Cost-effectiveness of an online interactive therapeutic patient education platform: Evidence from a randomized clinical trial for patients with end-stage renal disease

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Objective

This study presents a cost-effectiveness analysis *(CEA)* of an online interactive therapeutic patient education *(TPE)* platform compared to usual care for patients with end-stage renal disease *(ESRD)*, based on the PIC-r trial data over 18 months.

Methods

- The protocol has been published and is accessible by scanning the provided QR code.

Study population

- The CEA was designed as part of a multicenter, prospective clinical trial.
- ESRD or post-transplant patients were randomized 1:1:1 in i) a control group with no specific TPE program *(Control)*; ii) an intervention group with online TPE *(e-TPE)*; iii) an intervention group with online TPE coupled with community features such as a patient forum and a chat-room with both patients and health care professionals *(e-TPE+chat)*.

Cost and outcomes assessment

- Costs *(in 2022 euros)* were assessed from the French National Health perspective with an 18 months time horizon.
- Individual consumptions were provided by the local hospital Discharge database.
- A 2.5% discount rate was used.
- Patients completed the EQ-5D-5L™ questionnaire at baseline, 9 and 18 month after randomization.

Handling of protocol deviation and missing data

- Protocol deviations were seen in 142 patients *(72 and 70 in e-TPE and e-TPE+chat, respectively)*. Per protocol analysis *(PP)* was also carried out.
- Multiple imputation (*under the assumption of missingness at random)* using chained equations was employed to impute the remaining missing data by regression.

Cost-effectiveness analysis (CEA)

- ICERs were expressed in cost per Quality Adjusted Life Year *(QALY)* gained.

Additional statistical analyses

- Four models were estimated in both intention-to-treat *(ITT)* and PP analyses: Model 1: Multiple imputation using predictive mean matching; Model 2: Multiple imputation using linear regression; Model 3: Repeated measure mixed model; Model 4: Selection model *(under the assumption of missingness not at random)*.
- Uncertainty was handled by bootstrapping *(1,000 replications)* and cost-effectiveness acceptability curves *(CEAC)* were generated.

Results

Patient characteristics

- Among 539 patients, 180 (33.4%) received usual care (Control), 189 (35.1%) were in the e-TPE arm and 170 (31.5%) in the e-TPE+chat arm (*cf. Figure 1)*.
- Baseline characteristics were evenly matched across the three arms.

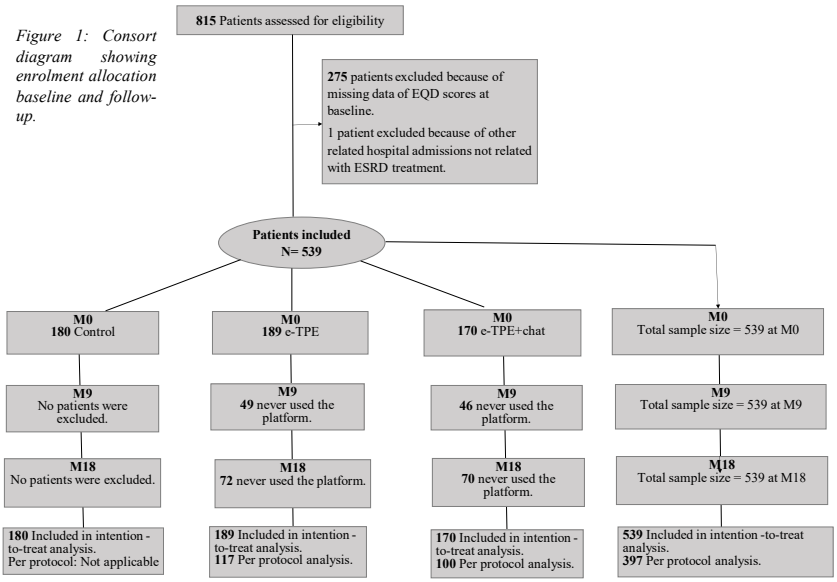
CEA results

- ITT analysis (*e-TPE versus control*)
  - Patients in the e-TPE arm had higher costs and QALYs than those in the control arm, resulting in mean differences in costs per patient of €503 (1,113), €732 (1,769), €699 (986) and €1,109 (4,236), respectively, for models 1, 2, 3 and 4 (*cf. Table 1 & Figures 2a-b).*
  - ICERs for models 1-4 ranged from €25,157 to €55,448 per QALY gained.
- PP analysis showed that e-TPE+chat vs. Control was both less costly and more effective (*cf. Table 1 & Figures 3a-b)*.

		Intention-to-treat *(ITT)* analysis				Per protocol *(PP)* Analysis			
		Model 1	Model 2	Model 3	Model 4	Model 1	Model 2	Model 3	Model 4
Difference in cost									
mean (SD)	e-TPE vs Control	503 (1,113)	732 (1,769)	699 (986)	1,109 (4,236)	819 (1,305)	878 (1,891)	1,253 (1,174)	786 (5,005)
	e-TPE+chat vs Control	211 (1,545)	3,515 (1,863)	3,993 (2,939)	5,362 (4,882)	-1,772 (930)	-2,915 (1,415)	-360 (1773)	-3,479 (3,934)
	e-TPE+chat vs e-TPE	-310 (1,618)	2,906 (2,380)	3,427 (3,046)	4,421 (4,886)	-2,657 (1,035)	-4,629 (1,672)	-2,273(2393)	-2,312 (4,479)
Difference in QALYs									
mean (SD)	e-TPE vs Control	0.02 (0.02)	0.02 (0.02)	0.02 (0.01)	0.02 (0.01)	0.02 (0.02)	0.02 (0.02)	0.02 (0.01)	0.02 (0.01)
	e-TPE+chat vs Control	-0.01 (0.02)	-0.01 (0.02)	-0,01 (0.01)	-0.01 (0.01)	0.01 (0.02)	0.01 (0.02)	0.01 (0.01)	0.02 (0.01)
	e-TPE+chat vs e-TPE	-0.02 (0.02)	-0.02 (0.02)	-0,02 (0,02)	-0.02 (0.02)	-0.01 (0.02)	0 (0.02)	-0.01 (0.02)	0 (0.02)
ICER									
€/QALY	e-TPE vs Control	25,157	36,597	34,936	55,448	40,939	43,882	62,699	39,312
	e-TPE+chat vs Control	Control dominant	Control dominant	Control dominant	Control dominant	e-TPE+chat dominant	e-TPE+chat dominant	e-TPE+chat dominant	e-TPE+chat dominant
	e-TPE+chat vs e-TPE	15,548	e-TPE dominant	e-TPE dominant	e-TPE dominant	265,755	e-TPE+chat dominant	227,365	e-TPE+chat dominant

Table 1: Results of regression for cost-effectiveness analysis. (€ 2022)

Figure 1: Consort diagram showing enrolment allocation baseline and follow-up.



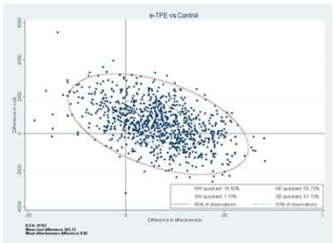


Figure 2a: Cost-effectiveness plane, ITT analysis (e-TPE vs Control model 1)

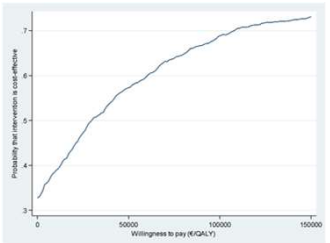


Figure 2b: Acceptability curve, ITT analysis (e-TPE vs Control model 1)

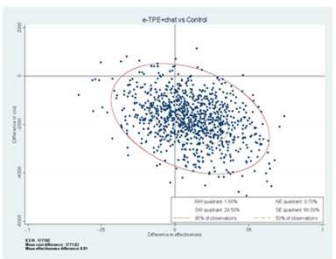


Figure 3a: Cost-effectiveness plane, PP analysis (e-TPE +chat vs Control model 4)

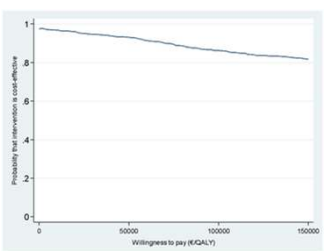


Figure 3b: Acceptability curve ,PP analysis (e-TPE+chat vs Control model 4)

Conclusion

- Results show that under an ITT analysis, e-TPE is CE for a WTP ranging between 25K€ and 56K€ while e-TPE+chat is only CE under a PP analysis. This indicates that community features should only be offered for patients most likely to use the platform.
- This calls for further analysis of patients' characteristics in order to help identify those most likely to benefit from these additional community features.

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Ethics

The study *(NCT03090828)* was approved by the Ile de France ethics committee *(CPP IDF IV)*, and by the national medicines agency *(ANSM)*. Authorisation for the consolidated patient database was obtained from the French data protection committee *(CNIL)* and registered as DR 2017–272.