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BACKGROUND: The recent Covid-19 Pandemic has underlined the need for a range of tools to ensure that people with acute or chronic diseases can keep in touch with care-givers, especially under emergency situations. The development and implementation of the EmERGE Pathway of Care, a new mHealth platform, in five European HIV clinics, integrated with their respective ICT systems, was the aim of this European Union Project [1].

OBJECTIVES HEALTH ECONOMICS: To estimate the efficiency of the implementation of EmERGE Pathway of Care for clinically stable PLHIV managed at five HIV Clinics. i) Before-and-after analysis to assess the use, cost and outcome of HIV service provision for medically stable PLHIV before and after implementation of EmERGE Pathway of Care. ii) To estimate the efficiency and additional benefits of the implementation of the EmERGE Pathway.

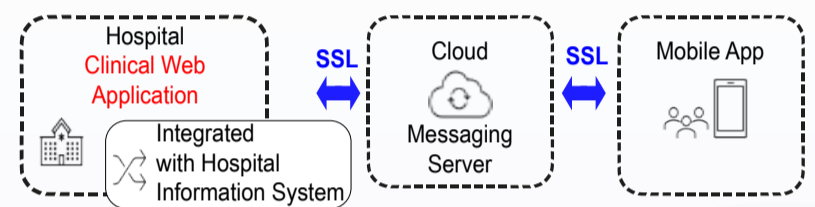
METHODS: i) **Process data** – use of HIV outpatient services by EmERGE participants collected from routine electronically held data one year pre- and one year post-EmERGE implementation to calculate mean use per patient-year (MPPY). ii) **Outcome data** – primary outcomes, CD4 counts and viral loads pre-and post- implementation of EmERGE. iii) **Cost data** – unit costs collected through four bottom-up and one top-down micro-costing studies performed in the five clinical sites. Unit costs were linked to the mean use of the services in a patient-year to calculate annual cost per patient-year (PPY) of services used by EmERGE participants. These were estimated in national currencies, then converted to OECD US\$ 2018 Purchasing Power Parities, while national 'wealth' was based on 2017 GDP Purchasing Power Parity. Efficiency was assessed using the incremental cost-effectiveness ratios (ICERs). The direct cost-estimates were from a public service perspective. iv) **Out of Pocket Expenditure** – Participants' out of pocket expenditure data were collected through completion of questionnaire at entry and exit of the study by them

RESULTS:

- 2251 participants were recruited and followed up between 2016 and 2019;
- 87%-93% participants were men, mean age at recruitment 41-47 years;

EMPLOYMENT AND OUT OF POCKET EXPENDITURE:

- 70-84% had full time employment, with a median 37.5 hours/week and monthly income \$1580;
- 5-16% participants received social services support median \$318-\$1,558/month.
- Median sick days three months before enrolment of participants was 0 days (IQR 0-1);
- 50-82% participants did not take days off to visit clinic
- The return trip to the clinic took a median 1.5-2.0 hours at a median cost between \$5-\$41.



USE AND COST OF OUTPATIENT SERVICES.

- The mean number of outpatient visits decreased in four sites from 9% at BSUH to 35% at HC-CHLC with reductions at UHID and ITM in between these ranges; for HC-IDIBAPS an 8% increase was observed (Table).
- Average outpatient services costs, including tests, procedures but excluding cost of ARVs, decreased between 5% and 33% for the clinics that saw a reduction in number of visits. At the HC-IDIBAPS annual cost for HIV outpatient services increased by 8% (Table);
- Adding the cost of ARVs to annual outpatient costs, increased these annual costs considerably in all sites (Table). Of the total annual HIV outpatient costs, 83%-91% of annual costs were due to ARVs.
- Across four sites the total annual costs of use HIV outpatient services were similar, but HC-CHLC, located in Portugal one of the least affluent countries, had the highest annual costs due to the highest ARV costs (Table).
- The least affluent country Croatia, pays as much for ARVs as the more affluent countries like Belgium, Spain and the United Kingdom (Table).

PRIMARY OUTCOME MEASURES: CD4 counts of Participants either remained stable or increased during the study period, while all participants became virologically undetectable shortly after entry to the study if there were not already, and remained undetectable for the rest of the study.

CONCLUSION: 1) The introduction of the EmERGE Pathway has been an efficient intervention. Annual costs in four sites decreased associated with a reduction in use of outpatient services. The increased cost at the HC-IBAB was due to internal organizational changes not related to the study. 2) Participants remained clinically stable after the implementation of the EmERGE Pathway; 3) Future efficiencies can be anticipated by extending the use of the Pathway to all PLHIV including those with comorbidities. If the use of EmERGE is extended, changes in the use, cost and outcome of these services should be monitored and evaluated. 4) ARVs were the main cost drivers for this stable group of PLHIV hence the overall reduction of annual costs that include ARV costs, have been small. 5) The price of ARVs needs to be relative to the wealth of the country. 6) The Covid-19 Pandemic has changed outpatient practices. mHealth tools like EmERGE can assist caregivers in successfully confronting such emergencies and in the long-term management of people living with HIV or other chronic conditions

Table. Average annual mean outpatient visits and average service cost per patient year (PPY) and 95% CIs based on 2018 US\$ PPPs

	pre-EmERGE		post-EmERGE		Percentage change
	PPY	95% CIs	PPY	95% CIs	
Institute of Tropical Medicine (ITM), Antwerp, Belgium					
Annual mean outpatient visits	2.6 (95%CI 2.4-2.8)		1.8 (95%CI 1.6-2.0)		31% decrease
Annual average service costs	\$1804 (95%CI \$1,730 - \$1,882)		\$1558 (95%CI \$1505 - \$1622)		14% decrease
Annual service costs & ARVs % of annual cost	\$13,281(95%CI \$13,207 – \$13,359) (86%)		\$13,035 (95%CI \$12,982 – \$13,099) (88%)		2% decrease
University Hospital for Infectious Diseases (UHID), Zagreb, Croatia					
Annual mean outpatient visits	4.0 (95%CI 3.8 – 4.3)		3.3 (95%CI 3.1-3.5)		17% decrease
Annual average service costs	\$2,143 (95%CI \$2,031 – \$2,260)		\$1,435 (95%CI \$1,352 – \$1,523)		33% decrease
Annual service costs & ARVs % of annual cost	\$12,814 (95%CI \$12,702 – 12,931) (83%)		\$12,106 (95%CI \$12,023–\$12,194) (87%)		6% decrease
Infectious Diseases Department, Hospital Clínic-IDIBAPS, (HC-IDIBAPS), Barcelona, Spain					
Annual mean outpatient visits	5.2 (95%CI 5.0 – 5.4)		5.6 (95%CI 5.4 – 5.8)		8% increase
Annual average service costs	\$1690 (95%CI \$1573 – \$1,822)		\$1,824 (95%CI \$1,707 – \$1,950)		8% increase
Annual service costs & ARVs % of annual cost	\$13,276 (95%CI \$13,159 – \$13,408) (87%)		\$13,410 (95%CI \$13,293 – \$13,535) (86%)		1% increase
Hospital Capuchos, Centro Hospitalar De Lisboa Central, (HC-CHLC), Lisbon, Portugal					
Annual mean outpatient visits	3.1(95%CI 3.0- 3.3)		2.0 (95%CI 1.9 - 2.1)		35% decrease
Annual average service costs	\$3,615 (95%CI \$3,577 – 3,648)		\$3,427 (95%CI \$3,400 - \$3456)		5% decrease
Annual service costs & ARVs % of annual cost	\$20,845(95%CI \$20,807 – \$20,878) (83%)		\$20,657(95%CI \$20,630 – \$20,686) (83%)		1% decrease
Brighton and Sussex University Hospitals NHS Trust (BSUH), Brighton, United Kingdom					
Annual mean outpatient visits	5.6 (95%CI 5.4-5.8)		5.1 (95%CI 4.9-5.3)		9% decrease
Annual average service costs	\$1,093 (95%CI \$1051 – 1,135)		\$987 (95%CI \$951 – \$1,026)		9% decrease
Annual service costs & ARVs % of annual cost	\$10,689 (95%CI \$10,646 – 10,730) (90%)		\$10,582 (95%CI \$10,546 – \$10,622) (91%)		1% decrease

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(1) Chausa P et al.: A New mHealth Solution for People Living with HIV. In: Henriques J., Neves N., de Carvalho P. (eds) XV Mediterranean Conference on Medical and Biological Engineering and Computing – MEDICON 2019. MEDICON 2019. IFMBE Proceedings, vol 76. Springer, Cham