

Increasing The Utilization Of Well-Baby Screening In Primary Health Care Centers Using Two Nudging Techniques: Randomized Controlled Trials

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Abstract

Background: Well-baby visits provide opportunities for early disease detection and prevention. However, the adherence to such visits is suboptimal. This issue could be improved by nudging techniques, which could save the healthcare system enormous direct and indirect costs. The objective of the current two randomized controlled trials was to assess the effects of defaults and text message framing on parents to increase the uptake of well-baby visits in Saudi Arabia.

Method: Two single-blinded, randomized controlled trials examined the efficacy of the default option and framed messages in child's attendance to the well-baby clinic.

Study 1: For the default, participants (N = 250) were randomly and equally assigned to either control or intervention group which received auto-scheduling. The control group did not receive appointment. The main outcome was percentage of attendance to the clinic.

Study 2: For the framing study (N = 378), three types of messages were randomly assigned to participants to test the framing effect against the control group. The main outcome of this study was percentage of booked appointments. Chi-square tests assessed the statistical differences in both studies.

Results: Study 1: The result indicates a significant difference in the well-baby clinic attendance between the default and the control group ($X^2 = 19.5$, $p < .001$). The intervention group had 20% attended appointments versus 2.4% in the control group

Study 2: The chi-square test shows that only the authority-framed message had a statistical difference compared to the control ($X^2 = 5.7$, $p = .017$). No difference was detected between the three types of messages.

Conclusion: Nudges such as default and framing are a promising approach to improve public's engagement with health services. Policymakers should consider behavioral insights when designing and implementing public health programs.

Keywords: well-baby - Primary health care centers – Saudi Arabia.

Introduction

Childhood is a time of accelerated growth and change (Novak & Morgan, 2019). Many medical organizations, including the American Academy of Pediatrics, encourage families to adhere to frequent well-baby visits (Hagan et al., 2007), as such visits provide opportunities for early disease detection, anticipatory growth guidance, and general health promotion. Evidence has shown that early detection of conditions enables early intervention, which optimizes child's health outcomes (Jonas et al., 2018; Sampson & Thompson, 2017; Sonuga-Barke et al., 2011).

In the same vein, the Ministry of Health (MOH) in Saudi Arabia has launched a dedicated public health program to promote well-baby visits for all children up to age of five. MOH's guidelines, known as the "Health Passport", provide parents with a printed year-by-year schedule at baby's birth to help them follow medical recommendations. The well-baby clinics are widely accessible and are free of charge at the primary health centers (PHC) across the country. In each visit, a complete physical exam is conducted to screen an array of conditions, including vision, hearing, oral, and developmental health (Ministry of Health, 2021).

Despite official recommendations, the improved access to the service through online booking, and the availability of clinics, there is a suboptimal utilization rate. Data from MOH shows that majority of parents do indeed adhere to the well-baby visits during the first two years of the child's age as these visits are bundled with compulsory vaccinations (internal confidential report, Sep 2021). However, uptake drops for the 3rd, 4th, and 5th year visits. Potential reasons for this low uptake may include failure to recall, lack of motivation, and poor knowledge. Research by Aldayel and colleagues (2020) surveyed a sample of Saudi parents to assess their knowledge of important developmental milestones for their children and found that 80% showed poor knowledge. Parents and patients frequently fail to adhere to policies that are in their best interest because they lack the ability or willingness to learn about the effects of that health policy on their health, or because the framing of the issue makes it seem trivial (Jenssen et al., 2019). Notably, well-baby visits are not mandatory, and parents are not obligated to do these checkups until their children need a health checkup for school registration, which could leave a gap of 3-4 years without any visit.

Principles of behavioral economics can be utilized to address this issue and to enhance the uptake of well-baby visits. Many studies have examined the effect of different nudges to help parents make better decisions for their children (Abhyankar et al., 2008; Binder et al., 2020; Mac Iver et al., 2021; Reiter et al., 2012). Blumenthal-Barby and Opel (2018) investigated the positive impact of applying behavioral insights in different settings, including encouraging parents to vaccinate their children, encouraging mothers to breastfeed their newborns, and reminding parents to administer medications for their children.

Delehanty and colleagues (2020) examined the effect of gain and loss framed messages in encouraging parents to screen their children for autism and found that loss-framed messages were more effective. Contrarily, a randomized controlled trial assessed the effect of four different message framings to promote vaccines to parents and found no effect (Nyhan et al., 2014). Moreover, another randomized trial studied the effect of applying defaults to encourage parents to enroll in a text-based learning program and found that 88% of the intervention group stayed in the program compared to only 1% in the control group who wanted to be enrolled in the program (Gennettian et al., 2020).

Experimenting different approaches to enhance policy implementation with insights from behavioral sciences could provide important lessons. Nudging parents to follow up with the well-baby visits could save the healthcare system enormous direct and indirect costs. In this study, two randomized controlled trials were conducted to study the effects of defaults and framing on parents to increase the uptake of well-baby visits within the Saudi Context

Research question 1: Do default appointments increase the attendance rates in the well-baby clinics?

Research question 2: Which type of message framings is more effective in increasing appointments booked in the well-baby clinics?

Understanding these mechanisms can help policymakers improve this accessible yet underutilized service at a national level, which can lead to significant health and economic outcomes.

METHODS

Participants

Mawid smartphone application was used to draw participants and implement the intervention. Mawid (Arabic for appointments) is the official Ministry of Health's platform for all residents to book and manage their health appointments. Citizens and non-citizens must use this platform to access public non-emergency health services. Data from Mawid provided the study population, which included all children who attended any medical appointment in one of the PHCs in Cluster 1 Health Administration in Riyadh, Saudi Arabia, without specifying any timeframe in the past. The inclusion criteria were: 1) children whose default PHC was within Cluster 1 (Riyadh), which had been set by one of the parents for all independent family members, typically based on geographical proximity to home; and 2) children who had just turned 36 months (3 years) between May 15-June 14, 2021, at the time of the study. Children who just turned 3 years were the target population, as they would be due for their first well-baby visit after the mandatory vaccinations in the first two years, where the major drop of attendance usually occurs. Those older than 36 months were excluded to avoid the possible overlap with late visits of 36-months visits. Children were selected randomly from the study population through the randomization function in Excel sheet.

IRB Statement

This study was reviewed and approved for research with human subjects by Princess Nourah Bint Abdul Rahman University Institutional Review Board (IRB # 22-0388).

Study 1

Objective & Design

This study followed a single-blinded, randomized controlled trial design to examine the efficacy of the default option in child's attendance to the well-baby clinic. According to Abu-Bader (2011), a minimum sample size of 88 participants is required to achieve a power of .8 to detect a medium effect size (.3-.5), given a two-tailed alpha of .05, and two intervention groups (degree of freedom = 1).

Procedure

Data extracted from Mawid included parents' cell phone numbers. Participants were randomly and equally assigned to either control or intervention group through the randomization function in Excel sheet. Parents of children in the intervention groups received an introductory SMS to inform them that they would soon receive an appointment for their child in the well-baby clinic at the default PHC because their child has just turned three years old. This introductory notification was sent to avoid any future surprise and ambiguity, as default appointments are not a common practice, and parents would usually book their own appointments. The following SMS was sent on a weekday around noon to ensure an optimal time for recipient's attention, "Greetings! Happy 3rd birthday for your child! Because of how critical this age is for early disease prevention, and to reassure all of us, we were keen to book your child an appointment at the well-baby clinic. You will receive the appointment details in the coming days. See you soon, Ministry of Health." Two days after this message, researchers from the behavioral insight team manually booked appointments for the intervention participants in the well-baby clinic at their default PHCs. When there was no available appointment at the default PHC, the team booked the appointment at the closest PHC to the default one. The appointment was scheduled within a week in the future to allow parents sufficient time to attend. After the appointment was booked, an automated, system-generated confirmatory SMS was sent to participants with all details (e.g., date, time, location of appointment etc.). Participants could reschedule or cancel the appointment as they wished.

The control group did not receive any reminder nor appointment alert, which is "business as usual".

Data Analysis

The main outcome of the study was the percentage of attended appointments in each group. This outcome was extracted from Mawid by checking the national ID of each participating child to determine the status of the appointment (show, no-show). Chi-square test was used to assess the statistical significance in the count of attended appointments in both groups. Fisher's exact test was used when assumptions of chi-square were not met. SPSS v. 23 was used to analyze the data, and significance was set at $p < .05$.

Results

Participants (N = 250) were assigned equally into intervention (n = 125) and control (n = 115). The result of the Fisher's Exact test indicates a significant difference in the well-baby clinic attendance between the two groups ($p < .001$). The intervention group had 20% attended appointments versus 2.4% in the control group (Table 1).

Table 1. Fisher's Exact Test Comparing the Number of Visits between Intervention and Control

Group	Attending Appointment		Fisher's two-tailed p
	No	Yes	
Control	122 (97.6%)	3 (2.4%)	< .001
Intervention	100 (80.0%)	25 (25.0%)	
Total	222 (88.0%)	28 (11.2%)	

Study 2

Objective & Design

This study followed a single-blinded, four-arm randomized controlled trial to examine the efficacy of three message framings on appointments booked for well-baby clinics. A minimum sample size of 122 subjects is required to achieve a power of .8 to detect a medium effect size (.3-.5), given a two-tailed alpha of .05, and 5 intervention groups (degree of freedom = 4) (Abu-Bader, 2011).

Instrument

The intervention messages were informed by cognitive biases, namely the MINDSPACE framework (Dolan et al., 2010; Reñosa et al., 2021). The messages used loss aversion, social norms, and the messenger effect. Loss aversion is one of the common biases that influence one's decision-making processes by emphasizing losses associated with a given behavior (Li et al., 2021). In addition, the impact of social norms operates through humans' tendency to be part of a group, which can lead to behaviors that are practiced solely to fulfill this need (Cookson et al., 2021). Also, given that humans are heavily influenced by who communicates information (Dolan et al., 2010), the messenger effect was utilized as a potential force that could nudge participants towards the desired behavior.

These messages had undergone thorough delineation and multiple revisions from the research team at the Nudge Unit to ensure cultural sensitivity and lingual accuracy. To remove any frictions that could hinder participants from booking their appointment to get the vaccine, all messages concluded with a direct link to book the clinic appointment (the link is universal for all types of smartphones to ensure inclusivity). Adding the booking link ensured directing participants to the desired behavior immediately after reading the message, the cue. Table 2 shows the content of each message.

Table 2. The SMS Used in the Intervention

Bias	Text
Loss aversion	Your child has completed his third year, and due to the importance of discovering diseases and disabilities at this age through the 3-year screening, book an appointment now at the well-baby clinic through the Mawid app: [universal direct link]
Social norms	Many children have benefited from the availability of the 3-year screening in healthcare centers. Your child can also benefit from this screening. Book an appointment now at the well-baby clinic through Mawid app: [universal direct link]

Authority	According to the instructions of the Ministry of Health, It's time for your 3-year-old screening. Book an appointment now at the well-baby clinic through Mawid app: [universal direct link]
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Procedure

Children's data were extracted from Mawid, which included parents' cell phone numbers and the child's national ID to determine the age eligibility. Participants were randomly assigned to one of the three intervention groups or the control group. For those in the intervention groups, the text messages were sent to the linked cell phone numbers on a Tuesday around 12:30 PM to ensure an optimal time for recipient's attention, taken into consideration the work time and cultural aspects in Saudi. The control group did not receive any message, which is "business as usual".

Data Analysis

The main outcome of the study is the percentage of booked appointments in the well-baby clinic. This outcome was extracted from the national booking system, Mawid, by checking the national ID of each child. Chi-square test was used to check the statistical significance difference in the count of booked appointments by study groups. Fisher's exact test was used when assumptions of chi-square were not met. SPSS v. 23 was used to analyze the data, and significance was set at $p < .05$.

Results

The results of the chi-square tests indicate that there is only one significant difference when comparing the control versus each of three intervention groups (Table 3). Those who received the authority framing booked significantly more appointments in comparison to the control group ($X^2 = 5.7$, $p = .017$). Loss aversion and social norms did not result in statistical significance when compared to the control regarding appointments booked (two-tailed Fisher's $p = .445$ and $p = .445$, respectively). To explore any differences between the three treatment framings, each framing was compared to the other two. There was no statistically significant difference between the three framings (Table 3).

Table 3. Comparison of Boked Appointment between Control and Intervention Groups

Group	Booking Appointment		X^2	p	Fisher's two-tailed p
	No	Yes			
Loss Aversion	95 (95.0%)	5 (5.0%)	-	-	.445
Control	98 (98.0%)	2* (2.0%)			
Total	193 (96.5%)	7 (3.5%)			
Social Comparison	95 (95.0%)	5 (5.0%)	-	-	.445
Control	98 (98.0%)	2* (2.0%)			
Total	193 (96.5%)	7 (3.5%)			

Authority	90 (90.0%)	10 (10.0%)			
Control	98 (98.0%)	2 (2.0%)	5.7	.017	-
Total	188 (94.0%)	12 (6.0%)			

* Fisher's Exact Test is used due to violation of the assumption of cell expected count

Comparisons between Intervention Groups

Social comparison	95 (95.0%)	5 (5.0%)			
Loss Aversion	95 (95.0%)	5 (5.0%)	1	1	-
Total	190 (95.0%)	10 (5.0%)			
Social comparison	95 (95.0%)	5 (5.0%)			
Authority	90 (90.0%)	10 (10.0%)	1.8	.17	-
Total	185 (92.5%)	15 (7.5%)			
Loss Aversion	95 (95.0%)	5 (5.0%)			
Authority	90 (90.0%)	10 (10.0%)	1.8	1.7	-
Total	185 (92.5%)	15 (7.5%)			

Discussion

The current study assesses the efficacy of the default and framing nudges in improving families' attendance to well-baby clinics. The first study reveals that default booking is an effective technique in nudging parents to adhere to recommended guidelines.

Evidence from the literature shows that different nudges have different effectiveness (Patel, 2018; Reñosa et al., 2021). One of the most effective ones is directing behavior through a default option (Patel, 2018). Defaults are socially acceptable and strongly effective under two conditions: 1) when the targeted group shares a common harmonious benefit and interest, and 2) when choices are not restricting, and people's autonomy are preserved (Carroll et al., 2009; Johnson & Goldstein, 2013). Defaults can influence decision-makers to believe that the defaulted choice is a policymakers' recommendation, implying a preferred action. Another mechanism the gives default options their powerful effect is through inertia. Inertia is when people prefer to keep what they have and resist changes to their usual business as human behaviors typically follow the path of the least resistance (Leonard, 2008). By setting a choice as default, the user is alleviated from the behavioral and cognitive burdens that accompany the decision-making process. Therefore, default appointments typically work as they free individuals from associated burdens.

Defaults have been employed in different contexts, such as organ donation registration, insurance plan, and retirements savings. For instance, countries who adopt the default (opt-out) donation policy have the highest number of registered donors (Carroll et al., 2009; Huang et al., 2018; Johnson & Goldstein, 2003). In addition, healthy food interventions have studied the representation of vegetarian menu as a default and their consumption was

increased significantly (Hansen et al., 2021). In the context of the current study, default scheduling removed many frictions, like filling forms or calling for booking, so it made it seamless and effortless for people to adhere to the desired behavior. According to the EAST framework for behavioral change, making desired behaviors easy is one of the cornerstones of successful behavioral interventions (M. Hallsworth et al., 2014). Defaults overcome decision bias where people are passive and have less time and attention to decide (Giubilini et al., 2019; Johnson & Goldstein, 2003; Johnson & Goldstein, 2013).

Although there are limited studies about the effect of auto-scheduling on people behavior, research in healthcare policies shows that people have a strong tendency to prefer the default choice that is allocated to them. For example, vaccination rates are strongly influenced by default (Giubilini et al., 2019; Michael Hallsworth et al., 2016; Johnson & Goldstein, 2013). One study similar to the current study found that 45% of participants who were auto scheduled for a flu vaccine have attended their appointment and got vaccinated (Chapman et al., 2010).

The second study in this research showed that parents who received an authority framed message were the most in utilizing well-baby services. Human reaction to information is strongly influenced by the perceived authority of the messenger. Studies shows that individual's behavior is greatly influenced when the information is communicated by experts or healthcare professionals (Dolan et al., 2010; Webb & Sheeran, 2006). However, a study by Deslatte (2020), found that during COVID-19 pandemic, the federal and expert framed messages have negative effect on social distancing in the United States. Another study shows that authority framed messages are less effective than the socially framed message. In this former study, participants gave the State's Secretary (the sending authority) a very low rating for trustworthiness (Zey & Windmann, 2021).

People's emotions about the messenger are crucial. The effect of high authority framed messages depends on people's trust and confidence in their states (Dolan et al., 2010). In the Saudi context, these two elements are present. Alnasser and colleagues (2020) found that 84% of Saudis get their COVID-19 updates from official sources, and 69% of them trusted the information from the Saudi Ministry of Health. The sociopolitical landscape in Saudi Arabia is conducive for mutual trust between the state and the people, which forms a type of contract that bestows on the state a high level of deference and trust (Almutairi et al., 2020). The present results lend support to this view. Overall, the effect of authority framed messages is highly contingent on the relationship between said authority and recipients.

Findings from this study should be taken with consideration of some limitations. First, the study sample was drawn from only one health cluster in Riyadh city. To mitigate any sort of biases, system generated randomization of participants within the cluster was adopted. There is little reason to believe that other health clusters would behave differently to the study intervention, given population homogeneity in Saudi Arabia (World Population Review, 2021). In addition, the study protocol sampled only children who had just turned three-years-old. Would parents demonstrate less concerns regarding their child's health as they age? A future study can track parents throughout the well-baby program to see if there is any drop in participation; such insight could help policymakers draw the appropriate interventions.

The promising findings of this RCT emphasizes the practicality and efficiency of utilizing behavioral sciences to advance public health. Using default appointments as a nudging technique is encouraging especially in the field of multiple, recurrent, and distant

health follow-ups and screenings. Adopting this technique in a larger scale should decrease many health consequences of missed periodic checkups. As a policy for the well-baby visits program, this should reduce the healthcare costs of late detection of children disorders and should therefore improve their overall quality of life (Sonuga-Barke et al., 2011). In addition, the trust and confidence people have in the state can be harnessed by delivering authority framed messages to improve public's adherence towards health services.

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