

Health technology assessment of hyperphosphatemia management among hemodialysis patients in Lebanon

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SUMMARY

Hyperphosphatemia is a common condition among hemodialysis patients, and is associated with increased risks of morbidity and mortality and higher health care costs. Hyperphosphatemia is typically managed through a combination of hemodialysis treatment, phosphate binding medications and dietary phosphorus restriction; this approach is supported by clinical evidence. Given budgetary constraints, information about the value for money spent on health interventions is being used increasingly by decision makers to guide the efficient allocation of available health care resources. Health technology assessment (HTA), a form of policy research that systematically examines both the direct and indirect consequences of a health technology, provides relevant input to decision making in policy and practice. Specifically, economic evaluations, a part of HTA, compares health technologies in terms of costs and outcomes to assess their value for money.

As in many countries, hemodialysis is a major public health problem in Lebanon, and hyperphosphatemia management in this patient population remains an ongoing challenge. Moreover, as part of the public rehabilitation strategy for the health sector, the integration of HTA into the decision making process for national public health care has been advocated. However, to date, no concrete action was taken in this regard. Therefore, we aim in this dissertation to provide insights into the HTA of hyperphosphatemia management among hemodialysis patients and explore economic considerations in this regard, with a focus of the Lebanese setting.

The escalating clinical and economic burden of hyperphosphatemia, coupled with the high cost of its management on one hand, and limited healthcare resources on the other, provide the rationale for fostering the search for cost-effective interventions for managing hyperphosphatemia among hemodialysis patients. In particular, we first provided an overview of the cost-effectiveness of phosphorus-lowering interventions in this patient population. We then explored the financial burden of hemodialysis and hyperphosphatemia management through phosphate binders in Lebanon. Finally, we assessed the clinical and economic value of intensive nutrition education as a phosphorus-lowering intervention among Lebanese hemodialysis patients.

In **Chapter 2**, we conducted a systematic review of published economic evaluations of interventions aiming to manage hyperphosphatemia among hemodialysis patients; we provided a descriptive analysis and critically appraised these studies. All records included in our review addressed the comparative cost-effectiveness of phosphate binders, and we could not identify any study on different hemodialysis modalities, a low-phosphorus diet, or other types of interventions. We found limited evidence on the cost-effectiveness of non-calcium based binders in prevalent and incident patients, in first-line and sequential use. We could not generate firm conclusions due to the sub-optimal quality and heterogeneity of the included studies; moreover, there was a lack of studies addressing some clinical scenarios. In **Chapter 3**, we explored the societal cost-of-illness of hemodialysis and its drivers in Lebanon. We also provided insights into the financial burden of managing hyperphosphatemia through phosphate binders in this patient population in Lebanon. Our estimates

revealed a 6-month societal cost of hemodialysis of \$9,258, with 91.7% of this cost attributable to healthcare costs, 4.2% to patient and family costs, and 4.1% to costs in other sectors (transportation), highlighting the high financial burden of hemodialysis on Lebanese society and the Lebanese healthcare system. We also observed the high cost of managing serum phosphorus through phosphate binders, especially calcium-free agents. In *Chapter 4*, we evaluated the clinical effect of intensive nutrition education on hemodialysis patients suffering from hyperphosphatemia. We found that this intervention is superior to the existing practice in Lebanon and to another proposed alternative, in terms of increasing patients' adherence to a low-phosphorus diet and managing their hyperphosphatemia without compromising their nutritional status. Finally, in *Chapter 5*, we explored the economic value of this nutrition education in Lebanon, using several scenarios. We found that the cost of the intensive nutrition education was very low in comparison with the societal cost of hemodialysis and the costs of other health interventions in this patient population. We also noted that this intervention yielded the greatest decrease in use of resources and societal costs in comparison with the existing practice and the other alternative. However, we could not find any effect on quality-adjusted life-years, and the intervention was dominated by its comparators. In light of the significance between group differences in baseline key parameters (serum phosphorus and malnutrition inflammation status), interpreting our findings was challenging. We suggest further long-term evaluation of intensive nutrition education on equitable groups at baseline, using a modeling study.

The findings of this dissertation present several implications for clinical practice, for decision making in the sphere of public health, and for research, notably in local HTA. First, we provide additional high-quality evidence about the beneficial clinical effect of intensive nutrition education as a phosphorus-lowering intervention among hyperphosphatemic hemodialysis patients. Second, the results of this study provide insights for public health policy makers about the debilitating financial burden of hemodialysis in Lebanon and about the need for a rational allocation of resources for hyperphosphatemia management in this patient population. We also provide some concrete implications for the implementation of national HTA. Finally, this dissertation generates several directions for future research in the field of hyperphosphatemia management among hemodialysis patients, and in the field of HTA, specifically economic evaluations, in Lebanon.