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Economic Evaluation of Improving Medication Adherence for Secondary Cardiovascular Disease Prevention: A Threshold Analysis

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Background and Objective

❖Adherence to lipid-lowering agents is very important in patients requiring secondary prevention. The World Health Organization reported that adherence to long-term cardiovascular treatments is lower than 50% in developing countries, which hinders the achievement of treatment goals to prevent cardiovascular events[1].

❖To improve medication adherence, several innovative technologies (e.g., mobile applications, devices) have been developed. However, their clinical and economic value has not been investigated. It is unclear how much additional cost these new adherence-enhancing technologies may have in order to remain cost-effective in improving CVD patient outcomes.

❖This study aims to assess the threshold permissible cost of implementing new technology for improving medication adherence in secondary CVD prevention.

Methods

❖A threshold analysis, based on a cohort-level simulation of secondary CVD prevention, was performed to assess the permissible cost of potential technologies to improve adherence to optimal levels (which is derived from a meta-analysis of 51 randomized controlled trials[2]) in patients requiring secondary prevention.

❖This study was reported according to Consolidated Health Economic Evaluation Reporting Standards 2022 (CHEERS 2022) statement[3]. We developed a Markov model to project both direct medical, non-medical, and indirect costs in 2022 USD and outcomes of those patients in Mexico and Thailand, which can represent upper middle-income countries in Latin-America and Southeast Asia[4]. We engaged local stakeholders to enhance the relevance of our findings. The analyses were conducted from a societal perspective over a lifetime horizon.

❖We assessed incremental costs and effectiveness of achieving an optimal adherence compared to current levels of adherence, which were reported as 50% and 52.7% for Mexico and Thailand, respectively[5, 6]. The effectiveness of improving adherence was calculated based on the most recent network meta-analysis of RCTs and the effectiveness of current adherence was estimated based on a dose-response meta-analysis of lipid lowering therapy[7, 8]. Cost and utility inputs were obtained from literature review and validated through stakeholder engagement[9-12].

❖We estimated permissible cost of implementing new technology to improve medication adherence for cost-saving and cost-effectiveness, based on willingness-to-pay (WTP) thresholds of each country (1GDP/LY (currently USD$11,091) for Mexico; 160,000THB/QALY (USD $4,688) for Thailand).

❖A series of sensitivity analyses were performed.

Figure 1. Decision model

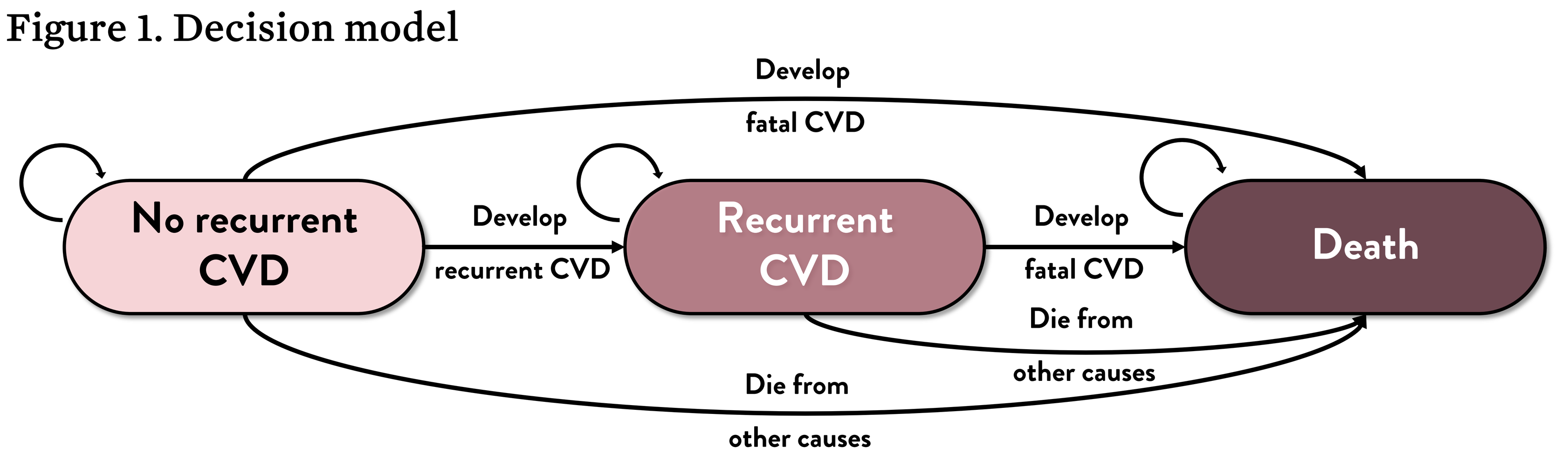


Table 1. Key input parameters

Input parameters	Mexico	Thailand
Perspective	Societal perspective	
Discount rate	5%	3%
Effectiveness		
optimal adherence (NMA of 51 RCTs)	88%	
adherence for status quo	50%	52.7%
RR of CVEs vs. Optimal adherence	1.224	1.207
Costs (in 2022 $USD)		
Direct medical costs		
lipid lowering therapy	$296	$28
non-fatal MI event	$11,474	$2,116
non-fatal MI subsequent	$1,723	$1,840
non-fatal stroke event	$6,375	$2,542
non-fatal stroke subsequent	$1,723	$2,328
fatal MI	$11,820	$6,841
fatal stroke	$10,819	$6,841
Direct non-medical costs	$4	$122
Productivity loss of illness	$102	$89
Productivity loss of premature death	Annual income, applied until 65 years old	
Utility weights		
alive without recurrent CVD	NA*	0.79
disutility after non-fatal MI	NA*	0.15
disutility after non-fatal stroke	NA*	0.23

*National guideline recommend to use life year as an effectiveness measure[13]
NMA, Network Meta analysis; RCT, Randomized controlled trial; RR, Relative risk; CVEs, Cardiovascular events; MI, Myocardial infarction

Results

❖Improving adherence to the optimal level reduced CVD events by 40 in Mexico and 34 in Thailand per 1000 CVD patients. This improvement resulted in 0.60 and 0.84 life-year gained, in Mexico and Thailand, respectively. Furthermore, it resulted in 0.68 QALY gain in Thailand.

❖The threshold analysis indicated that the lifetime permissible costs per patient for cost-saving were $416 and $219 in Mexico and Thailand, respectively. Considering country-specific WTP thresholds and incremental effectiveness (0.60 LY for Mexico and 0.68 QALYs for Thailand), lifetime permissible costs to be cost effective were $6,478 and $3,422, respectively.

❖The annual permissible cost per patient for cost-saving was $33 in Mexico and $15 in Thailand. In Mexico, permissible cost per patient per year for the technology to be cost-effective was $512, given the WTP threshold per life-year. In Thailand, this estimate was $230 annually, considering a WTP of $4,688 per QALY gained (Figure 2).

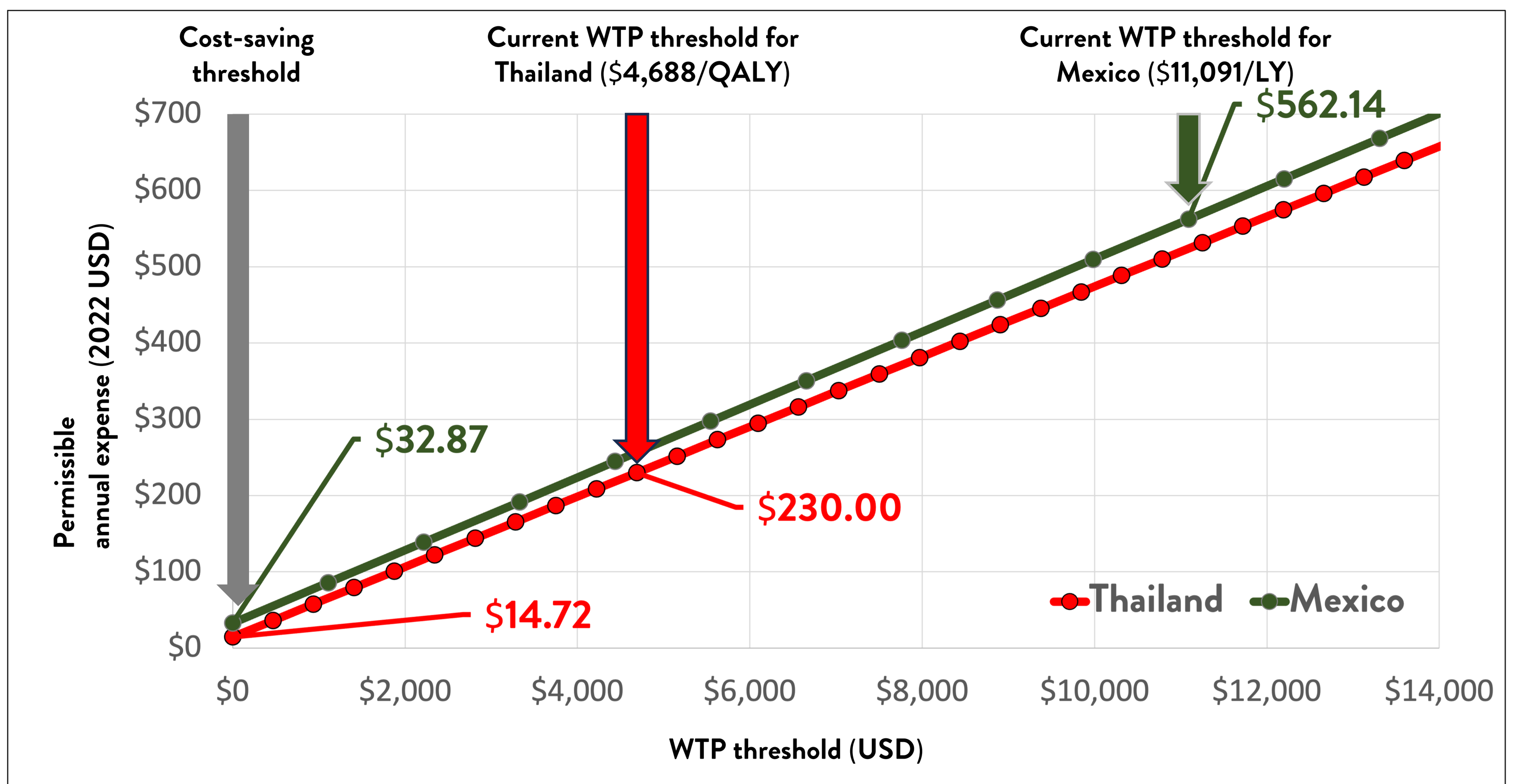
❖Cost-saving findings are robust across probabilistic sensitivity analyses with 100% of iterations remaining cost-saving. Furthermore, our findings remained cost-saving in most scenario analyses and deterministic sensitivity analyses except in applying increased lipid lowering therapy costs due to improved adherence in Thailand . When increased lipid lowering therapy costs in Thailand were included, the permissible expense of the technology to be cost-effectiveness was $214.94 per patient per year.

Table 2. Result of threshold analysis for permissible expense of technology per patient

	Mexico	Thailand
Lifetime Cost		
Direct medical costs ***saved*** (a)	-$382.60	-$289.68
Direct non-medical costs increased (b)	$2.56	$102.66
Productivity ***gained*** (c)	-$35.65	-$31.93
Lifetime incremental effectiveness (d)	0.60 LY	0.68 QALY
WTP threshold (w)	$11,091/LY	$4,688/QALY
Lifetime permissible expense of technology to be		
cost-saving*	$415.69	$218.95
cost-effective**	$6,477.51	$3,421.91

WTP, Willingness-to-pay; CVD, cardiovascular disease; LY, life year; QALY, Quality-adjusted life year * (a+c-b) ** (a+c-b))+d*w

Figure 2. Annual permissible expense per person by WTP threshold



WTP, Willingness-to-pay; LY, life year; QALY, Quality-adjusted life year

Discussion and Conclusion

❖This study showed the potential economic value of improving medication adherence in secondary CVD prevention from the societal perspective. Moreover, Our economic model is mainly based on network meta-analysis, which allow us to generalize our findings to different healthcare systems.

❖However, our study also has a major limitation due to theoretical input value of the 'optimal' medication adherence, which remains uncertain regarding whether it can be achieved through a specific intervention. Nevertheless, our input is based on the most recent meta-analysis of RCTs, which can be considered an optimal setting for ensuring medication adherence. Therefore, future studies are needed to estimate the economic value of a specific intervention with real-world evidence of improving adherence.

❖These findings support consideration of strategies by national healthcare systems to improve medication adherence (e.g., digital technologies or programs leading to behavior changes) in Mexico and Thailand.

References

1. WHO. Adherence to long-term therapies : evidence for action Geneva: WHO, 2003
2. Zhang et al. (2013) Clin Trials. 11(2):195-204
3. Husereau et al. (2022) Value Health. 25(1):3-9
4. Kongpakwattana et al. (2019) Pharmacoeconomics. 37(10):1277-86
5. Morales-Villegas et al. (2023) Arch Cardiol Mex. 93(1):77-87
6. Woodham et al. (2018) Journal of Health Research. 32(6):449-458
7. Chaiyasothi et al. (2019) Front Pharmacol. 22(10):547
8. Liu et al. (2021) J Cardiovasc Dev Dis. 8(11)
9. Carlos-Riviera et al. (2022) Cardiovascular and Metabolic Science. 33(2):52-63
10. Phrommintikul et al. (2022) Frontiers in Endocrinology. 13: article 824545
11. Tamteeranon et al. (2008) Economic evaluation of HMG-CoA reducatase inhibitor for primary prevention of cardiovascular diseases among Thai population
12. Jarungsuccess et al. (2014) Clin Ther. 36(10):1389-94
13. D.R. Consejo de Salubridad General (2017) Guia para la conduccion de estudios de evaluacion economica para la actualizacion del Cuadro Basico y Catalogo de insumos del Sector Salud en Mexico

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