

Cost of Implementing Complex Community Intervention for Healthier Lifestyle at Five Health Clinics in Malaysia

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Research

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Abstract

Background

A complex community intervention for behavioural change through the use of behaviour change counselling provided by community health promoters (CHPs) and utilisation of an E-health platform was designed to address an increasing number of obese and overweight women entering pregnancy. This paper describes a cost analysis of this novel intervention.

Methods

The analysis was performed from a provider's perspective, and calculated in Malaysian ringgit (RM). Included were costs for purchase of clients' progress monitoring equipment, including anthropometric measurement and information technology (IT) equipment; training and education of the CHPs and other healthcare personnel; and cost of contact between the clients and the providers; excluding costs for intervention planning and resource development; and research costs.

Results

Assuming that the intervention is running at a steady state; utilising existing facilities; and does not require additional time; total cost was RM 445,725.51 and average cost per intervention per person RM 3,073.97. About 50% of the total cost was for the purchase of IT equipment, 17% for the maintenance of the system and the remainder for consumables, emoluments and utilities.

Conclusions

Findings of this study suggests that implementation of the intervention requires the provider to invest heavily in IT hardware and maintenance of the E-health platform. However, this analysis is likely an under-estimate of the actual cost as it was conducted from a provider's perspective only and the intervention was assumed to have matured and running at a steady state; which may not be the case as changes were undertaken during its implementation to allow for maximum outcome.

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Background

The rising burden of obesity has resulted in an increasing number of overweight and obese women entering pregnancy (Huda, Brodie, & Sattar, 2010)]. These mothers are more likely to have infants with increased birth weight, macrosomia, higher neonatal fat mass at birth and a host of other adverse neonatal outcomes (Cheney et al., 2018). Eventually, these children carry a greater risk of being obese and

developing related metabolic disorders such as diabetes and cardiovascular diseases later in life (Gaillard, 2015)(Glastras, Chen, Pollock, & Saad, 2018).

Diabetes imposes a large economic burden on the national healthcare system and is among the leading cause of morbidity and mortality. The Fourth National Health & Morbidity Survey (NHMS), showed that prevalence of diabetes has increased by 31.0% in 5 years, from 11.6% in 2006 to 15.2% in 2011 (NHMS, 2011). To date, the true adverse impact diabetes has on the nation's resources is unknown as studies on cost-of-illness and economic burden of diabetes in Malaysia is lacking. International Diabetes Federation estimated the global healthcare expenditure on diabetes for 2010 and 2030 to be at least at USD 376 billion in 2010, and USD 490 billion in 2030 (Zhang et al., 2010). The study also estimates that the annual healthcare expenditure on diabetes for Malaysia in 2010 is between USD 600,407,750 to USD 1,005,095,050, or 16% of total health expenditure, with a mean health expenditure of USD 325.24 per person. It was projected that the cost will increase to between USD 1,073,139,020 to USD 2,194,617,640 (44–54% increase) in 2030.

Evidence has shown that the risk of developing diabetes mellitus (DM) is much greater in obese than in lean individuals. Studies has shown that an increase in body mass index (BMI) of just 1 kg/m² or waist circumference (WC) of just 1 cm, was associated with an increase in risk of developing metabolic diseases (Bombelli et al., 2011). This finding has made loss of body weight and body weight maintenance, as well as reduction in WC an important part for prevention of diabetes.

Increasing awareness about improving health among young women of childbearing age to improve the outcomes of their health, and eventually that of their offspring has spurred efforts at preconception lifestyle interventions. Lifestyle interventions targeting diet, physical activity and behaviour change are recommended for the treatment and prevention of obesity (Apovian et al., 2015). The preconception period offers a valuable window of opportunity as women who are planning to conceive are more susceptible to lifestyle advice and interventions (Wekker et al., 2019)(Herzig et al., 2006).

To reach these women, the interventions need to be available at the primary care or community level. Within the Malaysian healthcare context, the most suitable centre to deliver provide such intervention would be the health clinics. However, given the resource constraints faced by most health clinics, clear estimates of the costs and staffing required to deliver such interventions are important. This paper presents the pragmatic, real-world costs of implementing a complex preconception behavioural lifestyle intervention for women of childbearing age, in community settings.

Methodology

Study population and study setting

This study is part of a bigger study looking into the effectiveness of a complex community intervention (the Jom Mama intervention) aimed at enhancing women's health through behaviour change prior to conception. A randomised controlled trial to test its efficacy was carried out in the district of Seremban, in

Negeri Sembilan, Malaysia, from December 2015 to December 2017. The trial was registered at the National Medical Research Registry (NMRR), protocol number: NMRR-14-904-21963 on 21 September 2015, and at Clinical.Trials.gov, Identifier: NCT02617693 on 30 November 2015. Ethical approval to conduct the study was obtained from the Ministry of Health Malaysia. Details of the intervention and study is published elsewhere (Skau et al., 2016).

The study population consisted of newly married or engaged women living in Negeri Sembilan, aged between 20 to 39 years, nulliparous, not pregnant at the time of signing the informed consent, own a smartphone, with either an Android operating system version 4.1 and above or iOS operating system 7.0 and above with internet access. Women that are undergoing treatment for type 1 or 2 diabetes mellitus and not residing in the district of Seremban was excluded from the study.

The women were randomly assigned to either intervention or control group. At the end of the study, 305 participants completed the intervention, 145 from intervention and 160 from control group. Both groups received care as usual with the intervention group receiving additional Jom Mama Intervention. The Jom Mama intervention consists of two components; interactions with a community health promoter (CHP) which is made up of three face-to-face meetings, three phone calls, and communication through Whatsapp group chat; and an E-health platform which consists of a mobile application (for the participants) and a web-based interface which can be accessed by the CHP (total of six contact points). Aim of the intervention was to provide support and help participants improve their lifestyle (i.e. physical activity, diet, etc.). Intervention follow-up period is eight months from randomisation/baseline. The CHPs received 40 hours of training prior to the intervention. Monitoring and support mechanism for the CHPs consisted of regular peer support sessions, refresher training sessions and other lifestyle related training such as nutritional course and physical activity course.

The purpose of this paper is to provide an estimate of the resources needed and the cost to provide the intervention at the health clinics. For this purpose, we assumed that 1) the intervention is assumed to have matured and is running at a 'steady state'; 2) implementation of the intervention utilises existing facilities and equipment, except for new equipment that were required specifically for this initiative and for monitoring of the clients' progress, such as tablets, computers, stadiometer and weighing scale; and 3) that the conduct of the intervention or contact points does not take up additional time, i.e. was done within the usual working hours.

We describe costs associated with becoming familiar with and managing the intervention (including start-up costs for training CHPs in intervention implementation) and costs associated with providing the six contact points to approximately 145 clients. Costs associated with conducting a research protocol are not reported here as we assume that the health clinics provides the intervention as part of their normal operating activities and not as part of a research study.

Cost data collection and cost data analysis

The cost analysis was performed from a provider's perspective, i.e. the Ministry of Health Malaysia calculated in Malaysian ringgit (RM) and therefore excluded client and societal costs (and savings) (Drummond, Sculpher, Claxton, Stoddart, & Torrance, 2015). Only the costs of training and providing the intervention is reported in this paper. Costs of planning the intervention, and other one-off costs of developing the resources used in the intervention (e.g. development of the e-health platform and other educational materials) were not included, as these are "sunk" costs that would not be incurred if it were to be replicated to other health clinics. Research costs associated with the trial, such as investigator time, data collection and data entry costs were also excluded from the cost analysis.

Only costs that accumulate within the trial period were included as the cost analysis was performed alongside the main trial. Other costs that was taken into consideration included the cost of monitoring equipment such as information technology (IT) equipment (computers and tablets), stadiometer, weighing scales and measuring tape, were included in the marginal costs, as, if the intervention were to be repeated, these equipment would be required for monitoring of the participants.

Costs were identified and valued as all intervention-related direct costs such as contact with primary and secondary healthcare provider. Implementation costs, including training and education of the CHPs and all relevant healthcare personnel, and the ongoing contact between the clients and the providers were included. The costs were categorised into fixed and variable costs. Fixed costs were defined as cost inputs that does not vary with the quantity of output in the short term and vary with time rather than quantity. They include furniture and equipment costs. Variable costs were defined as costs that vary with the level of output and included supplies, consumables and salaries. No discounting was applied to the costs in the second year as the intervention was carried out over the two years, and the cost data was collected accordingly as it was accrued. Cost data was sourced from project documents and accounting records. Using a top-down approach, the costs were calculated using an Excel costing tool developed by the research team.

Sensitivity analysis

A sensitivity analysis was performed to determine how the differences in the cost items affects the total cost under different set of assumptions. The baseline costs were compared to the variations in the parameters.

Results

Cost of the Jom Mama intervention

A total of 145 women completed all six contact points during the study period. The contact points were conducted at five health clinic in the Seremban district. The estimated total cost for the intervention at all the clinics was RM 445,725.51. Average cost per intervention was RM3,073.96 per person. The cost for purchase of new equipment constituted the largest cost item (49%), followed by maintenance cost (17%) and cost of consumables (14%). The costs were summarised in Table 2.

Table 1
Costs for the Jom Mama intervention

Cost inputs		Total (RM)	% of total
Fixed costs	Equipment	217,542.30	48.81
	Maintenance	78,050.00	17.51
Variable costs	Consumables	62,089.07	13.93
	Emoluments	51,560.51	11.57
	Utilities	36,483.63	8.19
Total cost		445,725.51	100.00
Cost per intervention		3,073.96	

Sensitivity analysis

As the main component in the intervention was the role of CHPs and the Jom Mama application (both web and mobile applications) to initiate and sustain behavioural change in the participants, sensitivity analysis was done based on variations in these parameters. Result of the sensitivity analysis was as in Table 2. By limiting the number of healthcare personnel involved in the delivery of the intervention, the total cost was reduced by 0.68%, whilst if the cost for the maintenance of the servers were reduced to RM1,800 a month, the total cost was reduced by 7.39%. Server maintenance of RM1,800 a month was the lowest amount accrued during the study period.

Table 2
Results of sensitivity analysis in RM.

Cost Category	Cost Item	Scenario 1 (RM)	Scenario 2 (RM)	Scenario 3 (RM)	Scenario 4 (RM)
Fixed costs	Equipment	217,542.30	217,542.30	217,542.30	217,542.30
	Maintenance	78,050.00	78,050.00	100,000.00	45,125.00
Variable costs	Consumables	62,089.07	62,089.07	62,089.07	62,089.07
	Emoluments	51,560.51	48,549.18	51,560.51	51,560.51
	Utilities	36,483.63	36,483.63	36,483.63	36,483.63
Total cost		445,725.51	442,714.17	467,675.51	412,800.51
Average cost per person		3,073.96	3,053.20	3,225.34	2,846.90
Scenario 1: Base case; Scenario 2: CHPs are the only healthcare personnel involved in the intervention; Scenario 3: maintenance cost for the server was at RM4,000 per month; and Scenario 4: maintenance cost for the server was at RM1,800 per month.					

Discussion

The result of this study shows that it costs the government of Malaysia RM445,726 to deliver a behavioural change intervention at selected health clinics would require an average of RM3,074 per person. The purchase of new equipment constitutes the largest cost item (48.81% of total cost), and maintenance of the servers for the web and mobile application came in second at 17.51%. This cost estimates highlights the need for substantial budget allocation for implementation of a complex community intervention that combines the use of information technology and a personalised behaviour-change approach.

The intervention calls for a personalised approach to behaviour change. Hence, devoting healthcare personnel time to the intervention could detract from other possible interventions to be implemented (opportunity cost). This is something that any healthcare provider interested in implementing the Jom Mama intervention should consider. Another consideration is the differential cost in implementing this intervention versus other interventions with similar outcomes.

Our analysis identified several potential areas for cost savings that could be considered to reduce the overall implementation cost. Some of the implementation costs, such as server maintenance for data storage, training of the CHPs, service delivery and venue depends on how the intervention is to be implemented. Our analysis of the different implementation scenarios illustrates this. By limiting the number and type of personnel involved in the intervention, and if the data can be stored and managed at existing healthcare provider's data centre, the cost could be reduced further. Thus, a more careful analysis

prior to implementation would be recommended. However, potential cost savings from limiting the number of healthcare personnel involved in the intervention should not lead to a reduction in quality of intervention.

For this analysis, we assumed that the health clinics will be able to implement this intervention within current setting and operations. However, many facilities experience high staff turnover rate, which would require additional training and thus incur extra cost. In addition, our analysis did not take into account the cost of developing the e-health platform. However, as this is a one-off cost, it is therefore would not be significant in a wider roll-out.

Limitations

This study has several limitations. The first one is that the total cost could have been underestimated as it is conducted from a provider's perspective only. Additional cost analysis from different perspectives should be considered to enable a more comprehensive conclusion. Different perspective of cost, i.e. societal perspective that takes into account changes in behaviour, lifestyle improvement or quality of life of the clients would be a better outcome to be measured in the study. Some cost for peer training during the earlier phase of the intervention were not included in this analysis. Limitations arises as there were no formal mechanism to record the session, which may have led to underestimation of costs.

Second, the assumption that the intervention has matured and is running at a steady state could have led to an under-estimation of the total cost. The trial had few changes along the course of its implementation to allow for maximum intervention outcome. This has proven to be a challenge in data collection. As this cost analysis is a tag-along project, minute and detailed changes needed to be recorded to ensure context and every aspect that incurred costs were calculated. Ideally, cost for data management, validation and quality checks should also be included as part of running the intervention as well, as part of the monitoring and evaluation (M&E) plan. To allow a smooth implementation of the intervention on a larger scale, M&E plan should be taken into account as part of the overall implementation plan.

Recommendations

The Jom Mama intervention could potentially lead to a decrease in the NCD incidence in Malaysia. However, before nation-wide roll-out of the intervention, service providers are recommended to search for alternative ways to provide the service at a more sustainable cost. As economic strategies are one of the key factors for long-term sustainability of eHealth initiatives (Rosis & Nuti, 2018), it is also important to conduct further analysis to assess the sustainability of the intervention.

Conclusion

This study provides information on the costs of providing a complex community intervention to prevent the development of NCDs. Total cost for the programme was high, with an average cost of RM3,074 per person. The high cost was mainly due to expenses related to IT (hardware and maintenance). Further

data on the effectiveness of the intervention is required to be able to draw conclusions on its cost-effectiveness that will enable policy-makers to make decisions on implementation of the Jom Mama programme.

Declarations

Ethics approval:

This study was approved by the Medical Research and Ethics Committee (MREC) for the Ministry of Health Malaysia on May 11, 2016.

Consent for publication:

The Deputy Director General of Health's approval for publication was obtained prior to submission.

Availability of data and materials:

Data will be available on request by e-mailing the corresponding author.

Competing interests:

The authors declare that they have no competing interests.

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Not applicable

Authors' contributions:

NHAH is Principal Investigator and led the write-up of this paper with input from NSAB and NAZ. All authors contributed to the intellectual development of the proposal described and read and commented on drafts of this paper. All authors read and approved the final manuscript.

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