ORIGINAL ARTICLE

Design and implementation of the European-Mediterranean Postgraduate Programme on Organ Donation and Transplantation (EMPODaT) for Middle East/North Africa countries

Chloe Ballesté[1,2,3], Ricard Valero[1,4,5,6], Melania Istrate[1,3], Particia Peralta[7], Ashraf Adel Mosharafa[8], Ahmed Ali Morsy[8], Mohamed Adel Bakr[9], Ahmed Ibrahim Kamal Abdelkader[9], Hussein Sheashaa[9], Georges S. Juvelekian[10,11], Maha Khachab[10], Reshdi Ahdab[12,13], Wissam Faour[13], Nadia Tahiri Jouti[14], Mohammed Benghanem Gharbi[14,15], Rabia Bayahia[16,17], Taoufik Dakka[17], Peter Desatnik[18], Patrick Jambou[19], Przemyslaw Pisarski[20], Patrick Samson-Himmelstjerna[21], Klaus Michael Lücking[21], Martí Manyalich[1,2,3] & The EMPODaT Consortium

1 Surgery and Surgical Specializations Department, Faculty of Medicine, University of Barcelona, Barcelona, Spain
2 Transplant Counseling Department, Hospital Clínic de Barcelona, Universitat de Barcelona, Barcelona, Spain
3 Donation and Transplantation Institute (DTI), Barcelona, Spain
4 Department of Anesthesiology, Hospital Clínic de Barcelona, Universitat de Barcelona, Barcelona, Spain
5 Institut d'Investigacions Biomèdiques August Pi i Sunyer (IDIBAPS), Barcelona, Spain
6 Centro de Investigación Biomédica en Red Salud Mental (CIBERSAM), Madrid, Spain
7 CETT-UB Department, SE-elearning, University of Barcelona, Barcelona, Spain
8 Cairo University, Giza, Egypt
9 Mansoura Urology and Nephrology Center, Mansoura University, Mansoura, Egypt
10 Faculty of Medicine and Medical Sciences, University of Balamand, El-Koura, Lebanon
11 Saint George Hospital UMC, Beirut, Lebanon
12 American University Medical Center Rizk Hospital, Beirut, Lebanon
13 Gilbert and Rose-Marie Chagoury School of Medicine, Byblos, Lebanon

SUMMARY

This prospective study reports the design and results obtained after the EMPODaT project implementation. This project was funded by the Tempus programme of the European Commission with the objective to implement a common postgraduate programme on organ donation and transplantation (ODT) in six selected universities from Middle East/North Africa (MENA) countries (Egypt, Lebanon and Morocco). The consortium, coordinated by the University of Barcelona, included universities from Spain, Germany, Sweden and France. The first phase of the project was to perform an analysis of the current situation in the beneficiary countries, including existing training programmes on ODT, Internet connection, digital facilities and competences, training needs, and ODT activity and accreditation requirements. A total of 90 healthcare postgraduate students participated in the 1-year training programme (30 ECTS academic credits). The methodology was based on e-learning modules and face-to-face courses in English and French. Training activities were evaluated through pre- and post-tests, self-assessment activities and evaluation charts. Quality was assessed through questionnaires and semi-structured interviews. The project results on a reproducible and innovative international postgraduate programme, improvement of knowledge, satisfaction of the participants and confirms the need on professionalizing the activity as the cornerstone to ensure organ transplantation self-sufficiency in MENA countries.

Transplant International 2021; 34: 1553–1565

Key words
MENA countries, organ donation, training, transplantation

Received: 16 January 2021; Revision requested: 8 May 2021; Accepted: 10 May 2021; Published online: 22 June 2021

doi:10.1111/tri.13918

14 Faculty of Medicine and Pharmacy of Casablanca, Hassan II University of Casablanca, Casablanca, Morocco
15 Ibn Rochd Hospital, Casablanca, Morocco
16 Nephrology Department, University Hospital Ibn Sina, Rabat, Morocco
17 Faculty of Medicine, Mohammed V University, Rabat, Morocco
18 Faculty of Medicine, University of Lund, Lund, Sweden
19 Faculty of Medicine, University Côte d'Azur, Nice, France
20 University Hospital Freiburg, Freiburg, Germany
21 University of Munich, Munich, Germany

Correspondence
Chloe Ballesté MD, Associate Professor, Faculty of Medicine, Surgery Department, University of Barcelona, C/ de Casanova 143, E-08036 Barcelona, Spain.
Tel.: +34 678457098;
fax: +34 934 039 685;
E-mail: chloeballeste@ub.edu

*The EMPODaT Consortium details present in Acknowledgements section.

Introduction

The specialized training of healthcare professionals in deceased organ donation for transplantation has been recognized as one of the crucial factors to increase deceased organ donation rates [1–3]. In Europe, although deceased and living organ donation rates vary widely across the member states [4], there has been an overall progress in the field of organ donation and transplantation (ODT), with development of outstanding knowledge reflected by the establishment of ODT European national directives [5], national common procedures and high-quality training programmes. By contrast, regions with low or very low deceased donation rates almost lack of postgraduate training programmes in ODT, so that the gap between supply and demand of organs is growing, and the needs of well-trained healthcare professionals are still unmet [6,7]. One of the regions suffering from this situation is Middle East/North Africa (MENA) [3,8]. Despite heterogeneity of countries within the MENA region regarding healthcare systems, societal and organizational characteristics, common challenges include organ shortage, low deceased organ donation activity and, particularly, a remarkable deficiency in postgraduate education programmes on ODT.

Taking advantage of the large experience of the University of Barcelona (Spain) through the Transplant Procurement Management (TPM) educational programme in training specialists in organ and tissue donation for transplantation [9–11], an international consortium composed by universities from Spain, Germany, Sweden and France was established in order to design a postgraduate training programme on ODT for MENA countries. Such programme, named the European-Mediterranean Postgraduate Programme on Organ Donation and Transplantation (EMPODaT) project, sought to modernize the higher education training in ODT in selected MENA countries. Therefore, this study reports the design and the results obtained after implementation of the EMPODaT project, which was based on the following three main actions at recipient

country level: diagnosis of the current situation, training and quality evaluation of the project, based on the hypothesis that the project could improve the knowledge of participants in ODT.

Methods

The EMPODaT project was submitted for funding to the Tempus programme of the European Commission in response to the call of proposals of the Education, Audio-visual and Culture Executive Agency (EACEA). The project included the creation of an international consortium composed by universities from the European Union (EU) and beneficiaries' universities from MENA countries, and the design of a postgraduate education training programme on ODT. The international consortium was composed by universities of the EU, including the University of Barcelona and the Donation and Transplantation Institute (DTI) (Spain), the Albert-Ludwigs-University Freiburg (Germany), the University of Lund (Sweden), the Université de Nice (France) and partner universities from the European Neighbourhood and Partnership Instrument (ENPI), including Cairo University and Mansoura University (Egypt), Lebanese American University Gilbert & Rose-Marie Chagoury Sch and University of Balamand (Lebanon), and Université Hassan II–Casablanca and Université Mohammed V-Souissi (Morocco). These three MENA countries, Egypt, Lebanon and Morocco, fitted within the scope of the Tempus programme in the typology as well as in the national and regional priorities in ODT [12]. A total of 11 partners from 7 countries formed part of the consortium, with small and large, private and public institutions located in capitals and other provincial cities. The consortium considered and was inspired in all training programmes running in Europe, including those of the European Society for Organ Transplantation (ESOT).

The objectives of the EMPODaT project were the following: a) to assess the current situation of healthcare professionals in terms of already existing training programmes, Internet access, digital competences and facilities, training needs, ODT activity, and accreditation requirements on ODT; b) to design and implement a specific postgraduate training programme based on the current local situation, as well as to assess the impact of training on postgraduate students in healthcare sciences; and c) to evaluate the quality of the programme. The accepted definitions of living and deceased donors were as follows: living donor refers to a living human being from whom cells, tissues or organs are removed for the purpose of transplantation, and deceased donors to a human being declared, by established medical criteria, to be dead and from whom cells, tissues or organs are recovered for the purpose of transplantation.

The EMPODaT project began in December 2013 and finished in May 2016, with the development of learning contents, tools and modules from May 2014 to January 2015, and implementation and final evaluation with participants' certification from September 2014 to February-May 2016.

Diagnosis of the current situation

In relation to the existing training programmes on ODT, experts from 10 universities completed a 12-item e-mail questionnaire with closed answers (Appendix S1). The experts had to be university professors from the partner institutions, and they were all in charge of ODT in their countries. In relation to Internet connection, digital facilities and competences, six experts from the beneficiary universities completed a 13-item Internet-based questionnaire in which 11 items were closed questions, 1 was an open question, and 1 asking for computer skills which had to be scored from 1 (poor) to 5 (excellent) (Appendix S2).

To assess the training needs, experts from the beneficiary universities proposed a list of at least 60 postgraduate students in healthcare sciences of each university to complete a self-administered survey which was posted online and available in English and French. Answers were collected using Survey Monkey® software. Briefly, it included 112 items to collect data on demographics (6 items); already acquired knowledge on deceased organ donation (19 items) and organ transplantation (19 items) (Appendix S3); knowledge on deceased organ donation (19 items) and organ transplantation (19 items) they would be interested to receive more training in (Appendix S4); and already acquired skills in behavioural, functional or technical, professional, and information & communication technologies (ICTs) applied to learning (17 items) and skills they would be interested to received more training in these four areas (17 items). Already acquired knowledge and skills were scored from 0 (none) to 5 (excellent), whereas interest to receive more training was evaluated categorically as 'yes' or 'no'.

In relation to ODT activity and accreditation requirements, experts from local universities completed a 28-item e-mail questionnaire regarding data on law, regulations and living and deceased donation and transplantation activities with open and multiple choice

Table 1. Diagnosis of the current situation. Results of the self-administered questionnaire on knowledge already acquired and training needs

Questionnaire domains			Age, years 18–24	25–34	35–44	45–54	55–64	*P* value	Gender Male	Female	*P* value	Education level University*	Postgraduate
DONATION	TRAINED	Ethical & legal	2.5 ± 1.5 (50)	2.3 ± 1.2 (122)	2.9 ± 1.5 (40)	1.9 ± 1.1 (15)	2.8 ± 1.6 (13)	0.104	2.6 ± 1.3 (140)	2.3 ± 1.4 (100)	0.145	2.5 ± 1.4 (57)	2.4 ± 1.2 (78)
		Donor assessment	2.2 ± 1.6 (49)	2 ± 1.3 (121)	2.7 ± 1.5 (40)	1.9 ± 1.3 (15)	2.5 ± 1.4 (13)	0.089	2.3 ± 1.3 (140)	2 ± 1.5 (98)	0.056	2.1 ± 1.5 (56)	2 ± 1.3 (78)
		Brain death	2.6 ± 1.6 (49)	2.5 ± 1.4 (120)	2.1 ± 1.5 (40)	2 ± 1.1 (15)	2 ± 1.7 (13)	0.233	2.2 ± 1.5 (140)	2.6 ± 1.4 (97)	0.079	2.5 ± 1.4 (56)	2.8 ± 1.6 (78)
		Donor management	1.8 ± 1.6 (49)	1.4 ± 1.4 (121)	1.3 ± 1.6 (40)	1.2 ± 1.2 (15)	1 ± 1.1 (13)	0.241	1.4 ± 1.4 (140)	1.5 ± 1.5 (98)	0.679	1.7 ± 1.5 (56)	1.8 ± 1.5 (78)
		Family approach	2.1 ± 1.4 (49)	1.9 ± 1.3 (121)	1.9 ± 1.6 (40)	1.2 ± 1 (15)	1.2 ± 1.1 (13)	0.094	1.9 ± 1.3 (140)	1.8 ± 1.4 (98)	0.314	2.1 ± 1.3 (56)	2 ± 1.3 (78)
		Organ procurement	1.6 ± 1.4 (49)	1.6 ± 1.3 (120)	2 ± 1.5 (40)	1.6 ± 1.3 (15)	1.8 ± 1.3 (13)	0.527	1.9 ± 1.3 (139)	1.4 ± 1.5 (98)	0.015	1.5 ± 1.4 (56)	1.7 ± 1.3 (78)
		Risk of transmission	2.3 ± 1.5 (48)	1.9 ± 1.3 (119)	2.7 ± 1.4 (40)	1.4 ± 0.9 (15)	2.1 ± 1.4 (13)	0.004	2.1 ± 1.4 (138)	2 ± 1.4 (97)	0.406	2.3 ± 1.4 (55)	2.2 ± 1.3 (77)
		Quality assessment	2.1 ± 1.4 (49)	2 ± 1.2 (120)	2.4 ± 1.5 (40)	1.5 ± 1.2 (15)	2.1 ± 1.4 (13)	0.236	2.2 ± 1.3 (139)	1.9 ± 1.3 (98)	0.031	2.1 ± 1.4 (56)	2.1 ± 1.2 (77)
	INTERESTED	Ethical & legal	95.7% (47)	87.9% (120)	95% (40)	86.7% (15)	66.7% (12)	0.004	90.2% (138)	88.5% (96)	0.622	92.6% (54)	91% (78)
		Donor assessment	94.3% (47)	89.8% (118)	84.2% (40)	97.8% (15)	66.7% (12)	0.005	88.2% (136)	90.3% (96)	0.552	93.8% (54)	90.2% (78)
		Brain death	91.5% (47)	82.9% (117)	81.2% (40)	76.7% (15)	75% (12)	0.41	81.8% (135)	85.9% (96)	0.379	89.8% (54)	86.2% (76)
		Donor management	97.9% (47)	83.9% (119)	78.3% (40)	84.4% (15)	69.4% (12)	0.021	84.3% (137)	86.1% (96)	0.684	89.5% (54)	90% (78)
		Family approach	89.1% (46)	83.6% (119)	68.7% (40)	80% (15)	68.2% (11)	0.069	79.6% (137)	83.5% (94)	0.424	87.7% (53)	87.8% (78)
		Organ procurement	95.6% (46)	86.1% (119)	83.3% (39)	80% (15)	58.3% (12)	0.004	85.6% (135)	85.9% (96)	0.926	88.7% (53)	89% (77)
		Risk of transmission	90.8% (47)	83.2% (119)	75.8% (40)	82.2% (15)	61.1% (12)	0.073	80.3% (137)	85.1% (96)	0.308	90.7% (54)	83.8% (78)
		Quality assessment	94.7% (47)	86.5% (119)	95% (40)	90% (15)	75% (12)	0.057	88% (137)	91.1% (96)	0.352	90.7% (54)	89.7% (78)
TRANSPLANTATION	TRAINED	Surgical procedures	1.3 ± 1.3 (46)	0.9 ± 1.2 (112)	1.1 ± 1.1 (39)	0.8 ± 0.6 (14)	1.6 ± 1.9 (11)	0.182	1.3 ± 1.3 (130)	0.7 ± 1.1 (92)	0.002	1.2 ± 1.2 (51)	0.9 ± 1.2 (74)
		Waiting list management	1.5 ± 1.4 (46)	1.1 ± 1.2 (111)	1.9 ± 1.6 (38)	0.9 ± 0.7 (14)	1.5 ± 1.6 (11)	0.016	1.4 ± 1.3 (129)	1.2 ± 1.4 (91)	0.267	1.4 ± 1.3 (50)	1.1 ± 1.2 (74)
		Immunologic rejection	2.4 ± 1.6 (45)	2 ± 1.2 (112)	2.2 ± 1.7 (39)	1.1 ± 1.1 (14)	2.8 ± 1.5 (11)	0.011	2.1 ± 1.4 (129)	2 ± 1.5 (92)	0.623	2.4 ± 1.5 (51)	1.8 ± 1.1 (73)
		Transplant follow-up	1.9 ± 1.4 (45)	1.7 ± 1.1 (112)	2.3 ± 1.5 (39)	1.6 ± 1.2 (14)	2.6 ± 1.7 (11)	0.052	2 ± 1.2 (129)	1.7 ± 1.5 (92)	0.113	2 ± 1.4 (51)	1.6 ± 1 (73)
		Living donation	1.6 ± 1.3 (45)	1.6 ± 1.4 (111)	2.2 ± 1.6 (39)	1.4 ± 1.4 (14)	3 ± 1.9 (11)	0.008	2 ± 1.4 (128)	1.4 ± 1.6 (92)	0.011	1.6 ± 1.4 (51)	1.5 ± 1.3 (72)
	INTERESTED	Surgical procedures	93.3% (45)	62% (111)	54.9% (39)	47.7% (13)	38% (10)	0	67.3% (129)	62.2% (89)	0.363	78.9% (50)	77% (74)
		Waiting list management	90.9% (44)	84.1% (107)	84.2% (38)	76.9% (13)	90% (10)	0.71	83.1% (124)	88.6% (88)	0.26	88% (50)	83.3% (72)
		Immunologic rejection	84.1% (44)	92.1% (110)	89.5% (38)	69.2% (13)	80% (10)	0.051	86.5% (126)	90.3% (89)	0.35	84.3% (49)	92.2% (73)
		Transplant follow-up	92.7% (44)	92.2% (110)	85.1% (39)	81.5% (13)	85% (10)	0.248	90.2% (127)	89.9% (89)	0.934	91.2% (50)	91.5% (73)
		Living donor	92.4% (44)	89.3% (109)	79.5% (39)	79.5% (13)	68.3% (10)	0.075	86% (126)	87.4% (89)	0.734	91% (50)	88.9% (72)
INORMATION AND COMMUNICATION SKILLS	TRAINED	Behavioural skills	2.7 ± 1.5 (41)	3.1 ± 1.2 (102)	3.1 ± 1.1 (38)	2.8 ± 1.1 (13)	3.4 ± 1.6 (9)	0.326	3 ± 1.2 (118)	3 ± 1.3 (85)	0.989	2.8 ± 1.5 (48)	3.1 ± 1.3 (69)
		Functional/ technical	2.6 ± 1.5 (41)	3.1 ± 1.3 (102)	3.1 ± 0.9 (38)	2.2 ± 1.6 (12)	3.4 ± 1.1 (9)	0.055	3 ± 1.2 (117)	2.8 ± 1.4 (85)	0.402	2.7 ± 1.4 (48)	3.1 ± 1.3 (69)
		Professional management	2.7 ± 1.5 (41)	3 ± 1.3 (99)	3.1 ± 0.9 (38)	2.8 ± 1.2 (11)	3.3 ± 1.5 (9)	0.62	3 ± 1.2 (115)	2.9 ± 1.4 (83)	0.612	2.8 ± 1.5 (48)	3.1 ± 1.3 (69)
		ICTS	2.5 ± 1.7 (42)	2.9 ± 1.4 (102)	3 ± 1.1 (38)	2.8 ± 1.1 (12)	3.2 ± 1.1 (9)	0.504	2.9 ± 1.3 (118)	2.7 ± 1.5 (85)	0.512	2.6 ± 1.6 (48)	3 ± 1.5 (70)
	INTERESTED	Behavioural skills	85% (41)	82.5% (99)	80.3% (36)	87.7% (13)	57.1% (8)	0.283	81.4% (112)	82.7% (85)	0.794	85.7% (48)	77.4% (67)
		Functional/ technical	88.4% (41)	85.1% (99)	77.9% (35)	80.8% (13)	62.5% (8)	0.229	83.1% (111)	83.5% (85)	0.929	88.5% (48)	80.7% (66)
		Professional management	84.1% (41)	86.9% (99)	77.8% (36)	76.9% (13)	62.5% (8)	0.302	83.9% (112)	81.8% (85)	0.678	86.5% (48)	80.6% (67)
		ICTS	84.1% (41)	83.3% (99)	71.5% (36)	92.3% (13)	75% (8)	0.358	81.5% (112)	81.8% (85)	0.957	86.5% (48)	77.6% (67)

Data expressed as mean ± standard deviation, or percentages, with number of participants in parenthesis.

ICTS: information and communication technologies.

*University includes high school which has only 2 people.

answers (17 items), as well as accreditation requirements in the ENPI universities (seven items) (Appendix S5). Activities included in the diagnostic study are shown in Table S1.

Training

Based on the results obtained from the diagnosis of the current situation, a common 1-year training programme for the six universities from Egypt, Lebanon and Morocco was designed with a total of 30 European Credit Transfer and Accumulation System (ECTS) academic credits (25–30 h per credit, total 750–900 h). The methodology of the programme was based on e-learning and face-to-face modules, which were available in English and French.

The e-learning module included one course on organ donation (six topics for living and deceased organ donation) and one course on organ transplantation (seven topics on pre- and post-transplant aspects and surgical procedures from living and deceased donors). Five ECTS credits were assigned to each module. Both modules included pre- and post-tests. The organ donation and organ transplantation tests included 12 and 14 multiple choice questions with a single correct answer, respectively (Appendices S6 and S7). The questions were different for each student, being automatically and randomly selected. One attempt per participant was allowed, with a final score from 0 (minimum) to 10 (maximum) and 8 as the minimum qualification to pass. Moreover, self-assessment activities were

Specialization area							Years of experience					
Master	PhD	*P* value	Transplantation	Donation	Others	*P* value	0	1	2	3	4	*P* value
3 ± 1.3 (26)	2.4 ± 1.4 (79)	0.17	2.6 ± 1.3 (159)	2.1 ± 1.5 (12)	2.3 ± 1.6 (31)	0.186	2.2 ± 1.5 (53)	2.5 ± 1.1 (41)	2.4 ± 1.2 (35)	2.5 ± 1.3 (33)	2.7 ± 1.5 (78)	0.262
2.6 ± 1.1 (26)	2.2 ± 1.5 (78)	0.223	2.3 ± 1.3 (158)	1.4 ± 1.5 (12)	2.2 ± 1.8 (31)	0.093	1.9 ± 1.4 (51)	2 ± 1.2 (41)	1.8 ± 1.4 (35)	2.3 ± 1.5 (33)	2.5 ± 1.4 (78)	0.038
1.6 ± 1.5 (26)	2.1 ± 1.3 (77)	0.001	2.3 ± 1.5 (158)	2.1 ± 1.2 (12)	2.5 ± 1.7 (31)	0.739	2.6 ± 1.6 (51)	2.2 ± 1.3 (41)	2.8 ± 1.6 (34)	3.1 ± 1.4 (33)	1.9 ± 1.4 (78)	0
0.9 ± 1.3 (26)	1.1 ± 1.2 (78)	0.002	1.5 ± 1.4 (158)	1.3 ± 1.4 (12)	1.7 ± 1.7 (31)	0.698	1.3 ± 1.4 (51)	1.7 ± 1.5 (41)	1.6 ± 1.5 (35)	1.8 ± 1.6 (33)	1.2 ± 1.3 (78)	0.118
2.1 ± 1.6 (26)	1.4 ± 1.3 (78)	0.015	1.9 ± 1.4 (158)	1.1 ± 0.8 (12)	2 ± 1.5 (31)	0.113	1.6 ± 1.3 (51)	2.2 ± 1.2 (41)	2.1 ± 1.5 (35)	2 ± 1.4 (33)	1.6 ± 1.4 (78)	0.123
2.1 ± 1.2 (25)	1.7 ± 1.5 (78)	0.379	1.9 ± 1.4 (157)	0.8 ± 1.1 (12)	1.5 ± 1.5 (31)	0.02	1.3 ± 1.4 (51)	1.7 ± 1.4 (41)	1.4 ± 1.2 (35)	1.7 ± 1.4 (33)	2 ± 1.4 (77)	0.035
1.6 ± 1.4 (25)	2 ± 1.5 (78)	0.177	2.1 ± 1.4 (155)	1.4 ± 1.2 (12)	2.3 ± 1.6 (31)	0.137	1.8 ± 1.5 (50)	2 ± 1.1 (41)	2.2 ± 1.6 (34)	2.3 ± 1.3 (32)	2.1 ± 1.4 (78)	0.428
2.6 ± 1.4 (26)	1.9 ± 1.3 (78)	0.084	2.3 ± 1.2 (157)	0.9 ± 1.4 (12)	2 ± 1.4 (31)	0.002	1.7 ± 1.4 (51)	2.1 ± 1.2 (41)	2 ± 1.4 (35)	2.3 ± 1.1 (32)	2.2 ± 1.3 (78)	0.175
84.6% (26)	87.5% (76)	0.48	89.7% (156)	91.67%(12)	91.4% (29)	0.924	91.8% (49)	91.5% (41)	86.8% (34)	92.4% (33)	87% (77)	0.701
86.1% (24)	85.5% (76)	0.29	88.1% (154)	83.3%(12)	94.2% (29)	0.384	92.5% (49)	91.9% (41)	89.2% (34)	92.9% (33)	83.6% (75)	0.234
68% (25)	81.6% (76)	0.058	84.6% (153)	62.5% (12)	91.4% (29)	0.045	89.8% (49)	89% (41)	81.8% (33)	81.2% (32)	78.3% (76)	0.336
74.7%(25)	80.3% (76)	0.081	84.8% (155)	61.1% (12)	96.5% (29)	0.007	98% (49)	80.5% (41)	86.8% (34)	88.9% (33)	76.7% (76)	0.008
70% (25)	73.3% (75)	0.018	80.5% (154)	54.2% (12)	94.6% (28)	0.005	91.7% (48)	84.1% (41)	86.8% (34)	81.8% (33)	70% (75)	0.017
84% (25)	80.9% (76)	0.354	86.9% (153)	58.3% (12)	94.8% (29)	0.001	91.7% (48)	86.6% (41)	92.6% (34)	90.6% (32)	76.3% (76)	0.021
76% (25)	76.7% (76)	0.114	82.1% (155)	75% (12)	90.8% (29)	0.331	90.5% (49)	87.8% (41)	82.3% (34)	78.8% (33)	75.4% (76)	0.142
96% (25)	85.5% (76)	0.318	91.3% (155)	70.8% (12)	82.8% (29)	0.014	90.8% (49)	92.7% (41)	88.2% (34)	87.9% (33)	87.5% (76)	0.844
1.7 ± 1.7 (25)	0.9 ± 1.1 (72)	0.024	1.2 ± 1.3 (151)	0.3 ± 0.6 (11)	1.1 ± 1.3 (25)	0.098	1 ± 1.3 (48)	1 ± 1.1 (39)	1.1 ± 1.4 (32)	0.7 ± 0.7 (31)	1.2 ± 1.4 (72)	0.512
2.1 ± 1.7 (25)	1.2 ± 1.2 (71)	0.013	1.5 ± 1.3 (150)	0.9 ± 1.4 (11)	1.1 ± 1.3 (25)	0.254	1.2 ± 1.4 (48)	1.2 ± 1 (39)	1 ± 1.3 (31)	1.4 ± 1.2 (30)	1.6 ± 1. 5 (72)	0.244
2.4 ± 1.6 (25)	2.1 ± 1.5 (72)	0.075	2.2 ± 1.4 (151)	1.7 ± 1.8 (11)	2.6 ± 1.5 (25)	0.186	1.9 ± 1.4 (47)	2.1 ± 1.1 (39)	2.1 ± 1.4 (32)	1.9 ± 1.5 (31)	2.2 ± 1.6 (72)	0.828
2.4 ± 1.5 (25)	2 ± 1.4 (72)	0.056	2.1 ± 1.3 (151)	1.1 ± 1.1 (11)	2 ± 1.4 (25)	0.047	1.5 ± 1.2 (47)	1.9 ± 1.1 (39)	1.8 ± 1.3 (32)	1.8 ± 1.2 (31)	2.3 ± 1.5 (72)	0.017
2.5 ± 1.5 (25)	1.9 ± 1.7 (72)	0.02	2 ± 1.5 (150)	0.9 ± 1.2 (11)	1.5 ± 1.3 (25)	0.025	1.2 ± 1.3 (47)	1.5 ± 1.2 (38)	1.4 ± 1.3 (32)	1.9 ± 1.3 (31)	2.3 ± 1.7 (72)	0
48% (25)	49% (69)	0	62.7% (150)	40% (10)	87.2% (25)	0.002	87.2% (47)	68.3% (39)	75.5% (31)	63.2% (31)	45.1% (70)	0
86.4% (22)	85.3% (68)	0.913	84.9% (146)	80% (10)	95.8% (24)	0.308	89.1% (46)	87.2% (39)	90% (30)	75.9% (29)	83.8% (68)	0.504
86.1% (24)	87% (69)	0.472	91% (148)	96.7% (10)	77.3% (25)	0.051	90.6% (46)	88.9% (39)	88.2% (31)	93.3% (30)	83.6% (69)	0.556
85.8% (24)	89.1% (69)	0.734	92.9% (149)	75% (10)	88% (25)	0.036	94.8% (46)	90.3% (39)	94.8% (31)	90.3% (31)	84.5% (69)	0.13
86.1% (24)	81.2% (69)	0.327	90.4% (148)	46.7% (10)	92% (25)	0	96.4% (46)	87.7% (38)	89.2% (31)	92.5% (31)	75.6% (69)	0.005
3 ± 1.4 (21)	3.1 ± 1.1 (65)	0.652	3.1 ± 1.3 (144)	3 ± 0.8 (9)	3.1 ± 1.4 (23)	0.957	2.6 ± 1.5 (44)	3 ± 1.2 (37)	3.4 ± 1.1 (27)	3 ± 1.2 (30)	3.2 ± 1.2 (65)	0.143
3 ± 1.2 (21)	2.9 ± 1.2 (64)	0.472	3 ± 1.2 (143)	2.9 ± 1 (9)	3 ± 1.4 (23)	0.946	2.5 ± 1.4 (44)	2.9 ± 1.3 (37)	3.4 ± 1.1 (27)	3 ± 1.2 (30)	3 ± 1.2 (64)	0.055
2.9 ± 1.2 (18)	3 ± 1.2 (63)	0.533	3 ± 1. 3 (139)	2.9 ± 1.3 (9)	3.1 ± 1.4 (23)	0.868	2.6 ± 1.6 (44)	2.9 ± 1.3 (37)	3.3 ± 1.1 (27)	3.1 ± 1.2 (30)	3.1 ± 1.2 (60)	0.164
2.5 ± 1.2 (21)	3 ± 1.1 (64)	0.288	2.9 ± 1.3 (143)	2.6 ± 1.2 (9)	2.9 ± 1.8 (23)	0.77	2.5 ± 1.6 (45)	2.7 ± 1.4 (37)	3 ± 1.3 (27)	3.1 ± 1.3 (30)	2.9 ± 1.1 (64)	0.359
81.5% (19)	84.1% (63)	0.569	81.8% (139)	84.1% (9)	83.8% (22)	0.954	78.9% (44)	91.5% (37)	78.6% (26)	77.8% (30)	81.9% (60)	0.414
76.3% (19)	84.1% (63)	0.464	83.5% (138)	80.6% (9)	85.2% (22)	0.935	85.8% (44)	93.2% (37)	77.9% (26)	78.4% (29)	80% (60)	0.225
81.6% (19)	83.3% (63)	0.858	83.4% (139)	89% (9)	79.5% (22)	0.794	80.7% (44)	94.6% (37)	75% (26)	83.3% (30)	80.8% (60)	0.241
77.6% (19)	83.3% (63)	0.586	81.6% (139)	77.8% (9)	79.5% (22)	0.934	80.1% (44)	97.3% (37)	79.8% (26)	68.3% (30)	80.4% (60)	0.029

conducted to ensure appropriate knowledge acquisition, the completion of 80% of correct answers was mandatory with no restrictions on number of attempts.

The face-to-face module included local seminars, hospital traineeships in ODT and international assessment seminars, corresponding to a total of 20 ECTS. Six local seminars (3 for living and deceased organ donation and 3 for organ transplantation) were implemented by the ENPI coordinators of each university aimed to teach specific contents for each region needs, reinforcing key aspects for the attendees. Local seminars were evaluated by means of attendance (the participants should attend at least four seminars), and pre- and post-tests were also compulsory. Each university designed its own tests based on the topics approached, all were graded from 0 (minimum) to 10 (maximum). In addition, postgraduate students individually had to present a final dissertation about a topic related to the postgraduate curriculum presented and evaluated during the international assessment face-to-face seminar (IAFS) by an international board committee. A specific evaluation chart including 11 items divided in three areas (structure, presentation and relevance) in a scale from 1 (poor) to 10 (excellent) was used (Appendix S8).

Hospital traineeships included a 2-week periods in both deceased organ donation and transplantation units. Participants supervised by a hospital tutor attended and recorded all clinical and research activities performed in the assigned unit. A protocol for the traineeship was defined and activity charts were used to evaluate

postgraduate students' performances that included 7 items (attitude, interest shown, initiative, dedication, interaction with the group, participation in department's activities and punctuality), which were scored from 1 (poor) to 10 (excellent) (Appendix S9).

The IAFS was delivered in each ENPI partner country, aimed to reinforce and evaluate knowledge and skills acquired by participants throughout the postgraduate programme (Appendix S1). Highly interactive methodology was used including wrap-up sessions, simulation-based tools and workshops. Topics included were deceased donor detection systems, family approach, brain death, donor management and organ recovery, and solid organ transplant clinical cases. The student's performance during the workshops (deceased donor detection system, family approach, brain death and deceased donor management, organ recovery and kidney, liver, pancreas, heart and lung transplant clinical cases) was evaluated by the EU and local experts from the consortium in a scale from 1 (poor) to 10 (excellent) considering his/her attitude, interest shown, initiative and interaction with the group.

Quality evaluation

The assessment questionnaires were provided to all participants at the end of the EMPODaT project before their grades where delivered. The questionnaire was administrated in paper format during the IAFS and collected by the local coordinators. It included 15 questions divided into three topics: the programme (eight items), the faculty level (three items) and general aspects (four items) inquiring upon the quality of the different topics. It was scored from 1 (poor) to 5 (excellent) (Appendix S1). Also, semi-structured interviews consisted of comments or suggestions for a set of 7 open-ended questions related to the educational activities developed with the EMPODaT project. Interviews were carried out face-to-face or online to postgraduate students, experts and coordinators of the courses. Face-to-face interviews were performed in groups of 5–15 participants and discussions were free-flowing, allowing postgraduate students to share their views, opinions and thoughts. Interviews were also performed via individual e-mails containing seven questions prepared by members of the Quality Assurance Group (Appendix S13).

Statistical analysis

Categorical variables are expressed as frequencies and percentages and continuous variables as mean and standard deviation ($\pm$ SD). In relation to the training needs, answers to the questions of each area of knowledge were grouped according to main subjects, resulting 8 domains for deceased donation (ethical and legal aspects, donor assessment, brain death diagnosis, donor management, family approach, organ procurement, risk of transmission evaluation and quality assessment), 5 for transplantation (surgical procedures, waiting list management, immunological rejection, transplantation follow-up and living donation) and 4 for skills (behavioural skills, functional/technical aspects, professional management and ICTs). The results were assessed by age (stratified into 18–24, 25–34, 35–44, 45–54 and 55–64 age segments), gender (male and female), educational level (university degree, postgraduate diploma, master and PhD), area of specialization (donation, transplantation and nursing) and years of experience in the field (from 0 to 4). Pre- and post-test results of the e-learning modules were analysed by country and area of specialization using a mixed-effect model analysis. Results of the assessment of the EMPODaT project were analysed by country, university and area of specialization. Continuous variables were compared with the Student's *t*-test for independent samples. Statistical significance was set at $P < 0.05$.

Results

Diagnosis of the current situation

Morocco and Lebanon offered face-to-face training programmes on ODT without academic certification, but training was nonexistent in Egypt. All universities had Internet connection and computer facilities; additionally, universities from Morocco and Lebanon had available Learning Management Systems (Moodle®). Digital literacy trainings were not offered in Lebanon and in one Egyptian centre. All local coordinators scored their computer skills above 4.

Of a total of 444 postgraduate students of healthcare sciences who answered the self-administered survey on the training needs, 240 fully completed the questionnaire. As shown in Table 1, there were statistically significant differences according to the age of the postgraduate students in varied questions related to the topics of 'risk of transmission', 'ethical and legal aspects', 'deceased donor assessment', 'organ procurement', 'waiting list management', 'immunological rejection' and 'living donation'. Significant differences between males and females were also found in topics

related to 'organ procurement', 'risk of transmission', 'surgical procedures' and 'living donation', with higher scores in males. The area of specialization of the respondents also showed significant differences in 11 items, which mostly corresponded to the areas of knowledge in either transplantation or deceased organ donation. Moreover, significant differences according to years of experience were observed on the knowledge of 'brain death', 'organ procurement', 'deceased donor management', 'transplantation follow-up', 'surgical procedures' and 'living donation'.

Regarding ODT activities, all three countries had specific laws regulating ODT and the diagnosis of brain death. Lebanon was the only country that had a national organization in charge of ODT activities called National Organization for Organ and Tissue Donation and Transplant Lebanon (NOD-Lb). In Egypt and Morocco, ODT activities were supervised by the Ministry of Health. Egypt was the only country in which a deceased transplantation programme was not implemented, but the three countries had living donation programmes for kidney and liver transplants. Egypt and Lebanon accepted living-unrelated donors. At the time of the study, the number of officially reported transplant centres was 37 in Egypt, 13 in Lebanon and 6 in Morocco. In relation to accreditation requirements, all universities from the three countries had 6-month postgraduate programmes regulated by the universities themselves plus the Ministry of Health in Egypt.

Training

As shown in Table 2, all 90 participants significantly improved their knowledge on living and deceased donation and transplantation after attending the e-learning modules. Improvements were found in all three countries and specialization areas. In the e-learning organ donation module, the improvement was higher for Morocco as compared with Egypt and Lebanon, but in the e-learning transplantation module, participants specialized in organ donation showed a higher improvement when compared to the other groups. In the e-learning organ donation module, the mean difference of post-test *vs.* pretest scores was higher for Morocco as compared with Egypt and Lebanon regardless the specialization area of the postgraduate students, whereas in the e-learning organ transplantation module, the mean difference of post-test *vs.* pretest scores was higher for the specialization area of deceased donation as compared with specialization areas of transplantation and nursing regardless the country.

Local seminars of the face-to-face module were associated with improvements of knowledge of ODT in the universities of the three countries, although the percentages of improvements were variable (Table 3). Results of the final dissertations were similar in all countries, although postgraduate students of the University of Balamand (Lebanon) obtained the highest scores and those of the Lebanese American University Gilbert & Rose-Marie Chagoury Sch the lowest (Table 4). The

Table 2. Results of the e-learning modules on donation and transplantation by country and specialization area

	Countries			Specialization area		
E-learning module	Egypt (n = 30)	Lebanon (n = 30)	Morocco (n = 30)	Donation (n = 30)	Transplantation (n = 47)	Nursing (n = 11)
Donation						
Pretest score	7.2 ± 1.2	6.9 ± 1.8	5.3 ± 1.4	6.4 ± 1.7	6.8 ± 1.6	5.6 ± 2.3
Post-test score	8.7 ± 0.5	8.8 ± 0.7	9.0 ± 0.7	8.8 ± 0.7	8.8 ± 0.6	9.0 ± 0.5
Mean difference (95% CI)	1.42 (0.79–2.04)	1.83 (1.19–2.48)	3.71 (3.08–4.35)	2.60 (2.11–3.09)		
P value	<0.001	<0.001	<0.001	<0.001		
Transplantation						
Pretest score	5.1 ± 1.5	4.7 ± 1.3	5.3 ± 1.7	4.5 ± 1.7	5.5 ± 1.4	4.5 ± 1.1
Post-test score	9.5 ± 0.5	9.6 ± 0.4	9.4 ± 0.7	9.6 ± 0.6	9.5 ± 0.5	9.4 ± 0.8
Mean difference (95% CI)	4.48 (4.13–4.83)			5.04 (4.46–5.63)	4.01 (3.54–4.47)	4.92 (3.95–5.90)
P value	<0.001			<0.001	<0.001	<0.001

Data as mean ± SD.

CI, confidence interval.

Table 3. Improvements of knowledge of ODT after implementation of local seminars

Countries	Percentage of improvement based on total right answers of post-test vs. pretest					
	Seminars of organ donation			Seminars of organ transplantation		
Egypt	First	Second	Third	First	Second	Third
Cairo University	10.0	6.6	7.7	12.0	4.5	4.0
Mansoura University	27.0	17.0	27.0	22.0	16.0	29.0
Lebanon						
Lebanese American University Gilbert & Rose-Marie Chagoury Sch	36.3	4.0	4.0	20.0	20.0	20.0
University of Balamand	38.0	9.4	9.4	42.0	42.0	42.0
Morocco						
Université Hassan II-Casablanca	10.8	18.0	43.0	48.0	26.0	26.1
Université Mohammed V-Souissi	16.7	18.8	20.5	25.4	17.8	23.1

Table 4. Results of training: final dissertation, hospital traineeship and international assessment face-to-face seminar (IAFS)

Variables	Number	Final dissertation	Hospital traineeship		IAFS
			Donation	Transplantation	
Country					
Egypt	30	6.6 ± 2.6	7.3 ± 2.2	7.1 ± 2.6	7.0 ± 3.2
Lebanon	30	6.4 ± 2.9	7.9 ± 1.2	7.7 ± 1.2	8.0 ± 2.2
Morocco	30	6.5 ± 2.0	8.1 ± 2.3	8.0 ± 2.3	7.3 ± 2.0
Universities					
Cairo University	30	6.7 ± 2.4	7.0 ± 2.2	7.1 ± 2.3	6.6 ± 3.5
Mansoura University	30	6.4 ± 2.9	7.7 ± 2.2	7.1 ± 2.9	7.3 ± 3.0
Lebanese American University Gilbert & Rose-Marie Chagoury Sch	30	5.2 ± 3.9	9.1 ± 1.1	9.1 ± 1.1	7.5 ± 3.0
University of Balamand	30	7.6 ± 0.4	7.4 ± 0.6	7.1 ± 0.5	8.6 ± 0.6
Université Hassan II-Casablanca	30	6.9 ± 2.0	8.5 ± 2.3	8.2 ± 2.3	8.0 ± 2.0
Université Mohammed V-Souissi	30	6.2 ± 2.6	7.8 ± 3.2	7.8 ± 3.2	6.6 ± 2.7
Specialization area					
Donation	30	6.2 ± 2.5	7.7 ± 2.0	7.4 ± 2.2	7.4 ± 2.5
Transplantation	47	6.5 ± 2.5	7.6 ± 2.0	7.4 ± 2.2	7.3 ± 2.5
Nursing	11	7.5 ± 2.5	8.9 ± 1.0	8.9 ± 1.1	8.4 ± 1.8

Data expressed as mean ± standard deviation.

individual assessment of the hospital traineeships was also balanced among countries, being Morocco the country with highest scores in both donation and transplantation (donation: 8.1 ± 2.3; transplantation: 8.0 ± 2.3), and Egypt with the lowest scores in both areas (donation: 7.3 ± 2.2; transplantation: 7.1 ± 2.6). In relation to individual universities, postgraduate students from the Lebanese American University Gilbert & Rose-Marie Chagoury Sch achieved the highest scores in donation and transplantation, whereas in relation to specialization, the highest score was obtained by nursing (Table 4). Despite the fact of evaluating simultaneously the IAFS in both universities of each country, some differences were found; among countries, Lebanese participants showed the highest scores while the nurses group was the specialization area with highest scores (Table 4).

Quality evaluation

Overall, 64.5% (n = 58) postgraduate students completed the quality evaluation questionnaire. The

Transplant International 2021; 34: 1553–1565

Table 5. Results of the postgraduate student's assessment questionnaire to evaluate the EMPODaT programme in a scale (1–5) analysed according to country, university and specialization

		Country				University							Specialization area			
	Topics	Egypt (n = 30)	Lebanon (n = 30)	Morocco (n = 30)	P value	CU (n = 15)	MU (n = 15)	LAU (n = 15)	UOB (n = 15)	UH2C (n = 15)	UM5R (n = 15)	P value	Donation (n = 30)	Transplantation (n = 47)	Nursing (n = 11)	P value
Programme	Organ Donation online module	4.6 ± 0.7 (17)	3.8 ± 0.7 (20)	4.4 ± 0.6 (21)	0.001	4.7 ± 0.7 (12)	4.4 ± 0.9 (5)	4.3 ± 0.5 (6)	3.5 ± 0.7 (14)	4.4 ± 0.7 (8)	4.4 ± 0.5 (13)	0.001	4 ± 0.9 (19)	4.4 ± 0.7 (31)	4.3 ± 0.5 (8)	0.271
	Organ Transplantation online module	3.4 ± 0.9 (17)	3.6 ± 0.6 (20)	3.3 ± 1 (21)	0.604	3.3 ± 1 (12)	3.4 ± 0.9 (5)	4 ± 0.6 (6)	3.4 ± 0.5 (14)	3.1 ± 0.6 (8)	3.4 ± 1.2 (13)	0.584	3.2 ± 0.7 (19)	3.4 ± 1 (31)	4.1 ± 0.4 (8)	0.023
	Local seminar on organ donation	4.3 ± 0.8 (17)	4.3 ± 0.7 (19)	4.4 ± 0.7 (21)	0.867	4.3 ± 0.9 (12)	4.2 ± 0.8 (5)	4.5 ± 0.5 (6)	4.2 ± 0.7 (13)	4.6 ± 0.5 (8)	4.2 ± 0.7 (13)	0.730	3.9 ± 0.8 (19)	4.6 ± 0.6 (30)	4.3 ± 0.7 (8)	0.009
	Local seminar on organ transplantation	3.9 ± 0.9 (16)	4.4 ± 0.7 (20)	4.3 ± 0.6 (21)	0.201	3.8 ± 1 (12)	4.3 ± 0.5 (4)	4.7 ± 0.5 (6)	4.2 ± 0.7 (14)	4.1 ± 0.4 (8)	4.4 ± 0.7 (13)	0.264	3.9 ± 0.9 (19)	4.4 ± 0.6 (30)	4.4 ± 0.5 (8)	0.065
	International Assessment seminar	4.3 ± 0.7 (16)	3.9 ± 0.7 (19)	4.4 ± 0.6 (21)	0.072	4.3 ± 0.8 (11)	4.4 ± 0.5 (5)	4 ± 0.7 (5)	3.9 ± 0.7 (14)	4 ± 0.5 (8)	4.7 ± 0.5 (13)	0.056	4.1 ± 0.8 (18)	4.4 ± 0.6 (31)	4.1 ± 0.7 (7)	0.323
	Traineeship in organ donation unit	3.6 ± 1.2 (17)	4.1 ± 0.7 (19)	4.6 ± 0.6 (21)	0.003	3.4 ± 1.2 (12)	4.2 ± 0.8 (5)	4.3 ± 0.5 (6)	4 ± 0.7 (13)	4.6 ± 0.7 (8)	4.6 ± 0.5 (13)	0.009	3.8 ± 1.1 (19)	4.4 ± 0.8 (30)	4.1 ± 0.6 (8)	0.067
	Traineeship in organ transplantation unit	3.9 ± 1.2 (17)	4 ± 0.7 (19)	4.3 ± 0.7 (21)	0.327	3.7 ± 1.3 (12)	4.6 ± 0.5 (5)	4.3 ± 0.5 (6)	3.8 ± 0.8 (13)	3.9 ± 0.6 (8)	4.6 ± 0.5 (13)	0.043	3.6 ± 1.1 (19)	4.4 ± 0.6 (30)	4.1 ± 0.6 (8)	0.009
	Individual/group paper/project	4.2 ± 0.8 (15)	3.9 ± 0.9 (17)	4.1 ± 0.7 (12)	0.514	4 ± 0.8 (10)	4.6 ± 0.5 (5)	3.8 ± 0.8 (6)	3.9 ± 0.9 (11)	3.8 ± 0.5 (8)	4.8 ± 0.5 (4)	0.160	3.7 ± 0.8 (15)	4.3 ± 0.7 (23)	3.8 ± 0.8 (6)	0.063
Faculty level	ENPI coordinators	4.4 ± 0.6 (16)	4.1 ± 0.7 (19)	4.9 ± 0.4 (21)	0.001	4.5 ± 0.7 (11)	4.2 ± 0.4 (5)	4 ± 0 (5)	4.1 ± 0.9 (14)	4.8 ± 0.5 (8)	4.9 ± 0.3 (13)	0.008	4.3 ± 0.8 (19)	4.7 ± 0.5 (30)	4.3 ± 0.5 (7)	0.078
	EU experts	4.6 ± 0.6 (16)	4 ± 0.7 (19)	4.8 ± 0.4 (20)	0.000	4.5 ± 0.7 (11)	4.6 ± 0.5 (5)	4 ± 0 (5)	4 ± 0.9 (14)	4.9 ± 0.4 (8)	4.8 ± 0.5 (12)	0.010	4.3 ± 0.9 (19)	4.6 ± 0.6 (29)	4.3 ± 0.5 (7)	0.169
	Hospital traineeships tutors	3.9 ± 1.2 (16)	4 ± 0.7 (19)	4.8 ± 0.4 (21)	0.002	3.6 ± 1.3 (11)	4.4 ± 0.9 (5)	4 ± 0 (5)	4 ± 0.8 (14)	4.6 ± 0.5 (8)	4.8 ± 0.4 (13)	0.008	4.1 ± 1 (19)	4.4 ± 0.9 (30)	4.3 ± 0.5 (7)	0.481
General aspects	Organization	4.3 ± 0.8 (17)	3.5 ± 0.8 (19)	4.6 ± 0.5 (21)	0.000	4.4 ± 0.8 (12)	4 ± 0.7 (5)	3.8 ± 0.8 (5)	3.4 ± 0.8 (14)	4.5 ± 0.5 (8)	4.7 ± 0.5 (13)	0.000	4.1 ± 0.9 (19)	4.3 ± 0.8 (31)	3.9 ± 0.7 (7)	0.484
	Secretariat	4.4 ± 0.9 (17)	3.5 ± 0.8 (19)	4.7 ± 0.5 (21)	0.000	4.3 ± 0.9 (12)	4.6 ± 0.9 (5)	3.8 ± 0.8 (5)	3.4 ± 0.8 (14)	4.5 ± 0.5 (8)	4.8 ± 0.4 (13)	0.000	4.2 ± 0.9 (19)	4.3 ± 0.9 (31)	3.9 ± 0.7 (7)	0.419
	Objectives fulfilment	4.4 ± 0.8 (17)	3.7 ± 0.7 (19)	4.4 ± 0.6 (21)	0.005	4.4 ± 0.9 (12)	4.2 ± 0.4 (5)	3.6 ± 0.5 (5)	3.7 ± 0.8 (14)	4 ± 0.5 (8)	4.6 ± 0.5 (13)	0.012	4 ± 0.9 (19)	4.3 ± 0.6 (31)	3.9 ± 0.7 (7)	0.253
	Applicability to my professional career	4.1 ± 1.1 (17)	3.7 ± 1 (19)	4.5 ± 0.6 (21)	0.018	4.2 ± 1.1 (12)	3.8 ± 1.1 (5)	3.2 ± 1.1 (5)	3.9 ± 0.9 (14)	4.4 ± 0.5 (8)	4.6 ± 0.7 (13)	0.059	4.3 ± 0.9 (19)	4.2 ± 0.9 (31)	3.3 ± 1 (7)	0.049
Total		4.2 ± 0.6 (17)	3.9 ± 0.6 (20)	4.5 ± 0.3 (21)	0.001	4.2 ± 0.7 (12)	4.3 ± 0.6 (5)	4.1 ± 0.5 (6)	3.8 ± 0.6 (14)	4.4 ± 0.2 (8)	4.6 ± 0.3 (13)	0.009	4 ± 0.7 (19)	4.4 ± 0.5 (31)	4.1 ± 0.5 (8)	0.129

Data expressed as mean ± standard deviation; absolute numbers in parenthesis.

CU, Cairo University; MU, Mansoura University; LAU, Lebanese American University Gilbert & Rose-Marie Chagoury Sch; UOB, University of Balamand; UH2C, Université Hassan II-Casablanca; UM5R, Université Mohammed V-Souissi.

percentages of nonresponse by country, universities and specialization area were 43.4% for Egypt, 33.3% for Lebanon and 30% for Morocco; 66.7% for CU, 60% for LAU, 7% for UOB, 46.7% for UH2C and 13.4% for UM5R; and 36.7% for deceased donation, 34.1% for transplantation and 27.3% for nursing, respectively. As shown in Table 5, assessments for all 15 items were generally satisfactory with the majority of mean values around 4. Although there were significant differences between countries, universities and specializations, these differences were not relevant since scores obtained in all items were highly satisfactory (above 3.2 ± 1.1). Results of the semi-structured interviews confirmed the interest of participants in the EMPODaT project; in particular, they considered that the online organ donation module was well-explained and structured, but they found difficulties in following the online transplant module. The majority found the programme interesting and challenging putting stress on the innovative value that represented the project. Accreditation process was also mentioned as an aspect to be improved. Also, all agreed that it was necessary to continue and maintain the international network.

Discussion

The present study shows that the design and implementation of the EMPODaT project for MENA countries were associated with an improvement of knowledge in the fields of both living and deceased organ donation and organ transplantation. It was found that the postgraduate students in healthcare sciences from Morocco were those showing the greatest benefits especially in the different aspects related to deceased organ donation, probably due to their pretests lower scores in the deceased organ donation field in both the e-learning module and the local seminars. On the other hand, nurses were the specialization group that had learned more and reached highest scores in final dissertations, hospital traineeships and IAFS. These findings reinforce the hypothesis that globally there is a need of professionalization on the organ donation field and that multidisciplinary teams might benefit of common training approaches [13–16].

The training design that included blended methodology, innovative simulations, practical cases and hands-on traineeships in small groups encouraged multidisciplinary team-work spirit and proactive involvement in the activities at national level from an inter-hospital perspective. Expertise exchange among hospitals was a common practice during the project in the three countries. It also permitted the homogenization of knowledge through the e-learning contents meanwhile local specificities could be approached during the seminars involving local experts. The international board ensured the use of common evaluation criteria and promoted regional collaboration among MENA countries.

The study reveals the importance of starting from a diagnostic analysis of the current situation of each country in relation to their level of knowledge and clinical activity to target the contents, the scientific level and the learning methodologies to be applied in each university. At that time, without the evidence of Internet accessibility and ICTs skills among the university community, e-learning modules would not have been possible. Another factor that could have influenced training results is the selection of the postgraduate students since students enrolment was achieved by each university; however, this potential bias was avoided as their profile, background and experience requirements were previously agreed and defined to ensure comparable groups.

Regarding the quality assessment of the EMPODaT project, in addition to the general interest and positive opinions collected, it is interesting to note the willingness to maintain the international network and inter-university exchanges. As an example, the lack of deceased donation in Egypt was pointed out as an aspect to be considered while organizing the hospital traineeships, stressing the need to organize international student exchanges. Another aspect raised during the interviews was the complexity of the accreditation process at the local universities and the difficulties found to successfully achieve this procedure despite the previous European recognition of credits. The programme was feasible, reproducible and provided successful results, but unfortunately its continuity has been compromised due to paperwork and internal local procedures in addition to the financial aspect. However, how the benefits of the EMPODAT project, increasing ODT trainings at university level and improving the existing knowledge could change practice in MENA countries has not yet been evaluated. All educational materials, simulation tools and the academic curriculum have been released to each partner, so one of the main objectives of the EMPODAT programme was to allow the local universities to ensure self-sufficiency. Despite having access to all educational materials, up to the present time, the training programmes have not been replicated due to budget constraints and bureaucratic procedures to obtain accreditation at each university. However, the ETCS credits achieved with the 1-year training programme will be very valuable for each participant in

case of validation of credits for further masters and PhD programmes. Finally, it would be interesting to perform a prospective study to assess the long-term impact of training and to track career development of the postgraduate students that participated in the programme.

Some limitations have been identified during the study and the project implementation. Neither the clinical activity nor the ODT number of cases has been analysed before and after implementation of the EMPODaT project due to the lack of reliable ODT official data and methods to measure clinical performances. This has been the main barrier to demonstrate the impact of the training on the ODT activity of the three countries. Further research in this area should be carried out to identify the long-term impact of this training as it was also pointed in ETPOD study [17]. Another aspect that should be considered is the potential influence on the outcomes of the variable percentages of nonresponse to the questionnaire assessing quality evaluation. Although the limited number of countries that participated in the programme does not allow generalizing the present results to other countries of the MENA region, where the diversity of healthcare systems, demographics, socioeconomic status and experience in the ODT field is variable, the present results together with previous studies support that any effort to professionalize the activity improve deceased organ donation [18,19]. Based on the successful experience in the design and implementation of the EMPODAT project in three MENA countries, the feasibility to replicate the programme in other settings could be the hypothesis for further studies.

In conclusion, the EMPODaT project has been successful by reaching its main objective of increasing ODT training at university level and improving the existing knowledge among healthcare professionals in MENA countries, where these activities are still incipient. Innovative training materials, contents and methodologies have been developed by the university project partners in English and French becoming open source tools aiming to promote global living and deceased organ donation and transplantation activity beyond the project lifespan. The EMPODAT project was important as a national university-oriented training programme, but integration into an international network with access to established ESOT education activities or international programmes of the Transplantation Society (TTS) is necessary to overcome currently existing difficulties for effective implementation of ODT self-sufficient programmes in MENA countries.

Authorship

CB was the principal investigator, designed and performed study, collected data, analysed data and wrote the paper. RV supervised and coordinated the study, and revised the draft for intellectual content. MI, PP and MM contributed to data collection and analysis. The remaining authors coordinated the implementation of the study at local universities. All authors have seen and approved the final draft.

Funding

Tempus programme of the European Commission.

Conflict of interest

The authors have declared no conflicts of interest.

Acknowledgements

The authors thank Marta Pulido, MD, PhD, for editing the manuscript and editorial assistance.

The EMPODaT Consortium (members by institution in alphabetical order): Cairo University, Cairo, Egypt: Sayed Akl, Hesham Badawy, Rashad Barsoum, Ayman Dessouky, Wahid Doss, Hussein El-Fishawe, Rizk Elgalley, Manar Elkholy, Ahmed El-Shaarawy, Moustafa Elshazli, Maher Fawzy, Tarek Fayad, Hany Hafez, May Hassaballah, Adel Hosny, Karim Hosny, Mai Mehrez, Tarek Mohsen, Ahmed Mokhtar, Ahmed Ali Morsy, Ashraf Adel Mosharafa, Safinaz Othman, Ismail Rady Saad, Mohamed Said and Maysa Shawqy; Mansoura University, Mansoura, Egypt: Mohamed Abdelwahab, Ahmed Akl, Wafaa Albhaey, Mohamed Adel Bakr, Essam Abu Bieh, Tarek El Diasty, Mohamed El Saadany, Ahmed Halawa, Ahmed Ibrahim Kamal Abdelkader, Ayman Maher, Ahmed Mansour, Mohamed Nasr Mibed, Ayman Refaea, Rasha Refaie, Hussein Sheashaa, Ahmed Shokeir; Balamand University, El-Koura, Lebanon: Fadi Abou Jaoude, Maroun Abou Jaoude, Imad Hajj, Walid Faraj, Najat Fares, Boutros Ghanem, Najat Joubran, Georges S. Juvelekian, Maha Khachab, Kamil Nassar, Joe Nohra, Naji Riachi, Antoine Stephane and Farida Younan; Lebanese American University Gilbert & Rose-Marie Chagoury SCH (LAU), Beirut, Lebanon**:** Fayez Abilama, Fadi Abou Jaoude, Maroun Abou Jaoude, Reshdi Ahdab, Sola Aoun Bahous, Wissam Faour, Walid Faraj, Boutros Ghanem, Georges S. Juvelekian, Hala Kilani, Marwan Masri, Naji Riachi, Antoine Stephane, Farida Younan and Nazih Youssef; Hassan II University of Casablanca, Casablanca,

Morocco: Abderrahim Aït Mhamed, Lahoucine Barrou, Mohammed Benghanem Gharbi, Nisrine Bennani, Siham Bennani, Elisabeth Cassuto Farid Chehab, Abdelaziz Chlilek, Mohamed El Hassane Gharbi, Chafik El Kettani El Hamidi, Rachida Habbal, Malika Khabtou, Daniel Maroudy, Ghislaine Medkouri, Fathi Meziane, Benyounès Ramdani, Hicham Sbaï, Kenza Soulami, Nadia Tahiri Jouti and Mohamed Zamd; Mohammed V University of Rabat, Rabat, Morocco: Zaitouna Al Hamany, Rabia Bayahia, Abdelkader Belkouchi, Amine Benkabbou, Taoufik Dakka, Soukaina Doukkali, Mohamed El Hassane Gharbi, Ahmed Elhijri, Malika Essakalli, Mamoun Faroudy, Abdellatif Koutani, Mohamed Laaroussi, Said Moughil, Naima Ouzeddoun and Hakima Rou; University of Lund, Lund, Sweden: Peter Desatnik and Ehab Rafael; University Côte d'Azur, Nice, France: Patrick Jambou; University Hospital Freiburg, Freiburg, Germany: Klaus Michael Lücking, Przemyslaw Pisarski and Patrick Samson-Himmelstjerna; Donation and Transplantation Institute, Barcelona, Spain: Javier Aguirrezabalaga, Estephan Arredondo Cordova, Chloe Ballesté Delpierre, María Paula Gómez Gómez, Melania Istrate, Martí Manyalich Vidal, Gloria Páez, Patricia Peralta Lasso, Aneta Toncheva, Ricard Valero Castell and Juan Villar Gallardo; and University of Barcelona, Barcelona, Spain: Chloe Ballesté Delpierre, Ricardo Casaroli Marano, Melania Istrate, Martí Manyalich Vidal, David Paredes Zapata, Vicente Jose Torregrosa Prats and Ricard Valero Castell.

SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of the article.

Appendix S1. Questionnaire of existing training programmes in ODT.

Appendix S2. Questionnaire of Internet connection, digital facilities and competences.

Appendix S3. Questionnaire of training needs.

Appendix S4. Questionnaire of ODT activities in the ENPI countries.

Appendix S5. Questionnaire of accreditation requirements in the ENPI universities.

Appendix S6. Pre- and post-test of the donation e-learning module.

Appendix S7. Pre- and post-test of the transplantation e-learning module.

Appendix S8. Final dissertation evaluation chart.

Appendix S9. Hospital traineeship evaluation charts.

Appendix S10. IAFs evaluation chart on transplantation.

Appendix S11. IAFs evaluation chart on donation.

Appendix S12. Questionnaire of programme assessment.

Appendix S13. Questions for qualitative interview of project assessment.

Table S1. Activities included in the diagnostic study of the current situation.

REFERENCES

1. Matesanz R, Dominguez-Gil B, Coll E, de la Rosa G, Marazuela R. Spanish experience as a leading country: what kind of measures were taken? *Transpl Int* 2011; **24**, 333
2. Guide to the quality and safety of organs for transplantation, 7th Edition, 2016 European Directorate for the Quality of Medicines & HealthCare (EDQM), Council of Europe, ISBN: 978-92-871-8287-6.
3. International Registry of Organ Donation and Transplantation (IRODaT). Available at: https://www.irodat.org/. Accessed October 4, 2020.
4. Lennerling A, Lovén C, Dor FJ, *et al*. Living organ donation practices in Europe - results from an online survey. *Transpl Int* 2013; **26**: 145.
5. Consolidated text: Directive 2010/53/EU of the European Parliament and of the Council of 7 July 2010 on standards of quality and safety of human organs intended for transplantation. Available at: http://data.europa.eu/eli/dir/2010/53/2010-08-06. Accessed October 4, 2020.
6. Third WHO Global Consultation on Organ Donation and Transplantation. Striving to achieve self-sufficiency, March 23–25, 2010, Madrid, Spain. *Transplantation* 2011; **91**(Suppl. 11): S27.
7. Dominguez-Gil B, Delmonico F, Shaheen FAM, *et al*. The critical pathway for deceased donation: reportable uniformity in the approach to deceased donation. *Transpl Int* 2011; **24**: 373.
8. International Registry of Organ Donation and Transplantation (IRODaT). Available at: http://www.tpm.org. Accessed October 4, 2020.
9. Bousmah MA, Ventelou B, Abu-Zaineh M. Medicine and democracy: The importance of institutional quality in the relationship between health expenditure and health outcomes in the MENA region. *Health Policy* 2016; **120**: 928.
10. Manyalich M, Mestres CA, Ballesté C, Páez G, Valero R, Gómez MP. Organ procurement: Spanish transplant procurement management. *Asian Cardiovasc Thorac Ann* 2011; **19**: 268.
11. Manyalich M. Transplant Procurement Management – Donation and Transplantation Institute (TPM – DTI): a new formula to success in organ donation. *Transplant Journal of Australasia* 2013; **22**: 13.
12. Tempus Programme. Available at: https://eacea.ec.europa.eu/sites/2007-2013/tempus-programme_en. Accessed October 4, 2020.
13. De la Rosa G, Domínguez-Gil B, Matesanz R, *et al*. Continuously evaluating performance in deceased donation: the Spanish quality assurance program. *Am J Transplant* 2012; **12**: 2507.

14. Thomas M, Rentsch M, Drefs M, *et al*. Impact of surgical training and surgeon's experience on early outcome in kidney transplantation. *Langenbecks Arch Surg* 2013; **398**: 581.
15. Garcia VD, Miranda T, Luca L, Nothen R, Teixeira Pinto JB. Training hospital transplantation coordinators in Brazil. *Transplant Proc* 2007; **39**: 336.
16. Jawoniyi OO, Gormley K. How critical care nurses' roles and education affect organ donation. *Br J Nurs* 2015; **24**: 698.
17. Manyalich M, Guasch X, Paez G, Valero R, Istrate M. ETPOD (European Training Program on Organ Donation): a successful training program to improve organ donation. *Transpl Int* 2013; **26**: 373.
18. Domínguez-Gil B, Murphy P, Procaccio F. Ten changes that could improve organ donation in the intensive care unit. *Intensive Care Med* 2016; **42**: 264.
19. Salim A, Berry C, Ley EJ, *et al*. In-house coordinator programs improve conversion rates for organ donation. *J Trauma* 2011; **71**: 733.