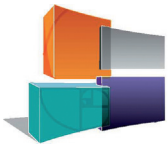
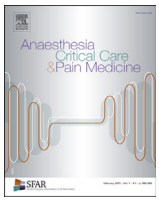
Anaesth Crit Care Pain Med xxx (2015) xxx–xxx



SFAR
Société Française d'Anesthésie et de Réanimation



Original article

Residents in tutored practice exchange groups have better medical reasoning as measured by the script concordance test: A pilot study

Vincent Compère [a,b,*], Jérôme Moriceau [a], Antoine Gouin [a], Pierre-Gildas Guitard [a], Cédric Damm [a], Delphine Provost [a], Roman Gillet [a], Véronique Fourdrinier [a], Bertrand Dureuil [a]

[a] Department of Anaesthesiology and Intensive Care, Rouen University Hospital, Rouen, France
[b] Laboratory of Neuronal and Neuroendocrine Communication and Differentiation (DC2N), EA4310, U982 Inserm, Federative Institute of Multidisciplinary Research on Neuropeptides 23 (IFRMP 23), University of Rouen, place Émile-Blondel, Mont-Saint-Aignan, France

ARTICLE INFO

Article history:
Available online xxx

Keywords:
Practice exchange group
Medical reasoning
Script concordance test

ABSTRACT

Background: This pilot study attempted to evaluate the impact of a practice exchange group (PEG) tutored by a senior anaesthesiologist on clinical reasoning performance of anaesthesiology residents for uncertain situations. Changes in clinical reasoning were measured by script concordance tests (SCT).
Methods: First, a curriculum, with educational objectives and assessment tools, was proposed to all residents at the beginning of their 6-month training. The first group (control) consisted of residents undergoing a 6-month rotation without PEG training. The second group (PEG group) consisted of the residents starting a new rotation 6 months later, who followed a weekly PEG session. In both groups, clinical reasoning was assessed in the same manner, with SCTs, multiple-choice questions (MCQs) and questions with short answers. The primary outcome measurement of this study was the SCT results in the group with PEG training (PEG group) in comparison with those without (control group).
Results: The performance in the SCT, expressed as the degree of concordance with the panel [95% confidence interval or CI], was better in the PEG group including 19 residents (72 [68 to 76] %) as compared to the control group including 17 residents (60 [57 to 63] % $P < 0.001$). Performances (mean [95% CI]) in MCQs and short answers were better in the PEG group (64 [57 to 71] and 74 [68 to 72] %, respectively) when compared with the control group (32 [28 to 36]% [$P < 0.001$] and 60 [52 to 68] % [$P < 0.01$], respectively).
Conclusion: Our pilot study suggested that a senior-directed, peer-conducted educational training might improve the clinical reasoning of anaesthesia residents as measured by the SCT.

1. Introduction

The on-call period is an important component of anaesthesiology residency training because residents practice technical skills and more importantly apply appropriate clinical reasoning to unresolved cases where clinical information may be incomplete and uncertainty may exist. The patient's condition may be critical, which does not allow enough time to perform all required investigations and unstable vitals potentially render professional guidelines difficult to apply. In addition, no established recommendations are available regarding specific anaesthesiology residency training in this context of uncertain anaesthesia care.

Peer learning or peer teaching is a method in which the student plays a direct role, not only as a learner but also as a teacher, by taking an active part in debates between peers [1]. This method has shown its efficacy on the education of clinical reasoning [2]. It is used particularly in the context of practice exchange groups (PEGs), also called peer or quality groups [3]. A PEG consists of a small group made of physicians drawn from the same specialty (peers) who meet regularly to review patient cases extracted randomly from their daily practice [4]. For each case, an exchange between participants leads to a confrontation of practices. At the end of the discussion, practitioners have to agree on a specific direction for action. If no satisfactory solution can be agreed upon, a literature search is then initiated. In the context of continuing

* Corresponding author at: Department of Anaesthesia and Intensive Care, Rouen University Hospital, 1, rue de Germont, 76031 Rouen, France.
Tel.: +33 2 32 88 82 83; fax: +33 2 32 88 83 26.
E-mail address: Vincent.Compere@chu-rouen.fr (V. Compère).

http://dx.doi.org/10.1016/j.accpm.2014.12.001
2352-5568/

medical education, the purpose of PEGs is to improve the quality of care, in comparison with peers and with medical frames of reference [3]. This methodology has also been successfully used for initial medical training [2,5] but, to our knowledge, it has not yet been used in anaesthesiology when residents are confronted with uncertain situations.

Therefore, this pilot study attempted to evaluate the impact on clinical reasoning during anaesthesiology residency training based on a PEG tutored by a senior anaesthesiologist. Changes in clinical reasoning applied to anaesthesia practices during uncertain adult general surgery or obstetric situations were assessed by using a panel of tools, including the script concordance test (SCT).

2. Material and methods

Residents in the anaesthesiology training program at Rouen University were invited to participate as subjects in the study. This prospective study took place over an 18-month period from May 2009 to November 2010 and consisted of two stages. The first stage was the development of a 6-month resident curriculum by a panel of academic and staff anaesthesiologists for uncertain situations with the establishment of educational objectives and assessment tools. The Ethics and Evaluation Committee for Non-Interventional Research at the Rouen University Hospital approved the study. All participants received information before any study procedures were undertaken. Afterwards, residents in the anaesthesiology training program were invited to willingly participate as subjects in the study.

These new educational objectives were given to all residents at the beginning of their 6-month rotation in our institution. Two resident groups were included 6 months apart without randomization. The first group was the control group and consisted of residents undergoing their 6-month rotation without PEG training. The second study group (PEG group) consisted of the residents starting their new rotation in our institution 6 months later and who underwent a weekly PEG session. In both groups, at the end of the training period, each resident had clinical reasoning assessed in the same formal manner, which consisted in a SCT, multiple-choice questions (MCQs) and short-answer questions. A MCQ was a question in which residents were asked to select the best possible answers out of the 5 choices from a list. The short-answer questions were about a clinical case realistically approaching situations that were experienced by residents.

The primary outcome measurement in this study was the resident performance as measured by the SCT with and without weekly PEG sessions. Secondary outcomes were the impact of this new program on the MCQs and short-answer questions.

2.1. Learning objectives

A panel of academic and staff anaesthesiologists, including three academics and 20 staff anaesthesiologists, all involved in uncertain anaesthesia and critical care for adult general surgery and/or obstetrics at the Department of Anaesthesia and Critical Care of Rouen University Hospital and the Dieppe General Hospital, was established. They were interviewed openly based on pedagogic and knowledge goals linked with residency training for anaesthesia and critical care in emergency situations. Objectives were then synthesized and transmitted to all participating residents.

2.2. Establishment of a tutored PEG

Each week in the PEG group, anaesthesia residents met at the University Hospital for 90 min under the supervision of a senior academic teacher. Four residents individually presented an anaesthetic situation they had to deal with during a recent uncertain anaesthesia period (2 obstetric cases and 2 adult uncertain surgery cases per week) to their peers. These cases represented either situations linked to difficulties associated with intensive care or came from daily practice. Following case presentation, there was an open discussion and the residents compared their practices. At the end of the exchange, the senior anaesthesiologist helped when necessary to reach a final joint consensus with the approval of the entire group. The senior teacher routinely insisted on the importance of clinical reasoning based on a single diagnostic decisional tree (in order of probability), additional examinations to be performed and medical care according to the degree of severity. In addition, a review of physiology and physiopathology was performed by the group.

2.3. Assessment of clinical reasoning

The same SCT was used as the main evaluation tool at the end of the 6-month training period for the control and PEG groups. The SCT confronted the residents with authentic uncertain clinical situations which were described in vignettes, each of them corresponding to one of the previously set objectives. The clinical situations were problematic even for experienced clinicians, either because there were not enough data or because situations were ambiguous. There were several options for diagnosis, investigation or treatment. The items (questions) were based on a panel of questions that an experienced clinician would consider relevant to this type of clinical setting. The item was consistent with the presentation of relevant options and new data (not described in the vignette). The task for the student consisted in determining the effect this new data had on the status of the option. An example of items from the therapeutic section of the test is illustrated in Table 1.

The SCT included 15 vignettes describing clinical situations that residents could be confronted with. Each vignette included three items. The first item either included a diagnostic hypothesis, plan for investigation or a treatment recommendation (Table 1). Then, new information (a sign, a symptom or a result of investigation) was presented. The resident's task was to assess, using a 5-point Likert scale, the influence of this new element on the diagnostic hypothesis, the plan for investigation or the treatment. The different points on the scale corresponded to positive values (the option was enhanced by the new data), neutral ones (the data did not change the status of the option) or negative ones (this option was ruled out by the data).

The scoring system was based on the principle that any answer given by one expert had an intrinsic value, even if that answer did

Table 1
Example of a script concordance test (SCT) applied to the case of a 20-year-old female patient admitted for a laparoscopic appendectomy for whom anaesthesia must be induced.

If you were considering doing	And then you find	The effect on the relevance of this treatment becomes
Preoperative nasogastric tube	Fasting for 6 hours	−2 −1 0 +1 +2
Rapid sequence induction	No preoperative nausea and vomiting	−2 −1 0 +1 +2
Intravenous midazolam premedication	Preoperative anxiety	−2 −1 0 +1 +2

−2: contra-indicated totally or almost totally; −1: not useful or even detrimental; 0: neutral; +1: useful; +2: necessary or absolutely necessary.

Please cite this article in press as: Compère V, et al. Residents in tutored practice exchange groups have better medical reasoning as measured by the script concordance test: A pilot study. Anaesth Crit Care Pain Med (2015), http://dx.doi.org/10.1016/j.accpm.2014.12.001

not coincide with those of other experts [6]. In the present study, the group of anaesthesiologist practitioners formed the expert panel. The principles of SCT have previously been summarized by Gibot and Bollaert [7]: for each item, the answer entitled the resident to a credit corresponding to the number of experts who had chosen it. All items had the same maximum credit, and raw scores were transformed proportionally to obtain a one-point credit for the answer that was chosen by most experts. Other choices received a partial credit. Thus, to calculate the scores, all results were divided by the number of individuals who had given answers chosen by the largest number of respondents. The total score for the test was the sum of all credits earned for each item. The total score was then transformed into a percentage score. Automatic correction software was used for scoring (available at http://www.cme.umontreal.ca/tcs; September 2009).

Moreover, assessment at the end of the 6-month training period for the control and PEG groups also included the same formal evaluation of well-defined clinical situations, based on the same real life uncertain clinical situations as for the SCT. This was achieved by the same 25 MCQ tests and one clinical case. Items on physiology, physiopathology as well as on existent current frames of reference were included in the MCQs (for example, guidelines about rapid sequence induction, local anaesthetic pharmacology, definition of preeclampsia). The clinical case included ten essay questions with short answers, each scored on 10 points, on a case of multiple injury trauma management with hemorrhagic shock.

2.4. Statistics

SCT performances were expressed as a degree of concordance with the panel. The MCQ tests and short-answer questions were scored on a maximum of 100 points each. The results are expressed as means, with 95% confidence intervals. The comparison between the two groups (primary, secondary outcomes and the number of students for each year) was conducted using a nonparametric Mann-Whitney test. Finally, the reliability of the script concordance tests was assessed using the Cronbach's alpha coefficient of internal reliability. It is a coefficient that is used to rate the internal consistency (homogeneity) or the correlation of the items in a test. Most measurement experts agree that a test with strong internal consistency will have moderate correlation among items (Cronbach's alpha of 0.7 to 0.9) and excellent internal consistency when the coefficient is superior to 0.9.

Our work is a pilot study investigating for the first time the impact of PEG on uncertain reasoning. Therefore, we did not perform *a priori* power calculations for sample sizes. Statistics were performed using GraphPad Prism® (GraphPad Software, La Jolla, CA). The Cronbach's alpha coefficient of internal reliability was scored at http://www.cme.umontreal.ca/tcs.

3. Results

3.1. Formulation of objectives

Three academic and 20 staff anaesthesiologists were involved in the panel responsible for the definition of resident learning objectives, listed in Appendices 1 and 2. Some objectives appeared in all records made by the trainers (for example: management of epidural analgesia, management of a caesarean section under general anaesthesia, management of postpartum haemorrhage or eclampsia, management of anaesthesia in shock patients at-risk of aspiration). Other objectives were expressed only once in the records (for example: fetal distress and neonate intensive care, prophylactic antibiotics, hemodynamic monitoring).

3.2. Assessment

Seventeen residents were present for the control group (five, four, six and two residents in their second, third, fourth and fifth years of residency, respectively) and 19 for the PEG group (seven, six, four and two residents in their second, third, fourth and fifth years of residency, respectively). Distribution by year of residency training was similar between both groups.

3.3. Script concordance tests

The Cronbach's alpha coefficient of internal consistency was 0.82. The group that underwent PEG performed better in the SCT than the control group (Table 2).

3.4. MCQ and Clinical Cases

For MCQs, the Cronbach's alpha coefficient of internal consistency was 0.87. The performance in MCQs and clinical cases was significantly better in the PEG group than in the control group (Table 2).

4. Discussion

This study showed that residents who completed their rotation after the implementation of a PEG performed better than those who did not, as measured by script concordance tests. The performance in MCQs and clinical cases was also better in the group that completed the training program including a PEG. An important limitation of our study was the absence of randomization and the presence of historic control group. Many confounding variables may have impacted resident learning processes during this study. Residents learn continuously and improve during their training. Moreover, the instructors, over the course of the many encounters they had with the residents, might have influenced them and given them their answers to the clinical scenario on the exam. We can postulate that the impact of these confounding parameters may be found to be equally distributed among the observed scores of the three tests. In fact, better SCT scores, observed after 6 months of PEG training, has now been added to our anaesthesiology residency training and may reflect a gain in clinical practice over this period. No changes other than PEG training have been introduced into the residency program and the PEG is the most likely factor accounting for the increase in the SCT scores we reported. The confounding factors were probably equally distributed in both groups. Another limitation of our study was that it took place in a single centre and involved the participation of a limited number of residents. In addition, there was no pre-test, and this should be considered in the design of future studies. This work suggests that the clinical reasoning of residents faced with uncertain situations can be improved by setting up tutored PEGs. Moreover, this pedagogic approach in the field of anaesthesia could lead to improved learning of declarative knowledge related to

Table 2
Resident scores on SCTs, MCQs and clinical cases.

	Control group	PEG group	*P*
SCT	60% [57 to 63]	72% [68 to 76]	<0.001
MCQ	32% [28 to 36]	64% [57 to 71]	<0.001
Short answers	60% [52 to 68]	74% [68 to 72]	<0.01

SCT: script concordance test; MCQ: multiple-choice questions; PEG: practice exchange group. The performance on SCTs was expressed as the degree (%) of concordance with the panel. The MCQ test and editorial in clinical cases were scored on a maximum of 100 points each. The results are expressed as means [95% confidence interval].

Please cite this article in press as: Compère V, et al. Residents in tutored practice exchange groups have better medical reasoning as measured by the script concordance test: A pilot study. Anaesth Crit Care Pain Med (2015), http://dx.doi.org/10.1016/j.accpm.2014.12.001

well-defined clinical problems because implementation of PEGs also improved their MCQs as well as their short answers scores.

"Acting in uncertain situations, making decisions in an uncertainty environment" is the formula that is used regarding the teaching of complex professional tasks [8] and it may in fact define the work of anaesthesiologists in uncertain situations. These situations are difficult to manage in real time, even for an experienced practitioner because all appropriate means for anaesthetic management must be considered. This difficulty raises the critical issue of the initial training of residents who are confronted with such uncertain situations. This study suggests that the establishment of a PEG could improve resident clinical reasoning performances as measured by SCTs in these situations. In fact, this particular form of interactive teaching allows residents to play a direct role, not only in their education but also, in the training of other learners actively participating in discussions between peers [1]. It has been shown that when the resident was placed in a teaching position, there was an improvement of clinical skills and clinical reasoning [9–11]. The concept of a PEG has previously been used in anaesthesia-intensive care to teach ethical reasoning applied to the training of residents [12]. These authors reported that the perception of the benefit of the teaching sessions, assessed using a structured questionnaire, was high (always $\geq$ 8/10), indicating that the learning sessions were considered as an educational process which helped deal with ethical issues relevant to the practice of anaesthesia and critical care. These discussion groups also encouraged a dialogue between residents. The groups also favourably assessed the work in small units, the quality of references and the acquisition of concepts that are the basis of medical ethics.

In a specialty where the constant concern is to ensure patient safety, other training and evaluation tools for residents concerning the management of at-risk situations have previously been assessed. For example, simulation appears as a discriminating and valid tool to evaluate the performance of residents in critical situations [13,14]. However, this approach has the main disadvantage of being very costly not only financially but also in terms of human resources. Another method of clinical teaching, based on problem solving, could be used. This approach is different from the PEG. While a PEG consists of same speciality physicians who review patient cases extracted from their daily practice in order to compare methods, problem-based learning is an artificial scenario built around specific pedagogical items. The problem is designed to formulate hypotheses and then, the student has to work different objectives. The problem-based learning method has now been developed for residents [15,16] and Yazigi et al. [17] reported interesting results in the field of anaesthesia. Not only learners but also tutors found a positive educational benefit from this training method. However, the real impact on knowledge acquisition and thinking among residents, as well as the development of their clinical competence, were not studied in depth.

The evaluation of clinical reasoning under uncertainty has been conducted using SCTs [18,19]. In medical intensive care, Gibot et al. [7] showed that a SCT given at the beginning of a session could identify students who perform poorly in terms of clinical reasoning. However, when given at the end of the session this could provide the means to assess progress. In our study, we used this test to assess clinical reasoning in anaesthesia. The score before establishing the PEG was comparable to that found for medical intensive care residents (between 60 and 65%) [7]. The 0.82-value on the Cronbach α test was considered an acceptable measure of the reliability of our SCT. Indeed, it is usually advised to obtain a ratio over or equal to 0.80 for certifying examinations [18]. However, although the SCT can assess reasoning and clinical expertise in a simple and reproducible way, this technique has certain limits. The choice of experts can be problematic and must be performed consistently, considering the competences to be assessed. In the present study, the panel of academic and staff anaesthesiologists was involved in uncertain anaesthesia and critical care for adult general surgery and/or obstetrics. It is understood that the SCT, being a written examination, does not, for example, assess all areas of clinical competence such as data collecting skills required during patient interviews or physical examinations. Yet, interestingly, we have found better results in declarative knowledge in the PEG group compared with the control group. Could it be that better SCT scores reflect better declarative knowledge, rather than an improvement in medical reasoning? In other words, is it possible that the control group residents did not have the declarative knowledge necessary to solve the SCT?

Fournier et al. [20] compared results based on the SCT and MCQ by using several populations of uncertain physicians of different levels of experience. They observed that most experienced physicians received better scores than residents. Moreover, scores obtained in the SCT and MCQs varied proportionally but without any significant correlation. This finding indicates that MCQs and the SCT explore two distinct but complementary aspects of competence in clinical reasoning. In our study, MCQ and open question scores were greater in the group that received PEG training. For open questions, the scores were still high in the control group. This observation is very similar to those experienced in real life and appealed to well-known repositories therefore leading to solutions (i.e. care of a patient with preeclampsia). This result illustrates that our resident group had a high degree of knowledge and clinical reasoning in uncertain medical situations and therefore was able to achieve higher scores. These results also suggest that the PEG led to better results in the field of declarative knowledge, which is knowing "what" as opposed to procedural knowledge, which is knowing "how", related to well-defined clinical problems.

In conclusion, this pilot study suggests that an expert-directed, peer-conducted educational intervention may improve the clinical reasoning of anaesthesia residents as measured by a SCT. Moreover, this pedagogical approach in anaesthesia could be a useful tool in the learning of declarative knowledge related to well-defined clinical problems. Further, controlled, randomized studies are warranted to determine whether the tutored PEG in fact improves clinical reasoning.

Disclosure of interest

The authors declare that they have no conflicts of interest concerning this article.

Acknowledgement

The authors are grateful to Richard Medeiros, the Rouen University Hospital Medical Editor, for editing the manuscript.

Funding: authors have received no funding from any source.

Appendix 1. Learning objectives in anaesthesia for adult general surgery

At the end of the session, the student should be able to:

- preoperatively evaluate a patient for uncertain surgery;
- perform anaesthesia for a patient with risk of pulmonary aspiration;
- perform anaesthesia for a patient in shock;
- manage multiple injury trauma;
- manage a multi-organ donor;
- manage the anaesthesia and critical care of:
  - aortic aneurysms,
  - abdominal surgery,
  - neurosurgery;

Please cite this article in press as: Compère V, et al. Residents in tutored practice exchange groups have better medical reasoning as measured by the script concordance test: A pilot study. Anaesth Crit Care Pain Med (2015), http://dx.doi.org/10.1016/j.accpm.2014.12.001

- perform a rapid induction sequence as well as standard induction and intubation techniques;
- assist in the supervision of patient recovery from anaesthesia;
- perform cardiopulmonary resuscitation (CPR) and advanced cardiac life support procedures;
- know antibioprophylaxis guidelines;
- perform peripheral and perimedular blocks;
- conduct a haemodynamic evaluation;
- manage bleeding during surgery.

Appendix 2. Learning objectives in anaesthesia for obstetrics

At the end of the session, the student should be able to:

- describe the physiological and pharmacological changes in pregnancy;
- perform a perimedullar block;
- manage anaesthesia during caesarean delivery;
- perform general anaesthesia for the parturient in both the non-emergent and emergent settings for vaginal delivery;
- discuss the obstetrical considerations/management of labour complications in breech delivery, cord prolapse, transverse lie, multiple gestation, brow presentation, premature rupture of membranes, and premature delivery;
- manage maternal haemorrhage;
- manage parturients with preeclampsia/eclampsia;
- manage foetal/neonatal distress;
- know the antibioprophylaxis guidelines;
- manage uncertain gynaecologic surgery.

References

[1] Walker-Bartnick LA, Berger JH, Kappelman MM. A model for peer tutoring in the medical school setting. J Med Educ 1984;59:309–15.
[2] Busari J, Scherpbier A. Why residents should teach: a literature review. J Postgrad Med 2004;50:205–10.
[3] Haute Autorité de Santé. Le groupe d'analyse des pratiques entre pairs - « Peer preview ». Paris: HAS; 2006, http://www.has-sante.fr.
[4] Cohendet C, Jacot P, Arnould M. Groupe de pairs : l'évaluation et la formation professionnelle au diapason de l'EBM. EBM 2003;34:1–2.
[5] Secomb J. A systematic review of peer teaching and learning in clinical education. J Clin Nurs 2008;17:703–16.
[6] Charlin B, Boshuizen HP, Custers EJ, Feltovich PJ. Scripts and clinical reasoning. Med Educ 2007;41:1178–84.
[7] Gibot S, Bollaert PE. Le test de concordance de script comme outil d'évaluation formative en réanimation médicale. Pedagogie Med 2008;9:7–18.
[8] Perrenoud P. Enseigner : agir dans l'urgence, décider dans l'incertitude. Savoirs et compétences dans un métier complexe. Paris: ESF; 1996.
[9] Sheets KJ, Hankin FM, Schwenk TL. Preparing surgery house officers for their teaching role. Am J Surg 1991;161:443–9.
[10] Minor S, Poenaru D. The in-house education of clinical clerks in surgery and the role of housestaff. Am J Surg 2002;184:471–5.
[11] Pelletier M, Belliveau P. Role of surgical residents in undergraduate surgical education. Can J Surg 1999;42:451–6.
[12] Yazigi A, Madi-Jebara S, Yazbeck P. Les séances d'apprentissage du raisonnement éthique appliquées à la formation des résidents en anesthésie-réanimation. Pedagogie Med 2007;8:177–83.
[13] Lebuffe G, Plateau S, Tytgat H, Vallet B, Scherpereel P. Interest of mannequin based simulator to evaluate anaesthesia residents. Ann Fr Anesth Reanim 2005;24:260–9.
[14] Gaba DM, Howard SK, Flanagan B, Smith BE, Fish KJ, Botney R. Assessment of clinical performance during simulated crises using both technical and behavioral ratings. Anaesthesiology 1998;89:8–18.
[15] Chamberland M. Clinical reasoning learning (CRL) sessions. An example of a contextualized teaching activity adapted to clinical stages in medicine. Ann Med Interne (Paris) 1998;149:479–84.
[16] Philp EB, Parker P, Rubin N, Tietze PH, Philp JR. The difficult patient: creation of a curriculum by third-year family practice residents. Fam Med 1996;28:553–8.
[17] Yazigi A, Nemr E, Abou Jaoudé S, Antakly M. L'apprentissage par la méthode des cas appliqués à la formation des résidents en anesthésie-réanimation. Pedagogie Med 2002;3:232–326.
[18] Marie I, Sibert L, Roussel F, Hellot MF, Lechevallier J, Weber J. The script concordance test: a new evaluation method of both clinical reasoning and skills in internal medicine. Rev Med Interne 2005;26:501–7.
[19] Carriere B, Gagnon R, Charlin B, Downing S, Bordage G. Assessing clinical reasoning in pediatric uncertain medicine: validity evidence for a Script Concordance Test. Ann Emerg Med 2009;53:647–52.
[20] Fournier JP, Thiercelin D, Pulcine C, et al. Évaluation du raisonnement clinique en médecine d'urgence: les tests de concordance des scripts décèlent mieux l'expérience clinique que les questions à choix multiples à contexte riche. Pedagogie Med 2006;1:20–30.

Please cite this article in press as: Compère V, et al. Residents in tutored practice exchange groups have better medical reasoning as measured by the script concordance test: A pilot study. Anaesth Crit Care Pain Med (2015), http://dx.doi.org/10.1016/j.accpm.2014.12.001