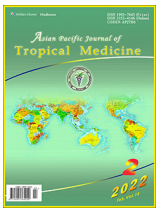

Letter to Editor

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Alternative mix-and-match COVID-19 vaccine administration *versus* standard vaccination for prevention of severe COVID-19: A specific cost utility analysis

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Till now, over 220 million people throughout the world have already been affected by coronavirus disease (COVID-19). Vaccination is the most effective strategy to prevent the spread of COVID-19[1]. Several pharmaceutical companies have announced the success of their COVID-19 vaccine study. Additional publications on the vaccine's efficacy and inoculation costs are available. When it comes to a new immunization, the cost and accessibility of the vaccine are crucial considerations[2]. In most cases, it is necessary to administer two intramuscular vaccine doses. While some scientists provide strategies for reducing the risk and overcoming the problem of insufficient COVID-19 vaccination supply by administering COVID-19 in a different way. Hence, a concern on utility of the new COVID-19 vaccine should be able to prevent overall COVID-19 and severe infection. The efficacy of COVID-19 vaccinations has been decreased due to the introduction of new variations of concern. Countries in disadvantaged regions have struggled to produce enough vaccine doses, and the development of new variations of concern has diminished the efficacy of existing COVID-19 vaccinations. The mix-and-match method, which employs heterologous vaccines in the first and second doses, may be able to address the issues raised[3]. Furthermore, this method has been related to an increase in cellular and humoral immune responses without a significant rise in negative side effects. As a result, this strategy has the potential to increase immunization effectiveness while also addressing vaccine shortages in low-income communities[3-5].

While implementing the new vaccination technique, the cost, feasibility, and safety are all significant factors to consider. In this study, the authors compare the cost-utility of alternative mix-and-match COVID-19 vaccine administration to routine vaccination in specific terms of preventing severe infection using publicly available data. The various immunizations accessible in a developing Asian region are re-evaluated. Primary data comes from the local ministry of public health (from the Department of Disease Control's Emergency Operations Center; available at https://www.prachachat.net/marketing/news-837033). Vaccination techniques that have been re-evaluated include standard and mix-and-match techniques. The studied standard techniques in this report are: (1) inactivated-inactivated vaccine; (2) viral vector-viral vector vaccine and (3) mRNA-mRNA vaccine. The studied mix-and-match techniques in this report are: (1) inactivated-viral vector; (2) inactivated-mRNA vaccine and (3) viral vector-mRNA vaccine. The pricing and availability of each vaccine are based on publicly available information (https://covid-19.kapook.com/view241253.html). The reported vaccine administration unit cost depending on the local situation is referred to. According to publicly available information, the cost of one dose of inactivated, viral vector, and mRNA vaccine is 26.18, 4.62 USD, and 17.07 Euro, respectively.

The authors used a cost-utility analysis[6] to assess the cost and value of all COVID-19 immunization regimens for specific prevention against severe infection that were evaluated. The reported vaccination efficacy for avoiding severe SARS-CoV-2 infection is mentioned in terms of utility. For cost allocation, the reported proposed vaccine price is employed, while the indicated protection rate is assigned as utility for cost-utility analysis. The cost per utility of each COVID-19 vaccination regimen were calculated, and the cost utility value of vaccine administration were compared. Table 1 shows the cost comparison of several vaccination regimens based on cost analysis. The most expensive vaccine regimen is inactivated-inactivated-viral vector vaccine, while the least expensive is viral vector-viral vector vaccine. Table 1 shows the cost per unit utility

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of various vaccination regimens based on cost utility analysis. The inactivated-inactivated vaccine regimen has the highest cost per unit utility, while the viral vector-mRNA vaccine regimen has the lowest. COVID-19 vaccine insufficiency continues to be an issue in many developing nations. It's challenging to come up with a new alternative approach of immunization. COVID-19 vaccine administration *via* a mix-and-match strategy could provide a solution to the problem. For a new vaccination administration technique in preventive medicine, a cost and value analysis is required. There are some cost utility findings when comparing different types of COVID-19 vaccinations, however there is little evidence on different vaccine administration tactics[7–9]. On the other hand, no research has been done on the COVID-19 vaccination schedul that combines different vaccines. Thus, the authors utilized a typical medical economics approach to examine the cost and value of the mix-and-match COVID-19 immunization regimens.

As previously stated, the novel COVID-19 vaccine's value should be judged on its ability to prevent both overall COVID-19 infection and severe infection[10]. Currently, the majority of published evidence focuses on the ability to avoid COVID-19 in general, rather than severe COVID-19, which is a real clinical issue[7–9]. Hence, a specific evaluation on prevention against severe COVID-19 is useful. If we consider severe form of COVID-19 is an actual problem at present, the specific analysis of utility of vaccination against specific severe infection will be useful. For reassessment on different vaccine regimens, there is a difference in the calculated cost-utility value. According to this study, a mix-and-match vaccination strategy may deliver a superior cost-utility ratio than a traditional immunization program. The viability of employing mix-and-match can be supported by this data. This finding in the present study with specific focus on severe infection is concordant with the cost-utility analysis with focus on overall COVID-19.

Table 1. Cost-utility analysis for several standard and mix-and-match COVID-19 vaccination regimen with specific focus on preventing severe infection.

Vaccination regimens	Cost (Euro)	Utility (%)	Cost-utility value (Euro)
Inactivated-inactivated	52.36	90.8	0.58
Viral vector-viral vector	17.16	94.1	0.18
mRNA-mRNA	34.42	100	0.34
Inactivated-viral vector	30.80	93.4	0.33
Inactivated-mRNA	43.34	100	0.43
Viral vector-mRNA	21.78	100	0.22

If a mix-and-match regimen is planned, an mRNA vaccine component is recommended. There should be no inactivated vaccine component, regardless of whether it is mixed and matched or not. Conclusively, the mix-and-match viral vector-mRNA vaccine regimen appears to be the best, according to the results of a cost-utility study. The inactivated-inactivated, on the other hand, should not be used.

Conflict of interest statement

We declare that we have no conflict of interest.

Authors' contributions

RM and VW has equal contribution in ideas generating, writing, analyzing and final approval for submission.

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