Effectiveness of a training on the recognition of subtle facial emotions in health and social workers

Efficacia di un training sul riconoscimento delle emozioni facciali impercettibili negli operatori sanitari e sociali

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SUMMARY. Purpose. This study analyzed the effectiveness of a training course on the recognition of subtle facial emotions in health and social workers, especially those who work in contact with difficult and aggressive patients in psychiatric wards and emergency departments. **Methods**. A total of 177 health and social workers were involved in the training course (138 females and 39 men, mean age was 53.3 years). The training was implemented in three different editions of the course (a three day course each) on the prevention and management of violence and the learning achieved has been evaluated in each edition. During the second and third day of training, 14 photographs from the Ekman SETT Test, representing the seven universal emotions (anger, fear, sadness, disgust, contempt, surprise, happiness), were administered to all participants. Participants selected the emotion demonstrated in each photograph on a response sheet. Differences in the answers between these two days were tested. **Results.** The participants in the three editions showed a statistically significant improvement in the subtle facial emotion expressions recognition ability. Female health and social workers recognized significantly better facial emotion expressions than their colleagues (difference in the two days for the emotions= 0,205; p=0.006). Considering the professional qualifications, physicians have shown less ability in recognizing facial expression of anger, compared to nurses and other health and social workers (difference in the scores for anger of the third and the second day= 0.213; p=0.024). **Discussion and conclusions.** The study showed that the ability to recognize subtle facial expressions of emotions can be trained. The skills acquired during the training can be used to enhance communication with patients, especially with difficult and aggressive ones and their family members in emergency and psychiatric settings. The course on prevention and management of violence should possibly include training on the recognition of subtle facial emotions.

KEY WORDS: training, subtle facial emotions, emotion recognition, aggression, violence, healthcare and social workers.

RIASSUNTO. Scopo. Lo studio ha analizzato l'efficacia di un training sul riconoscimento delle emozioni facciali impercettibili negli operatori sanitari e sociali, soprattutto quelli a contatto con pazienti difficili e aggressivi. **Metodi.** 177 operatori sanitari e sociali (138 donne e 39 uomini, età media 53,3 anni) hanno partecipato al corso. Il training è stato implementato in tre diverse edizioni del corso (un corso di tre giorni ciascuno) sulla prevenzione e gestione della violenza e l'apprendimento è stato valutato in ogni edizione. Durante il secondo e il terzo giorno del corso, 14 fotografie del Test SETT di Ekman, che rappresentano le sette emozioni universali (rabbia, paura, tristezza, disgusto, disprezzo, sorpresa, gioia), sono state presentate ai partecipanti. Gli operatori hanno selezionato l'emozione mostrata in ogni fotografia su un foglio di risposta. Le differenze nelle risposte tra i due giorni sono state valutate. **Risultati.** I partecipanti alle tre edizioni del corso hanno mostrato un miglioramento significativo nel riconoscimento delle emozioni facciali impercettibili. Le operatrici sanitarie e sociali hanno mostrato un maggiore riconoscimento delle espressioni delle emozioni rispetto ai loro colleghi (differenza tra i due giorni per le emozioni= 0,205; p=0,006). In merito alla qualifica professionale, i medici hanno dimostrato un minore riconoscimento della rabbia, rispetto agli infermieri e agli altri operatori sanitari e sociali, una differenza nei punteggi per la rabbia tra il terzo e il secondo giorno= 0,213 (p=0,024). **Discussione e conclusioni.** Lo studio ha dimostrato che il riconoscimento delle emozioni facciali impercettibili può essere insegnato. Le abilità apprese possono essere utilizzate per migliorare la comunicazione con i pazienti, specialmente con quelli aggressivi e i loro familiari. Il corso sulla prevenzione e gestione della violenza dovrebbe includere un training sul riconoscimento delle microespressioni delle emozioni.

PAROLE CHIAVE: training, espressioni facciali impercettibili, riconoscimento delle emozioni, aggressioni, violenza, operatori sanitari e sociali.

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INTRODUCTION

Recognizing facial emotion expressions is essential in the relationship with patients and in preventing aggressive behavior in patients and their family members. Several studies have shown that there is an improvement in terms of treatment quality, treatment compliance, and treatment outcome, when physicians are able to recognize patient's emotions. Also patient's satisfaction is significantly improved[1,2].

Paul Ekman, in his article "Emotions revealed: recognition facial expressions" stated that recognizing patient's facial expressions, including micro-expressions, can be useful in the doctor-patient relationship[3].

This is fundamental, especially in the therapist-patient relationship, because in this scenario the relationship represents one of, if not the most important, therapeutic tool. On the other hand, an inaccurate or incorrect interpretation of facial expressions may cause interpersonal and social conflicts[4] and over time it may even deteriorate the quality of the relationship[5,6]. In addition, in some situations, such as episodes of agitation and violence, understanding patient's emotions is essential[7].

Recognizing emotions through facial expressions is considered an important source of emotional information[8] and more accurate than other sources of expressive information[9]. Moreover, the ability to decipher emotions on people's faces is considered one of the most important component of emotional intelligence. Previous studies have focused on teaching the recognition of facial emotion expressions to medical students[10,11]. Ragsdale et al.[12] noted that physicians and medical students can learn how to recognize subtle facial emotion expressions and how to use this skill in the context of patient care after a short training. In recent years, the recognition of facial emotions has become a research object and a clinical central topic in psychiatry[13,14]. In fact the accurate recognition of emotions is one of the main skills required for mental health professionals to carry out the care and treatment of patients. Dalkiran et al. carried out the first researches on the ability to recognize facial emotions in psychiatrists with psychotherapeutic or psychopharmacological training[13,14].

The authors noted that psychiatrists with a psychotherapeutic approach were more accurate in recognizing facial emotions of sadness, if compared to psychiatrists with psychopharmacological training. Empathy is an essential factor for success in psychotherapy[15] and neuroimaging studies have shown that empathy is associated with the ability to recognize emotions[7]. Psychotherapists who are able to recognize emotional signals can achieve a higher quality doctor-patient relationship, a greater adherence to follow-up from the patient, a more accurate diagnosis and a more precise identification of the patient's emotions without experiencing excessive empathy and its consequences[16]. According to Gultekin et al., the improvement of facial expressions recognition skills can be useful to reduce the conflicts between patients and healthcare workers[17].

Emotions include micro expressions and mini expressions. Micro-expressions occur only for a short time and usually last for around 1/25 of a second[18]. Their brevity is such that most observers fail to perceive them, although their recognition can be improved by training in the decoding of facial expressions. Subtle expressions are low intensity emotional expressions that occur when a person is starting to feel an emo-

tion, when the emotional response is of low intensity and when people are trying to suppress or hide their emotions, but they're not able to do it completely.

Emotions may involve even just a part of the face such as eyebrows, eyelids, cheeks, nose, lips or chin and are also known as partial expressions[19]. While the recognition of micro-expressions is based on the perception of a total expression of the emotion which, however, manifests itself for a short period of time, the identification of subtle expressions requires the recognition of an emotion from partial cues. These expressions are often the most important ones, since they can tell us what is not *yet* being said in words or may not ever be said[20]. Furthermore, some scientists found out that women had a better ability to recognize facial expressions (both basic emotions[21-24] and more complex ones[25]) compared to men.

Although the ability to recognize facial expressions is considered important in the doctor-patient relationship[26], there is no specific training during the degree course for physicians, including psychiatrists, on topics such as non-verbal communication skills and recognition of patients' emotions, collection of medical reports, how to explain the medical intervention to a patient and on how to deliver bad news[2,27]. If the patient becomes aggressive, de-escalation techniques are a recommended non-physical intervention for the management of violence and aggression in mental health settings[28-30].

We are not aware of studies that have evaluated a training in the recognition of subtle facial emotions in health and social workers. In 2019, the Local Health Unit Roma 2 organized a training for health and social workers with the aim to improve the ability to recognize facial expressions related to the seven universal facial expressions and to those partially hidden. The study wanted to investigate whether skills, such as recognition of subtle facial emotions, could be taught to health and social workers. The hypothesis of the present study is that the Sett test improves subtle expression reading skills. The skills acquired during the training, should be used to enhance communication with patients, especially with difficult and aggressive ones and their family members.

METHODS

Participants

177 health and social workers (138 females and 39 men, mean age was 53.3 years) participated in three different editions of the training course (a three day course each) on the prevention and management of violence. 138 (78%) of them were women and 39 (22%) were men. Of the participants, 112 (63.3%) were nurses, 31 (17.5%) were physicians and 34 (19.2%) belonging to other health and social workers (psychologists, medical radiology technicians, occupational therapists, professional educators, social workers).

Socio-demographic variables of the participants are illustrated in Table 1.

The health and social workers were trained to recognize mild, partial or concealed anger and early signs of aggressive behavior. The skills acquired during the training should be used to enhance communication with patients, who have the potential to become

angry and assaultive, or those who have already become violent. This research has not included a control group.

The training course was carried out in three editions, of a three-day course (May, June and October 2019) and the learning achieved has been evaluated in each edition. A set of 14 photographs from Ekman SETT Test were shown to the participants in the second day and again after 5-7 days in the last day of the training course. This was approved by the Local Ethics Committee (ref. 4991/2018).

Instrument

The Ekman SETT (Subtle Expression Training Tool)[20] is designed to improve recognition of subtle expressions of emotion. This comprises 37 photographs of the same Caucasian girl with happiness, surprise, fear, anger, sadness, disgust and contempt facial expressions. While the original Ekman test has a Cronbach alpha value of 0.62, in our experience we found a value of 0.72.

Procedure

During the training participants individually completed pre- and post-assessment. In the pre-assessment, subjects viewed fourteen black and white photographs on slides, representing one of the seven universal emotions (anger, fear, sadness, disgust, contempt, surprise, happiness) expressed by the same model, to avoid inattention. Each worker was given a sheet of paper with lines numbered from 1 to 14. At the top of the paper the seven universal emotions were reported. The health and social workers were able to look one photo at a time for a few seconds, because during a regular conversation emotions last from half a second to four seconds maximum. Participants selected the emotion demonstrated in each photograph on a response sheet. On completion of the pre-assessment a score, expressed as percentage correct, was assigned and recorded. The trainer explained to the participants how to recognize facial expressions of emotions through differences and similarities in the regions of the eyes, nose and mouth. The post-assessment followed the same procedure as the pre-assessment and again a score was recorded.

The study was carried out in compliance with the ethical standards required for research with human beings, respecting the basic principles included in the Declaration of Helsinki and has been approved by the Local Ethics Committee (ref. 4991/2018). Participation in the training and in its evaluation was voluntary. They provided consent via participation in the evaluation.

The procedure for the selection of study participants included health and social workers from the Emergency area in contact with difficult and aggressive patients and their families.

Statistical analysis

The descriptive analysis has provided the frequency tables indicating the absolute values and the rates for the qualitative variables. It also provided the mean and the standard deviation for the quantitative variables.

The McNemar test was used in relation to the differences between the answers for each item considered between the second and the third day of the course. In addition, a score was created for the variables anger (items 5, 8, 9, 11, 13) and emotions (all the other variables). This score was the sum of the single score for each item, and finally a difference in the scores of the third and the second day (delta) was calculated for anger and emotions. Finally, a multivariate analysis was conducted with two models of multiple linear regression in which the dependent variables were the delta score of emotions and the delta score of the item anger, indicating with positive values an improvement in recognition skills. In these models, the explicative variables were age, gender (female vs male), profession (physicians and nurses vs other health and social workers), training edition number (second and third vs first). The godness of the model was evaluated through the R^2 coefficient.

The significance level was set at $p<0.05$. All statistical analyses were conducted with the Statistical Package for Social Sciences for Windows (SPSS) release 25.0.

Table 1. Socio-demographic variables of the participants.

Variable	N (%) or mean (DS)
Gender	
Females	138 (78)
Male	39 (22)
Age	53.3 (8.0)
Professional Qualification	
Physicians	31 (17.5)
Nurses	112 (63.3)
Other health and social workers	34 (19.2)

RESULTS

The ability of recognizing subtle facial emotion expressions among the participants of the three editions of the training between day 2 (before training) and 3 (after training) showed some significant differences.

Anger:
- the recognition of controlled and dissimulated anger had a significant increase for item 5-anger (very controlled anger, or very mild, with a slight contraction and thinning of the lips);
- for item 8-anger (very controlled anger, with lowered eyebrows and tight lower eyelids);
- for item 9-anger (dissimulated anger (the person seems happy because of the smiling lips, but the eyebrows do not overlap with any expression of happy);
- for item 11-anger (controlled anger, with tight eyelids);
- for item 13-anger (controlled anger, with slightly strained lower eyelids and stretched jaw) respectively from 18.6% to 78%, from 59.9% to 86.4%, from 3.4% to 75.1%, from 25.4% to 73.4% from 81.9% to 93.2%.

Sadness:
- item 1-sadness (expressed by a foggy look and the lowering of the upper eyelid);
- item 3-sadness (expressed by bending oral commissures downwards) showed significant accuracy rates, respectively from 69.2% to 84% and from 24.9% to 63.8%. Regarding the emotion of fear, the rates of item 6-fear (controlled fear, with tight lips) and item 12-fear (controlled fear, with raised and converging eyebrows) increased re-

Effectiveness of a training on the recognition of subtle facial emotions in health and social workers

spectively from 7.9% to 70.1% and from 18.1% to 56.5%. *Disgust*:

- the rates of item 2-disgust (represented by narrow eyes) increased from 24.9% to 46.3%;
- item 7-disgust (represented by the raised upper lip) increased from 6.2% to 40.7%.

Finally, the rate of item 14-contempt (expressed by the contraction of one mouth angle) increased from 45,8% to 71.2%. The reported rates are all significant (p<0.05), except for the item 4-happiness (the corners of the mouth are slightly raised) and the item 10-fear or surprise (only raised upper eyelids), emotions recognized by most participants already before the start of training. The rates of accuracy of all participants in terms of recognition of facial emotion expressions are presented (Table 2).

In relation to gender, female health and social workers were more able to recognizing facial emotion expressions compared to male workers (delta emotions= 0.205; p=0.006).

Among the seven universal emotions, the emotion of anger mainly reached the highest rate of recognition in both sexes.

Physicians have shown less ability in recognizing facial expression of anger than nurses and other health and social workers (delta anger= -0.213; p=0.024). The health and social workers who participated in the II edition recognized the facial expressions of anger less than those who participated in the I and III edition (delta anger= -0.183; p=0.020).

Finally, there was a positive correlation in health and social workers between the work experience and the recognition of anger faces (delta anger= 0.182; p=0.022).

The results of the multiple regression analyses are showed in Table 3.

Table 3. Results of multiple linear regression analysis.

Variable	Delta emotions	Delta anger
	β (p)	β (p)
Age	0.064 (0.417)	0.182 (0.022)
Female Gender	0.205 (0.006)	0.082 (0.264)
Professional Qualification		
Physicians	-0.139 (0.139)	-0.213 (0.024)
Nurses	0.058 (0.537)	0.019 (0.835)
Editions		
2nd	-0.143 (0.07)	-0.183 (0.020)
3rd	-0.113 (0.153)	0.063 (0.428)
R^2	0.101	0.104

DISCUSSION AND CONCLUSIONS

All participants in the three editions of the training course showed a statistically significant increased rate in the ability of recognizing all facial emotions after adequate training, except for item 4-happiness and item 10-fear, which have been identified before the training started without any problem, since these emotions are clear and well identifiable. After the training, the highest rate of facial expression recognition was anger, without any gender difference. Other studies have shown that males are more accurate than females in recognizing facial expression of anger[31,32]. Moreover, in our study a positive correlation was observed between the length of service and the ability to recognize the facial expression of anger. This result is in agreement with the studies of Gultekin et al.[17]. Considering professional qualifications, physicians showed less accuracy in anger recognition, if compared to nurses and other health and social workers, probably due to the fact that most nurses are females.

The participants of the second edition also showed a lower recognition af anger, if compared to those of the first and third editions, and this can be attributed to different compositions of the groups. However, female health and social workers showed more skill in recognizing subtle facial emotion expressions compared to male workers. These results are in agreement with previous studies[21-24] and with the literature on empathy which states that women have more empathy than men[22,25]. All participants showed a significant accuracy rate in the recognition of fear at the end of the training. Tse et al.[33] stated that it may sometimes be difficult to recognize fear which is often confused with surprise. A recent study indicates underlying connections among six basic emotions, which might explain the recognition confusion[34]. Likewise, Gultekin et al.[17] confirmed a lower accuracy rate of recognizing fear in nurses.

As reported by many authors, recognizing subtle facial emotions is important for healthcare workers, especially for those exposed to the risk of aggressive behaviour, such as in psychiatric wards and emergency department. Staff training is considered among the best strategies that can be taken to mitigate the risk of violence toward health care workers and to understand the risk of aggression[35,36], and there is evidence of increased confidence, improved attitude, skills, and

Table 2. Recognition of emotions, differences between day 2 and 3 during the three Editions of the course.

Item	Day 2	Day 3	P
Item 1 - sadness	69.2%	84%	0.002
Item 3 - sadness	24.9%	63.8%	<0.001
Item 2 - disgust	24.9%	46.3%	<0.001
Item 7 - disgust	6.2%	40.7%	<0.001
Item 4 - happiness	69.5%	71.8%	0.720
Item 5 - anger	18.6%	78%	<0.001
Item 8 - anger	59.9%	86.4%	<0.001
Item 9 - anger	3.4%	75.1%	<0.001
Item 11 - anger	25.4%	73.4%	<0.001
Item 13 - anger	81.9%	93.2%	<0.001
Item 6 - fear	7.9%	70.1%	<0.001
Item 10 - fear or surprise	63.3%	62.1%	0.901
Item 12 - fear	18.1%	56.5%	<0.001
Item 14 - contempt	45.8%	71.2%	<0.001

knowledge on risk factors after the training[37]. These factors are of particular interest, since evidence suggest these situations can affect health workers' performance[38].

Currently, opportunities to learn how to identify facial emotion expressions for health and social workers are limited[39,40]. This training course provided a free opportunity for physicians, nurses and other health and social workers in contact with patients of Local Health Unit Roma 2 to develop this ability in a short period of time. Photographs for subtle facial expression recognition have been rigorously selected by Ekman's Subtle Expression Training Tool (SETT). SETT has already been used to improve subtle expression reading skills in medical students[41].

The study has its limits. First, the sample is quite small, and the training should be replicated with a larger sample.

Second, the training was carried out only for health and social workers of Local Health Unit Roma 2 and it would be useful to propose it for workers of other companies with the aim to compare the results. Besides the different ability in recognizing facial emotions between physicians, nurses and other health professionals were not assessed in the different health care fields. This study has not included a control group. The participation in the training course was voluntary and therefore participants could already be interested in this topic. Another possible limitation is concerning the gender of participants, since the number of females was higher compared to males. However, in order to consider this possible bias, we carried out the multiple regression analysis, taking into account gender as a possible confounder.

Finally, the study did not examine the actual consequences of the training on communication of health professionals with aggressive patients and their family members or the satisfaction of patients. So, our study can be considered preliminary. However, this is one of the first studies that demonstrates that the training is successful in the ability to recognize subtle facial emotion expressions in health and social workers.

Our training focused on the recognition of subtle expressions of emotions. Infact the ability of health and social workers to recognize early signs of aggression such as hidden anger is in itself a tool for violence prevention, but it is also a very important tool for triggering de-escalation techniques[28-30].

The results of the study showed that emotion recognition ability can be improved through specific training.

It would be interesting to evaluate if specific training can be equally powerful for other groups of participants such as medical students. SETT is effective, simple tool for improving subtle expressions reading skills in health and social workers. The results of this study can be used to develop and implement future research aiming to improve the ability to recognize partial or subtle facial emotions in health and social workers, in order to improve doctor-patient relationship and reduce the conflicts between patients and healthcare workers. The course on prevention and management of violence should possibly include training on subtle facial emotion expressions recognition ability.

REFERENCES

1. Magai C, Cohen CI, Gomberg D. Impact of training dementia caregivers in sensitivity to nonverbal emotion signals. Int Psychogeriatr 2002; 14: 2538.
2. Blanch-Hartigan DB, Ruben MA. Training clinicians to accurately perceive their patients: current state and future directions. Patient Educ Couns 2013; 92: 328-36.
3. Ekman P, Yamey G. Emotions revealed: recognizing facial expression. BMJ 2004; 328: 75-81.
4. Leber S, Heidenreich T, Stangier U, Hofmann SG. Processing of facial affect under social threat in socially anxious adults: mood matters. Depress Anxiety 2009; 26: 196-206.
5. Poole JH, Tobias FC, Vinogradov S. The functional relevance of affect recognition errors in schizophrenia. J Int Neuropsychol Soc 2000; 6: 649-58.
6. Hooker C, Park S. Emotion processing and its relationship to social functioning in schizophrenia patients. Psychiatry Res 2002; 112: 41-50.
7. Riess H, Kraft-Todd G. E.M.P.A.T.H.Y.: a tool to enhance nonverbal communication between clinicians and their patients. Acad Med 2014; 89: 1108-12.
8. Leppanen JM. Emotional information processing in mood disorders: a review of behavioral and neuroimaging findings. Curr. Opin. Psychiatry 2006; 19: 34-9.
9. Boyatzis CJ, Satyaprasad C. Children's facial and gestural decoding and encoding: relations between skills and with popularity. J Nonverb Behav 1994; 18: 37-55.
10. Endres J, Laidlaw A. Micro-expression recognition training in medical students: a pilot study. BMC Med Educ 2009; 9: 47.
11. Forrest DV. FRONTLINE: teaching affect recognition to medical students: evaluation and reflections. J Am Acad Psychoanal Dyn Psychiatry 2011; 39: 229-41.
12. Ragsdale JW, Van Deusen R, Rubio D, Spagnoletti C. Recognizing patients' emotions: teaching health care providers to interpret facial expressions. Acad Med 2016; 91: 1270-5.
13. Dalkiran M, Gultekin G, Yuksek E, et al. Facial emotion recognition in psychiatrists and influences of their therapeutic identification on that ability. Compr Psychiatry 2016; 69: 30-5.

14. Dalkiran M, Yuksek E, Karamustafalioglu O. Facial emotion recognition ability in psychiatrists, psychologist and psychological counselors. European Psychiatry 2017; 41: 157.

15. Farber SK. My patient, my stalker empathy as a dual-edged sword: a cautionary tale. Am J Psychother 2015; 69: 331-55.

16. Chikovani G, Babuadze L, Iashvili N, Gvalia T, Surguladze S. Empathy costs: negative emotional bias in high empathiser. S Psychiatry Res 2015; 229: 340-6.

17. Gultekin G, Kincir Z, Kurt M, et al. Facial emotion recognition ability: psychiatry nurses versus nurses from other departments. Clin Invest Med 2016; 39: 61-5.

18. Frank MG, Ekman P. The ability to detect deceit generalizes across different types of highstake lies. J Pers Soc Psychol.1997; 72: 1429-39.

19. Warren G, Schertler E, Bull P. Detecting deception from emotional and unemotional cues. J. Nonverbal Behav 2009; 33: 59-69.

20. Ekman P. Emotions revealed. Understanding faces and feelings. London: Orion Publishing, 2003.

21. Hoffmann H, Kessler H, Eppel T, Rukavina S, Traue HC. Expression intensity, gender and facial emotion recognition: Women recognize only subtle facial emotions better than men. Acta Psychol 2010; 135: 278-83.

22. Montagne B, Kessels RPC, Frigerio E, de Haan EHF, Perrett DI. Sex differences in the perception of affective facial expressions: do men really lack emotional sensitivity? Cogn Process 2005; 6: 136-41.

23. Biele C, Grabowska A. Sex differences in perception of emotion intensity in dynamic and static facial expressions. Exp Brain Res 2006; 171: 1-6.

24. Mancini G, Agnoli S, Baldaro B, Ricci Bitti PE, Surcinelli P. Facial expressions of emotions: recognition accuracy and affective reactions during late childhood. J Psychol 2013; 147: 599-617.

25. Alaerts K, Nackaerts E, Meyns P, Swinnen SP, Wenderoth N. Action and emotion recognition from point light displays: an investigation of gender differences. PLoS One 2011; 6: e20989.

26. Schreckenbach T, Ochsendorf F, Sterz J, et al. Emotion recognition and extraversion of medical students interact to predict their empathic communication perceived by simulated patients BMC Med Educ 2018; 18: 237.

27. Blanch-Hartigan D. An effective training to increase accurate recognition of patient emotion cues. Patient Educ Couns 2012; 89: 274-80.

28. Price O, Baker J, Bee P, Lovell K. Learning and performance outcomes of mental health staff training in de-escalation techniques for the management of violence and aggression. Br J Psychiatry 2015; 206: 447-55.

29. Price O, Baker J, Bee P, et al. Patient perspectives on barriers and enablers to the use and effectiveness of de-escalation techniques for the management of violence and aggression in mental health settings J Adv Nurs 2018; 74: 614-25.

30. Price O, Baker J, Bee P, Lovell K. The support-control continuum: an investigation of staff perspectives on factors influencing the success or failure of de-escalation techniques for the management of violence and aggression in mental health settings. Int J Nurs Stud 2018; 77: 197-206.

31. Boyatzis CJ, Chazan E, Ting CZ. Preschool children's decoding of facial emotions J Genet Psychol 1993; 154: 375-82.

32. Roos TC, Niehaus DJH, Leppanen JM, et al. Facial affect recognition and exit examination performance in medical students: a prospective exploratory study. BMC Med Educ 2014; 14: 245.

33. Tse WS, Lu Y, Bond AJ, Chan RCk, Tam DWH. Facial emotion linked cooperation in patients with paranoid schizophrenia: a test on the Interpersonal Communication Model. Int J Soc Psychiatry 2011; 57: 509-17.

34. Wang Y, Zhu Z, Chen B, Fang F. Perceptual learning and recognition confusion reveal the underlying relationships among the six basic emotions. Cogn Emot 2019; 33: 754-67.

35. Stowell KR, Hughes NP, Rozel JS. Violence in the Emergency Department. Psychiatr Clin North Am 2016; 39: 557-66.

36. Ashton RA, Morris L, Smith I. A qualitative meta-synthesis of emergency department staff experiences of violence and aggression. Int Emerg Nurs 2018; 39: 13-9.

37. Heckemann B, Zeller A, Hahn S, Dassen T, Schols JM, Halfens RJ. The effect of aggression management training programmes for nursing staff and students working in an acute hospital setting. A narrative review of current literature. Nurse Educ Today 2015; 35: 212-9.

38. Edward KL, Ousey K, Warelow P, Lui S. Nursing and aggression in the workplace: a systematic review. Br J Nurs 2014; 23: 653-4, 656-9.

39. Ekman P. International, PLC. Our core modules. 2016.

40. Empathetics. Evidence-based courses. 2016.

41. Yu EH, Choi EJ, Lee SY, Im SJ, Yune SJ, Baek SY. Effects of micro- and subtle-expression reading skill training in medical students: a randomized trial. Patient Educ Couns 2016; 99: 1670-5.