bradycardia, masseter muscle spasm, full-stomach, extrajunctional nicotinic receptors and phase II block. This list facilitates associations and ruling out multiple choices for an answer.
2. Going over every single possible answer to determine whether it was true or false based on the association list found in the first step.
3. Using information from prior questions to facilitate finding a solution for new questions.
4. At the end of the session, the mentor recommended review of specific texts touching on topics detected as weaknesses that hindered the process of correctly answering the practiced questions.

In order to optimize session time use, the resident was asked to answer 250 practice questions per week. When a question was marked as wrong or he/she recognized that getting to the right answer was the result of guessing, that question was flagged. The group of flagged questions was reviewed with the mentor twice a week, following the same procedures described above. Additionally, there was an open line of communication via text message and e-mail between resident and mentor, to help with hints during individual question practice or to discuss aspects related to the mentorship process.

During each session, a conversation took place to address comfort and stress levels, answer questions and discuss the remediation process in general. According to MRP guidelines, if during these discussions, the mentor found out that the level of stress and discomfort were not progressing positively as expected, a meeting with the psychological counselor was advised.

In order to evaluate progression in terms of test performance, sessions of timed 25-question tests were scheduled every three weeks and 50-question blocks were administered twice before the second attempt to take the ABA Basic exam. A keyword analysis of the failed questions was conducted and those keywords were reviewed in detail with the mentor.

Finally, the keywords that were consistently present as weak in the ABA basic exam and the MRP simulated tests were assigned to the resident, who would present them in great detail in front of the remediation committee, in a format that included both presentation and a question session formulated by the committee. During the whole process, the resident was assigned to rotations with low workload to enhance study time. In addition, academic days dedicated to individual study and/or mentor meetings were scheduled once every two weeks, and during the week before the second attempt to take the ABA basic exam.