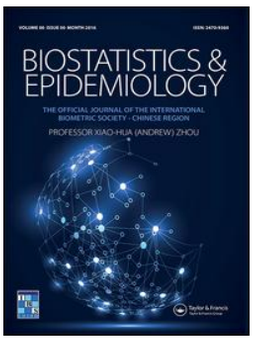

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RESEARCH ARTICLE

Modeling time taken to HIV testing and uptake of test results: extension of the PWP model to handle time-dependent covariates

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ABSTRACT

Improving HIV testing among the populations at high risk is one of the first steps to achieving the Sustainable Development Goal target of ending AIDS by 2030. This study aims to develop multivariate statistical models to describe the HIV testing behavior of most at-risk populations. HIV testing data of 5667 Female Sex Workers (FSWs) registered with the National HIV Prevention Programme in 10 districts of Sri Lanka during 2016 and 2017 were modeled using univariate and multivariate survival analysis techniques. As the proportional hazard assumption was violated, the Prentice Williams & Peterson (PWP) model was extended to include time-dependent covariates. The results show that the PWP gap time model and all univariate Cox Proportional Hazard Models generated consistent results. However, a higher number of effects of factors and their interactions were detected in the gap time model than in univariate models. The gap time model generated more precise estimates with lower standard errors compared to the total time model. The study concludes that the PWP model can be extended to handle time-dependent covariates. The PWP gap model is the more appropriate technique to model the time taken for HIV testing and subsequent clinic visit to uptake test results among Most at-risk Populations.

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KEYWORDS
HIV testing; multiple ordered events; extended PWP model; time-dependent covariates; multivariate survival model

1. Introduction and background

Globally, all nations work hard to realize the Sustainable Development Goal (SDG) of ending the AIDS epidemic by 2030 [1]. One crucial part of this plan is the early detection of HIV cases and bringing HIV treatment to all who need it. Research indicates that by 2012, less than 50% of key populations in many Asian and African countries do not know their HIV status [2]. It usually takes a few days to a few weeks to get the results of an HIV test, especially in developing countries. Therefore, follow-up clinic visits to receive HIV test results are also important to know the HIV status and act on it [3]. Studies have shown that in traditional HIV prevention programs nearly one-third of the patients screened for HIV usually fail to return for follow-up visits to uptake the test results [4]. Figure 1 illustrates the HIV testing behavior of FSWs.

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test results. It is important to identify high-risk FSWs with higher partner exchange rates at the time of registration and must provide a specific and more targeted prevention service package to the high-risk FSWs.

3.8. Limitations of the study

HIV testing behavior of FSWs also depends on the facility (STD clinics) and service provider-related factors such as location, waiting time, personal experience of the first visit, the effectiveness of pretest counseling, stigma, and discrimination, etc. However, this study did not focus on these facility-related factors and therefore were not included in model building.

4. Conclusion

The results conclude that the PWP model can be extended to handle time-dependent covariates when the proportional hazard assumption is violated. The study has further demonstrated the PWP gap model is more capable of detecting effects and hence has higher power of the test compared to univariate models. This is mainly because as, in general, multivariate tests provide cumulative evidence. In addition, the gap time multivariate model has performed better than the PWP total time multivariate model in terms of generating precise estimates resulting in narrow confidence intervals. Thus, the PWP gap model is more appropriate to model the time taken for HIV testing and subsequent clinic visits to uptake test results provided that the actual time of all clinic visits can be obtained from program data. Time-dependent covariates may indirectly measure the efficacy of the HIV prevention program on HIV testing. The individual effects and their interactions indicate that a common prevention program cannot be adopted for all FSWs but differential interventions should be thought of depending on their background and work setup. For instance, high-risk FSWs are less likely to test for HIV and uptake the test result, thus FSWs need to be categorized at the time of registration with HIV prevention programs and more intensive program need to be developed for high-risk FSWs.

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Disclosure statement

No potential conflict of interest was reported by the author(s).

Data availability

The data that support the findings of this study are available from the corresponding author on reasonable request.

Ethical approval

The research protocol and other related documents were submitted to the ethical review committee (ERC) of the Sri Lanka Medical Association (SLMA) for ethical approval and exemption for ethical review was received on 20th April 2018 (ERC – 18-007) as the study is based on the secondary data and there is no direct involvement of human participants.

Informed consent from the respondents

Not Applicable

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