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Background

Pneumococcal diseases are bacterial infections caused by *Streptococcus pneumoniae* which range from invasive pneumococcal disease (IPD) with severity level of moderate to severe including meningitis, septicaemia and pneumonia to non-invasive pneumococcal disease with milder infections such as sinusitis and otitis media**.** According to World Health Organization (WHO) estimate, about 1.6 million cases of fatal pneumococcal disease occurred worldwide every year, typically in infants and the elderly. The incidence and mortality rates are described in pneumonia and IPD which are notably higher in developing countries with the majority of deaths taking place in sub-Saharan Africa and Asia.

In Malaysia, pneumonia is the second leading cause of death after ischaemic heart disease with 12.2% of 109,164 medically certified death in 2019 and remains the leading cause of death for females, accounting for 13.2% of death in 2019, 12.8% of death in 2018 and 14.1% of deaths in 2017. It was also estimated that the community acquired pneumonia incidence was highest in the youngest and oldest age groups. Pneumonia is the most common pneumococcal disease in Malaysia. *Streptococcus pneumoniae* is a significant pathogen which is responsible for community acquired pneumonia in Kuala Lumpur and potentially in the nearby Klang Valley areas with about 13.2% was reported among adult patients with community-acquired pneumonia at a major urban-serving hospital in Kuala Lumpur.

Pneumococcal vaccine has been developed since early 1900 and has evolved with time. It has been used to prevent pneumococcal diseases for more than three decades. At present, two different kinds of pneumococcal vaccines are available on the market are: (i) the 23-valent polysaccharide vaccine (PPV23) that is available since the early 1980s and (ii) two conjugate vaccines that are available since 2009, the 10-valent (PCV10) and the 13-valent (PCV13).[8] World Health Organization (WHO) recommends the inclusion of PCVs in childhood immunisation programmes worldwide[8] and Centre for Disease Control and Prevention (CDC) recommends routine administration of PPV23 for all adults 65 years or older.[9]

Recently, in Malaysia, immunisation for children less than two years old with the pneumococcal conjugate vaccine PCV10 has been added into the National Immunisation Programme beginning December 2020 for infants born from January 2020. This decision is deemed crucial and timely for Malaysia in combatting the increased incidence of pneumococcal disease in children in recent years. However, there is yet a national programme to be established for pneumococcal vaccination with PPV23 targeting the elderly in Malaysia albeit their increased risk of morbidity and mortality related to invasive pneumococcal disease.

Hence, this technology review was conducted to review the current best scientific evidence on pneumococcal vaccination with PPV23 for the elderly before its implementation in Malaysia.

Objective

The objective of this technology review is to assess the effectiveness, safety and cost-effectiveness of pneumococcal vaccination with PPV23 for elderly.

Methods

Studies were identified by searching electronic databases. The following databases were searched through the Ovid interface: MEDLINE(R) In-process and other Non-Indexed Citations and Ovid MEDLINE(R) 1946 to present. EBM Reviews-Cochrane Database of Systematic Reviews (2005 to December 2020), EBM Reviews-Cochrane Central Register of Controlled Trials (December 2020), EBM Reviews – Database of Abstracts of Review of Effects (1st Quarter 2020), EBM Reviews-Health Technology Assessment (1st Quarter 2020), EBM Reviews-NHS Economic Evaluation Database (1st Quarter 2020). Parallel searches were run in PubMed. Appendix 3 showed the detailed search strategies. No limits were applied to the search. The last search was run on 8 December 2020. Additional articles were identified from reviewing the references of retrieved articles. One of the tools used to assess the risk of bias and methodological quality of all the articles retrieved is the Critical Appraisal Skills Programme (CASP) checklist. All full text articles were then graded based on guidelines from the U.S./Canadian Preventive Services Task Force.

Results and conclusion:

From a total of 1137 titles identified through the Ovid interface,16 studies were included in this review which were consisted of systematic reviews with meta-analysis (six), cohort study (one), retrospective cohort study (two), cross-sectional study (one), quasi-experimental study (one) and cost-utility analysis (five). The included articles were published between 2016 and 2020. Most of the studies were conducted in countries such as Japan, South Korea, US, Spain, Europe and UK followed by studies conducted in Sweden as well as Australia for cost-utility analysis.

Effectiveness

There was good level of retrievable evidence to suggest that pneumococcal vaccination with PPV23 in elderly population had low to moderate efficacy against invasive pneumococcal disease (IPD) and pneumococcal pneumonia. Evidence on effectiveness of PPV23 against all-cause pneumonia and mortality were not statistically significant.

Safety

There was no serious adverse events and safety issues reported in the included studies.

Cost/Cost-effectivenes/Economic Implication

Cost analyses done in industrialised countries showed varying results depending on parameters and thresholds. The estimates of disease burden, vaccine effectiveness, cost assumptions and the effects of herd protection had the most influence on the results. For financial implication, assuming 100% coverage, introduction of pneumococcal vaccination with PPV23 for elderly ≥65 years old in Malaysia is estimated to have an economic implication of approximately RM 189 million to RM 345 million in the first year.

Organisational issues

Hospitalisation

Limited fair level of retrievable evidence to suggest that pneumococcal vaccination with PPV23 in elderly population reduced

all-cause inpatient hospital stays.

Guidelines

Various international organisations from industrialised countries recommend pneumococcal vaccination with PPV23 for the elderly and other high-risk groups. However, WHO stated that in resource limited settings where there are many competing health priorities, a higher priority should be given to introducing and maintaining high coverage of infants with PCV vaccine given the substantial effects of herd immunity in adult age groups following routine infant immunisation