UNIVERSITI TEKNOLOGI MARA

COST-EFFECTIVENESS ANALYSIS OF GAMIFIED-REALITY-VIDEO-OBSERVED-THERAPY (GRVOTS) FOR TUBERCULOSIS TREATMENT ADHERENCE IN SELANGOR AND NEGERI SEMBILAN

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ABSTRACT

The World Health Organization Global Tuberculosis Report 2023 indicates that Malaysia's tuberculosis (TB) incidence rose from approximately 97 per 100,000 population in 2021 to 113 per 100,000 in 2022, reflecting ongoing TB control challenges. Suboptimal TB treatment adherence continues to pose challenges to programme performance and long-term disease control. This study evaluated the cost-effectiveness of the Gamified-Reality-Video-Observed-Therapy (GRVOTS) mobile application, developed by the Universiti Teknologi MARA (UiTM) inventor team led by Dr Nurhuda Ismail, compared with Directly Observed Therapy (DOT) in improving TB treatment adherence in selected government healthcare facilities in Selangor and Negeri Sembilan. A multi-phase study design was employed, comprising secondary data analysis (Phase 1), cost-domain validation using a Modified Nominal Group Technique (Phase 2), and economic evaluation from the provider perspective (Phase 3). DOT data were extracted from the National Tuberculosis Registry (NTBR) for the year 2022, while GRVOTS patient data were obtained from an existing single-arm intervention dataset. TB treatment adherence rate was the primary effectiveness outcome and categorised as "adhere" and "not adhere." The GRVOTS group recorded 64 adherent patients (90.1%) and 7 non-adherent patients (9.9%), whereas the DOT group recorded 59 adherent patients (83.1%) and 12 non-adherent patients (16.9%) ($p = 0.313$). The annual provider cost of DOT across five facilities ranged from RM10,832.01 to RM40,421.74, with an overall mean of RM22,099.82 and a mean cost per patient of RM762.06. The total provider cost for GRVOTS ranged from RM63,594.70 to RM83,549.85, with an overall mean of RM72,723.72 and a mean cost per patient of RM36,361.86, reflecting the small number of GRVOTS patients managed per facility ($n = 1–4$). At the aggregate level, the incremental cost was RM50,623.90 with an incremental effectiveness of five additional adherent patients, resulting in an overall incremental cost-effectiveness ratio (ICER) of RM10,124.78 per additional TB treatment adherence achieved. Facility-level ICERs ranged from RM934.28 to RM11,110.03 per additional adherence, indicating variation according to clinic scale and patient volume. Overall, GRVOTS demonstrated improved TB treatment adherence compared with DOT, with economic performance influenced by implementation scale, supporting further consideration of GRVOTS as a digital adherence strategy within Malaysia's TB control programme.

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TABLE OF CONTENTS

CHAPTER 1
INTRODUCTION

1.1 Research Background

Tuberculosis (TB) is a serious public health problem that affects people worldwide. The World Health Organization (WHO) estimates that 10.6 million individuals worldwide were diagnosed with TB in 2021, an increase of 4.5% from the previous year(World Health, 2022) . This large number of cases demonstrates that TB is still one of the world's top causes of mortality. The disease is caused by the bacteria Mycobacterium tuberculosis, which primarily affects the lungs but can also affect other parts of the body. The disease spreads through the air when an infected person coughs, sneezes, or talks ((Natarajan et al., 2020). The WHO's End TB Strategy aims to reduce TB-related fatalities by 90% and new cases by 80% between 2015 and 2025.

In Malaysia, the TB burden remains a significant public health concern. According to the Ministry of Health (MoH) in Malaysia, the TB incidence rate increased to 97 per 100,000 population in 2021, compared to 80.88 per 100,000 population in 2019(Ab Rashid et al., 2023). However, the TB mortality rate increased from 3.69 per 100,000 population in 2019 to 7.01 per 100,000 population in 2021. (Ministry of Health, 2022) This means that while the number of new TB cases may be decreasing, the mortality rate is still high and requires further attention. A model projection by (Nurhuda, 2017) estimates that the number of TB cases in Malaysia will reach 300,000 by 2030. An increase in this estimation highlights the need for continued efforts to control the spread of TB in Malaysia.

1.1.1 Treatment Adherence and Compliance in TB Management

The World Health Organization (WHO) defines tuberculosis (TB) treatment adherence as the extent to which a patient takes anti-TB medication as prescribed, typically achieving more than 90% of the recommended doses under supervision (World Health Organization, 2017a). However, contemporary TB control strategies emphasize that adherence extends beyond pharmacological compliance. Optimal adherence is achieved when TB treatment is delivered within a comprehensive, patient-