

DEVELOPING A DATA MONITORING  
SYSTEM FOR METHADONE FLEXI  
DISPENSING (MFLEX) SERVICE USING  
MAHALANOBIS-TAGUCHI SYSTEM

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I hereby declare that I have checked this thesis and in my opinion, this thesis is adequate in terms of scope and quality for the award of the degree of Master of Science.

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I hereby declare that the work in this thesis is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at Universiti Malaysia Pahang or any other institutions.

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Thesis submitted in fulfillment of the requirements  
for the award of the degree of  
Master of Science

Faculty of Manufacturing and Mechatronic Engineering Technology

UNIVERSITI MALAYSIA PAHANG

FEBRUARY 2022

## ACKNOWLEDGEMENTS

I am very thankful to Allah SWT, with His willingness and blessing giving me the patience, strength, ability, and opportunity to allow this research work entitled ‘Developing a data monitoring system for methadone flexi dispensing (MFlex) service using Mahalanobis-Taguchi system’ to be complete in a short period. I would also love to describe my deepest commitment to my supervisor, Dr. Mohd Yazid bin Abu who consistently supports and contributing to me with his intuition and proficiency throughout this research work. I am honestly grateful to him for his invaluable productive critique which tremendously benefited my research work.

My deepest and outstanding gratitude to my parents and family for their valuable encouragement, financial, support, advice, opinion, criticism, and scrupulousness that help me perform this task more along with the period of my research until the achievement of this task. Again, thanks to all my colleagues and everyone that supported their interpretations, assistance, and direction for me during this research work development until it is fully ended. They will continually remain as the reason for my accomplishment.

Lastly, I have no uncertainty to say that, without this continuous guidance and valued help and instruction from time to time, I would not be capable to perform the entire task skillfully. My gratitude goes to all panels who contribute me their judgments and direction that have upgraded my ability and wisdom by their criticisms

Thank You Very Much.

## ABSTRAK

Program pendispensan methadone flexi (MFlex) merupakan salah satu komponen pengurangan bahaya bagi menangani isu HIV/AIDS dalam kalangan pengguna dadah suntikan dan pada masa yang sama menangani isu ketagihan opiat, khususnya heroin. Mengikut sistem sedia ada melalui laporan makmal ujian darah dan carta aliran methadone seperti yang ditunjukkan oleh klinik, ia tidak mempunyai penunjuk generik untuk mengelaskan pesakit yang sihat dan tidak sihat. Daripada itu, pesakit bagi program MFlex perlu melakukan 4 jenis ujian darah dan 4 jenis aliran dos methadone untuk melihat prestasi kesihatan mereka. Seterusnya, bagi mengesahkan bahawa pesakit mengalami masalah hati, doktor akan merujuk kepada parameter *Alk Phosphatase*, *ALT (SGPT)*, and *AST (SGOT)* dalam ujian darah dalam membuat keputusan. Walaupun parameter tersebut telah dibuktikan secara klinikal, terdapat keperluan untuk mempertingkatkan sistem tersebut dengan menentukan tahap sumbangan bagi setiap parameter melalui kaedah baharu. Masalah yang sama juga berlaku kepada aliran dos methadone. Memandangkan sistem yang sedia ada memerlukan penambahbaikan lagi ke arah pengelasan dan pengoptimuman, hasil pengesahan melalui data yang tidak diketahui iaitu pesakit methadone baharu akan menjadi kurang tepat. Klinik juga mengambil masa yang lebih lama untuk menentukan prestasi kesihatan pesakit dan kerajaan terpaksa menanggung sedikit perbelanjaan tambahan. Objektif kerja penyelidikan ini adalah untuk mengaplikasikan sistem Mahalanobis-Taguchi (MTS) dalam program MFlex. Data yang dikumpulkan diambil dari klinik Bandar Pekan dengan 34 parameter bagi ujian darah dan 16 parameter bagi dos methadone. Dua jenis kaedah MTS digunakan seperti *RT-Method* dan *T-Method* untuk pengelasan dan pengoptimuman masing-masing. Hasilnya, *RT-Method* dapat mengelaskan antara sampel yang sihat dan tidak sihat, manakala *T-Method* dapat menilai parameter penting dari segi tahap sumbangan untuk ujian darah dan dos methadone. Dalam pengesahan data yang tidak diketahui, 60 sampel yang tidak diketahui dalam ujian darah dan 24 sampel yang tidak diketahui dalam dos methadone telah disahkan menggunakan MTS. Kesemuanya mempunyai bilangan tahap sumbangan positif dan negatif yang berbeza untuk mencapai nilai MD yang lebih rendah. Terdapat 6 jenis pengubahsuaian untuk membuktikan penyelesaian yang dicadangkan dan pengubahsuaian jenis 6 telah dipilih sebagai penyelesaian terbaik. Kesimpulannya, seorang ahli farmasi dari klinik Bandar Pekan telah mengesahkan bahawa MTS mampu untuk menyelesaikan masalah pengelasan dan pengoptimuman dalam program MFlex. Oleh itu, ianya mungkin menarik sekiranya MTS lebih diaplikasikan dalam sektor penjagaan kesihatan seperti ia boleh diaplikasikan kepada pandemik yang melanda Malaysia pada masa kini iaitu kes *Coronavirus* (Covid-19) di mana ia boleh mengelaskan pesakit Covid-19 yang teruk, kematian dalam sebulan, dan tahap jangkitan.

## ABSTRACT

Methadone flexi dispensing (MFlex) program is one of the components of harm reduction to address HIV/AIDS issues among injecting drug users and at the same time address the issue of opiate addiction, especially heroin. According to the existing system through laboratory report of blood test and methadone trend chart as shown by the clinic, it does not have generic indicator for classifying the healthy and unhealthy patient. From that, patient under MFlex program is required to do 4 types of blood tests and 4 types of methadone dosages trends to observe their healthiness performance. Subsequently, to confirm that the patient has liver problems, a doctor will refer to the Alk Phosphatase, ALT (SGPT), and AST (SGOT) parameters in the blood test to make a decision. Although those parameters have been clinically proven, there is a need to enhance the system by determining the degree of contribution for each parameter through a new method. A similar problem also happened to the methadone dosages trends. Since the existing system need further enhancement towards classification and optimization, the results in the validation through unknown data which is new methadone patients would be less accurate. The clinic also takes a longer time to determine the patient's healthiness performance and the government has to bear some additional expenses. The objective of this research work is to apply Mahalanobis-Taguchi system (MTS) in the MFlex program. The data is collected at Bandar Pekan clinic with 34 parameters in the blood tests and 16 parameters in the methadone dosages. Two types of MTS methods are used such as RT-Method and T-Method for classification and optimization respectively. As a result, the RT-Method is able to classify between healthy and unhealthy samples, while the T-Method is able to evaluate the significant parameters in terms of degree of contribution for the blood tests and methadone dosages. In validation of unknown data, 60 unknown samples in blood tests and 24 unknown samples in methadone dosages have been validated using MTS. All of them have different number of positive and negative degree of contribution to achieve lower MD. There are 6 types of modification to prove the proposed solution and type 6 modification has been selected as the best solution. In conclusion, a pharmacist from Bandar Pekan clinic has confirmed that MTS is able to solve a problem in classification and optimization in the MFlex program. Therefore, it might be interesting if MTS is applied more in the healthcare sector such as it can be applied to the pandemic that hit Malaysia nowadays which is the cases of Coronavirus (Covid-19) where it can be classifying the severe patients of Covid-19, the deaths in a month, and the infection stage.

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