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Freely Available Online

JOURNAL OF PUBLIC HEALTH INTERNATIONAL
*ISSN NO: 2641-4538*

Research article

DOI: 10.14302/issn.2641-4538.jphi-20-3641

# A Predictive Tobacco Control Mass Media Programming Model to Achieve Best Buys in Low –and Middle-Income Country Settings

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## Abstract

**Background:** Evidence based message design and efficient dissemination of messages are critical to the success of tobacco control mass media campaigns. Although evidence to measure effectiveness of messages is emerging within low -and middle-income country (LMIC) settings, evidence-based approaches for mass media message dissemination is currently lacking due to challenges in accurate assessment of gross rating points (GRPs) for efficient delivery of campaign messages. Approaches to more accurately predict optimal campaign impact are required to achieve best-buys in resource constrained settings

**Method:** A case study approach compared findings from two national tobacco control mass media campaigns implemented in Bangladesh. Stage one reviewed protocols to assess the efficacy of message designs. Second stage analysis involved a review of the mass media campaign recall findings from cross-sectional, post-intervention surveys. Last, a post assessment of GRPs for both campaigns was conducted to support the development of an algorithm to better predict campaign impact at the greatest cost-efficiencies.

**Results:** Message mean pre-test scores identified that the Baby Alive campaign scored approximately 20% lower than mean pre-test scores of messages for the Graphic Health Warning campaign. Media dissemination for the Baby Alive campaign was also relatively low at 165GRPs achieving 16.8% prompted recall while the Graphic Health Warning campaign delivered 292GRPs to achieve 47.0% prompted recall. The analytic-predictive model identified that for messages with high pre-test scores an increase of only 1.5GRPs was required to the existing media plan to potentially achieve an additional percentage point of recall.

**Discussion:** Given the weaknesses in GRP calculations in LMIC settings, analysis of multiple metrics should be considered to achieve best buys for tobacco control mass media campaigns. Based on optimal message mean pre-test scores of 90%+ and delivery of 292GRPs, which achieved 47% campaign recall, optimal recall of 70% could be predicted with a media plan delivering 342GRPs. More analytical-predictive mass media programming models need to be developed in other LMIC settings examining multiple campaign findings to confirm if this algorithm can provide better returns on investment with efforts directed toward delivering interventions that are supported by a strong evidence base.

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**Keywords:** tobacco control, global tobacco epidemic

**Received:** Dec 02, 2020 **Accepted:** Dec 07, 2020 **Published:** Dec 16, 2020

**Editor:** Sasho Stoleski, Institute of Occupational Health of R. Macedonia, WHO CC and Ga2len CC , Macedonia.

## Introduction

The burden of global tobacco-related morbidity and mortality is substantial with tobacco accounting for more than 7.2 million deaths every year (including deaths resulting from exposure to second-hand smoke). Over 85% of these premature deaths from tobacco are estimated to occur in low -and middle-income countries (LMICs) with mortality projected to increase markedly over coming years.

Bloomberg Philanthropies is the principal donor of tobacco control programs in LMICs contributing nearly $1 billion since 2007 to combatting the global tobacco epidemic through proven tobacco control policies and approaches. One of the implementing agencies supporting the initiative is Vital Strategies (formerly World Lung Foundation) which has been implementing and evaluating tobacco control mass media campaigns (MMCs) and policy initiatives globally since 2008 with over 200 national and regional campaigns implemented in around 27 LMICs.

Hard-hitting tobacco control MMCs have been found to increase awareness of the risks of tobacco use, change attitudes, build self-efficacy perceptions and intentions, increase tobacco cessation behaviours with adults' and prevent uptake of smoking in youth. There is also increasing evidence of MMCs successes in LMIC settings. Critical to the success of tobacco control MMCs, including those in LMICs, are variables related to tobacco control message design and message delivery.

*Message Design Factors*

Effective design of tobacco control messages is critical to ensuring high recall and impact of MMCs, including promoting quit attempts. Numerous studies across a range of settings have identified variables contributing to the efficient design of tobacco control MMC messages[9, 10]. These include recent findings from LMICs which highlight the importance of using graphic and visceral imagery in messages to build personal risk perceptions, and the use of testimonials of tobacco victims to provide personalised, culturally relevant and compelling appeals to more fully engage message receivers. An important first step to build the evidence base for what works in LMIC settings, involved a global review of best practice tobacco control messages and adaptation and pretesting of the messages in multiple country settings. The formative research was designed to identify if the television public service announcements (PSAs), initially proven successful in high income countries (HICs), could also be successful in culturally diverse LMIC contexts.

The message pre-testing utilised mixed methods approaches including focus group discussions supplemented with self-administered quantitative ratings of 10 or more proximal indicators, identified from previous pre-test protocols conducted in a number of other country settings and indicative of a MMCs effectiveness. Message indicators examined how strongly participants agreed or disagreed that the PSAs made them "stop and think", "was personally relevant to their lives", "provided new information", and "made them feel concerned about their tobacco use". Other indicators for successful messages included; "discussion with others" or "trying to persuade others to quit". The evidence from LMICs confirmed the key message variables predicting the success of MMC messages featured personalised, graphic, visceral and emotive imagery which resonates with local audiences[12, 13].

*Message Delivery Factors*

Although, evidence from high income countries (HICs) indicates that effective message design, and appropriately weighted dissemination of campaign media plans can achieve high numbers of quit attempts' while the reduction or cessation of MMC message dissemination also shown to significantly reduce to markedly reduce the engagement of tobacco users and reduce quit attempts. Recommendations from HICs indicate message delivery frequency of four to eight exposures per person month being necessary for campaigns to 'cut through' the competing clutter of other advertising content, with the recommendations consistent across a number of HIC settings. '

Evidence on best practice media plans for tobacco control mass media campaigns in HICs are based on gross rating points (GRPs) which is a measure of campaign message reach and frequency to a specific target audience. Studies identify weekly plans of around 100 GRPs may be adequate' with this measure providing an average of one exposure per person in the target population. This indicates that a media plan generating 400 GRPs per month on average, will expose 100% of the target population to campaign messages at least

four times. Alternatively, 50% of the audience would be exposed to the messages eight times, and so on. However, higher doses of message frequency have also been found to increase recall of campaign messages.

Of significance is the fact that existing studies have examined GRP counts based on media viewing characteristics in HICs, where audiences have broad access to media channels, high weekly viewing hours, with audiences being largely homogenous. Given these findings MMCs implemented in the resource constrained settings of LMICs may have considerably less impact given the likelihood that risk populations, particularly in rural areas, have more limited access to mass media channels and lower viewing duration. Additionally, country demographic data indicates considerable differences in socioeconomic, cultural and media viewing habits as well as lower access to televised media particularly with high risk, low income groups in rural areas. Given these potential impediments to message delivery with these groups a closer investigation of message dissemination factors is warranted with specific reference to country development indicators.

This is likely because national and multinational advertisers in LMICs are generally more interested in marketing of fast-moving consumer goods (FMCGs) to higher income groups who can afford to buy. Discussions with media planners in a number of LMIC settings have identified that media surveys are predominantly conducted in urban areas with media planners clients provided with estimates of 'nominal GRPs' rather than 'actual GRPs'. Given these factors, sampling methods to calculate GRPs in a number of LMIC settings may be particularly biased against public health campaigns to reduce social inequalities and disparities, given the fact that vulnerable populations predominantly reside in rural areas.

The findings indicate that post-analytic models may provide more accurate assessment of actual GRPs attained with MMCs in a number of LMIC currently using rudimentary media survey data to calculate media reach and frequency. Implications are that greater message frequency may be required to rural populations than the four exposures per month promoted in HICs to assure high 'top-of-mind' campaign recall, critical in providing MMC attribution of behavioural impact and subsequent quit attempts.

Given the importance of message design, delivery and frequency variables and the considerable costs of media plans, mass media campaign message dissemination should operate to provide the optimal returns on investment (ROI) or best-buys, through cost-effective solutions, to help curb the tide of noncommunicable diseases (NCDs), including for primary risk factors related to tobacco use. Despite the importance of gaining a better understanding of how optimal message design and message delivery variables, may interact to provide optimal behavioural impact and cost efficiencies for tobacco control campaigns in resource limited settings, current evidence on optimal approaches in the context of low -and middle income countries is rare.

*Country Context*

Given the considerable resource constraints and programming challenges for tobacco control in LMIC settings, Bangladesh may also be better predisposed to achieving successful tobacco control MMCs outcomes than other LMIC settings. A positive factor is that the country has a relatively large population of around 165 million concentrated within a small land mass of 148 thousand km², with one of the highest population densities of 1,100 people per square kilometre in the world. Other indicators which point to opportunities for effective MMCs are the generally broad number of media networks with more than 20 TV channels broadcasting across the country. Around 14 national level Tobacco control MMCs have been implemented with the support of BP in Bangladesh since 2011 with campaign evaluations showing amongst the highest recall and good behavioural impact in countries in the populous Asian region.

Media plans purchased for the MMCs in Bangladesh also identify relatively low cost per rating point to other country tobacco control programs in the region[31]. However, Technical Advisors to the MMCs have also identified challenges in developing more predictive media plans in Bangladesh and other LMICs. This is as a result of the rudimentary but evolving science in measuring audience viewership, demographics and audience ratings. Kantar research, which operates worldwide in 90 countries provide media planners with weekly data from which we develop plans. However,

prior to December 2014, the system utilised "People Meters" (which used to track data based on frequency matching system) but since that time the system has been updated to "TAM" (TV Audience Measurement - by enhanced Audio Matching System). The media researchers have also installed more meters in households in Dhaka Metro, peri-urban (other) and rural, as well as Chittagong metro and rural) with a total sample of 16,200 respondents 15+ years split equally by gender and having cable and satellite connections. This transition from the Nielsen proprietary "black box" system of establishing television audience ratings, to one using larger more representative sample sizes has paved a move away from identifying "nominal GRPs" to providing data on actual GRPs which may be achieved with more recent media plans.

**Method**

Case studies were conducted of two MMCs implemented in Bangladesh in 2015-16. Although, the use of best practice messages and media plans of around 400GRPs were key objectives in the campaign design and implementation, a number of resource limitations resulted in considerably varied results. Thus, these two campaigns may provide more interesting data for exploration of possible relationships between the message designs, and message delivery - identified through television GRPs and campaign post-intervention Knowledge, Attitude and Behaviours (KAB) surveys conducted soon after the exhaustion of the media plans.

Findings from the published and unpublished post intervention KAB surveys identified audience recall levels from 16% - 67% achieved. The considerable variance in recall of MMCs highlights the need to more closely examine factors related to message design and dissemination - measured through media reach and frequency data - in Bangladesh. The objective is to identify if a more predictive MMC programming model can be developed for Bangladesh as well as reviewing the adaptability of the model to tobacco control MMCs in other LMIC settings.

A three-stage method was utilised for the study incorporating qualitative and quantitative approaches. The approach was designed to assess the key variables under investigation and those believed that may contribute most to achieving campaign impact expressed through the following algorithm:

$$Agrp = (grpD / Ms) \; X \; (Or - R)$$

$$Or$$

Where: *Ms*=Mean rating score of the tobacco control message through standardised pre-test indicators (Assuming mean score is ≥ 85%); *grpD*=GRP delivery of independently monitored campaign media plan; *R*=Recall of campaign messages measured through cross-sectional KAP impact evaluation; *Or*=Optimal recall to achieve campaign success at most cost-effective margin, and; *Agrp*=Additional GRPs required to achieve optimal recall (Or=70%)

The assessment of the initial campaign message, called "Baby Alive", was adapted from a campaign initially implemented by the New York Department of Health. The message was subsequently adapted and pre-tested in Bangladesh as part of the 10-country message testing study[17] with the Baby Alive campaign implemented in Bangladesh 2015. The second campaign, called "People behind the packs," featured two TV messages to support the launch of graphic pictorial graphic health warnings (GHWs) on tobacco packs in Bangladesh, implemented in 2016.

The Baby Alive campaign message used graphic and emotive imagery of the harms caused to young children as a result of exposure to second-hand smoke (SHS). The People behind the packs GHWs campaign included an emotive message from a mother with an asthmatic child focusing on the harms of SHS, and a highly graphic message featuring a patient with a tracheostomy (see Fig. 1.).

*KAP surveys*

A precondition to assessing the impact of tobacco control MMCs is audience recall of the campaign messages. This provides attribution of the campaign messages to subsequent knowledge attitude and behaviour (KAB) indicators, including cessation behaviours, measured through cross sectional, post-intervention KAB surveys. KAB surveys, conducted soon after the exhaustion of media plans are also in evidence in LMIC contexts. The post intervention survey findings provide programmers with the evidence to ensure that highly rated messages, identified through message pre-testing, are also disseminated with adequate media weightings, to achieve maximum recall at a population level.


Figure 1. Imagery from the "Baby Alive" (left) and "People behind the packs" Graphic Health Warnings mass media campaigns (middle and right) implemented in Bangladesh in 2015-16.

The first stage of the study was designed to rate the mean scores from an identical series of 9 indicators for message effectiveness and impact, developed initially as part of the 10-country message testing study. Message efficacy was measured through the items using self-administered questionnaires, completed by respondents after viewing the messages and rated on 5 points Likert scales - strongly agree to strongly disagree. The initial pre-test study for Baby Alive used 16 focus group discussions (FGDs) of male tobacco users located in Dhaka and Chittagong, given the low smoking prevalence of females in Bangladesh. The second People behind the packs GHWs message pre-test used 8 FGDs located in urban and rural areas surrounding Dhaka city. An additional 4 items used for the GHW message pre-test, were excluded from comparative analysis (see Table 1).

The second stage of study used post-intervention analyses of both campaign media plans, which were independently monitored by a commercial media monitoring agency based in Bangladesh. Given the GRP information in Bangladesh only provides nominal GRPs, a predictive programming model relies on accurate estimates of actual GRPs generated through post analysis and what impact those GRPs may have on audience recall and subsequent cessation rates. Therefore media analyses assessed the total number of spots placed and post estimates of actual GRPs delivered.

The third stage of the study involved examination of both campaign KAP impact evaluations. The impact assessment methods used standardised post -intervention, cross-sectional surveys with fieldwork for both surveys conducted soon after the campaigns' completion, by experts also tasked to conduct the Bangladesh GATS survey. The KAP impact evaluations of the two campaigns identified a representative sample, based , of tobacco users, aged 16-55 years, living in households in urban and rural areas of Bangladesh. Households were selected using a clustered, stratified, multi-stage random sample design, with each household having an equal probability of selection. The sample size for the first Baby Alive campaign evaluation was approximately 2400 (tobacco users and non-users), while the sample size for GHWs survey was approximately 1800 respondents (tobacco users only).

Audience recall findings from both campaigns, were finally compared against the GRPs generated for each campaign, as well as factoring scores for the specific campaign messages, to identify possible relationships between message impact, GRP delivery and campaign recall findings. Finally, an examination

was conducted of key variables of campaign message impact, identified from pre-test scores, message reach and frequency, identified from confirmed GRP counts, and the combined unprompted and prompted recall findings for both campaigns from the KAP impact evaluations. The second algorithmic transformation, based on access to the abovementioned values, allows for the calculation of optimal recall *Or* = 70% and the additional GRPs required to attain *Or* of the target audience, with an anticipated resultant improvement in other KAP indicators.

*(70%) = (Agrp X Ms/grpD) + R*

Statistical tests included Independent *T*-tests, Chi-Squared test for heterogeneity at 95%*, 99%** and 99.9%*** confidence levels, for all the pre-test indicators, and average mean scores.

**Results**

Findings from the comparative analysis of post-production message pre-test scores of the messages from the Baby Alive and GHW campaigns, against the nine standardised indicators are presented in Table 1. The "Baby Alive" message had an aggregated mean score of 70% across the nine indicators with lower scores against indicators of "*Makes me feel uncomfortable*" (47%) "*Is relevant to my life*" (45%) and "*Made me stop and think*" (63%). The two GHW messages overall mean scores were 89% (Mother and Child-Asthma) and 90% (Throat Cancer), with both rating significantly higher than the Baby Alive message, specifically on items "Made me stop and think" ($p$=0.015), and; "Made me uncomfortable" ($p$=0.001).

Findings from the second stage of investigation related to media plan GRP delivery, assessed through the independently monitored reports from the national TV channels contracted to air both campaign messages: Baby Alive Campaign (2015) and GHW Campaign (2016). Post analysis calculations identified the actual GRPs achieved with both campaign plans (see Table 2.). There were considerable differences in GRP deliveries across both campaigns as well as differences in GRPs delivered for messages within the same campaign plan, in the case of the GHW campaign, which featured the two messages.

The Baby Alive media plan, which aired from 28th June-13th July 2015, across seven national TV stations including the government channel BTV, generated a total of 165 GRPs, with 1,765 spots aired during a six-week programming period. The GHW campaign featuring Mother and Child-Asthma and Throat Cancer messages, aired from 28th March - 31st May 2016, across 14 channels, excluding the government BTV channel. This campaign achieved 292 GRPs with a total of 5,228 spots aired during a programming period of similar duration. An examination of GRP counts for individual campaign spots identified that the Baby Alive message achieved 165 GRPs, while the GHW campaign messages; Asthma, Mother and Child, achieved 207 GRPs, while the Throat Cancer PSA achieved only 85 GRPs (see Table 2.).

Stage three study objectives identified recall of campaign messages and related changes in KAP indicators identified through the post-intervention, cross-sectional, impact evaluations. Recall findings for the 2015 Baby Alive and 2016 GHW campaigns are provided in Table 3. Recall of the Baby Alive campaign message following prompting, was only 16.8%. The GHW campaign messages were recalled by nearly one in two (47.0%) of Bangladeshi adults who recalled at least one of the campaign messages, with the Mother and Child Asthma message recalled by 25.5% of respondents following prompting, while the Throat Cancer message was recalled by 56.8% of respondents.

When assessing message impact, and the number of GRPs achieved for each message, against the recall of the messages, the Baby Alive Campaign equates to 9.8 target audience rating points (TARPs) for each percentage point of recall (16.8% recall at 165 GRPs) whereas the GHW campaign required 7.08 TARPs for each percentage point of recall (41.2% recall for 292 GRPs). This indicates a steady rate of return of 8.11 TARPs for each percentage point of prompted recall for Asthma, Mother and Child (25.5% recall at 207 GRPs). However, the higher recall attained by the more graphic Throat Cancer message, at much lower GRPs (56.8% recall at only 85 GRPs) identified that this message required only 1.49 TARPs of message delivery (calculated through audience reach x frequency data) for each percentage point of recall.

Furthermore, the study message pre-test results identified that the messages that ranked highest in the message pre-testing scores: Throat Cancer, 90%,

Table 1.

| % Positive Response | Baby Alive | GHW Throat Cancer | GHW Child Asthma | *p*–value |
|---|---|---|---|---|
| Easy to understand | 93% | 97% | 100% | 0.880 |
| Taught me something new | 79% | 100% | 96% | 0.258 |
| Made me stop and think | 63% | 100% | 87% | 0.015* |
| Was believable | 88% | 97% | 95% | 0.787 |
| Made me uncomfortable | 47% | 88% | 80% | 0.001** |
| Is relevant to my life | 45% | 54% | 68% | 0.090 |
| Concerned about tobacco use | 76% | 83% | 87% | 0.685 |
| More likely to try to quit | 69% | 92% | 95% | 0.093 |
| Likely to talk about message | 71% | 98% | 96% | 0.077 |
| **Item Rating Mean Scores:** | **70%** | **90%** | **89%** | **0.217** |

P-value calculated at 95%*, 99%** and 99.9%*** confidence levels.

Table 2. Media plan television monitoring report GRPs for 2015 Baby Alive Campaign, and 2016 Asthma and Throat (GHW) campaign messages.

| GRPs | | | |
|---|---|---|---|
| **Channel** | **Baby Alive** | **GHW-Asthma** | **GHW-Throat Cancer** |
| ATN Bangla | 37 | 0 | 0 |
| Bangla Vision | 21 | 7 | 5 |
| BTV | 3 | 0 | 0 |
| Boishakhi | 22 | 0 | 0 |
| Channel 24 | 0 | 9 | 4 |
| Deepto TV | 0 | 37 | 31 |
| Desh TV | 0 | 3 | 3 |
| Ekushey TV | 0 | 6 | 5 |
| Independent TV | 20 | 2 | 0 |
| Jamuna TV | 0 | 10 | 5 |
| Maasranga TV | 0 | 3 | 5 |
| Mohona TV | 0 | 15 | 18 |
| My TV | 0 | 6 | 0 |
| RTV | 28 | 4 | 0 |
| Somoy TV | 35 | 9 | 10 |
| Channel 9 | 0 | 94 | 0 |
| Zee Bangla | 0 | N/A | N/A |
| **Total** | **165** | **207** | **85** |

Table 3.

| | ***n*** | **Prompted Recall %** | **GRPs Achieved** |
|---|---|---|---|
| Baby Alive PSA | 402 | 16.8% | 165 |
| Child Asthma (GHW) PSA | 306 | 25.5% | 207 |
| Throat Cancer (GHW) PSA | 681 | 56.8% | 85 |
| GHWs (Both PSAs) | 987 | 66.5% | 292 |
| ***p*–value** | | <0.001*** | <0.001*** |

P-value calculated at 95%*, 99%** and 99.9%*** confidence levels.

Asthma, Mother and Child, 89%, and Baby Alive,70%; also had similar rankings for prompted recall with Throat Cancer being the most recalled PSA (56.8%), followed by Asthma, Mother and Child (25.5%), with Baby Alive PSA (16.8%) being the least recalled message. This was despite considerable differences in the reach and frequency of messages to target audiences identified through the GRP counts: Throat Cancer; 56.8% prompted recall at 85 GRPs, Child Asthma; 25.5% prompted recall at 207 GRPs and Baby Alive 16.8% prompted recall at 165 GRPs (see Table 3).

Identification of key variables identified that the Health Warning" (GHW) campaign which featured two public service announcements: Mother and Child-Asthma (89%) and Throat Cancer (90%) had high message impact for the pre-test scores, while the baby Alive message had relatively lower impact against the same indicators (70%). Media delivery variables for the Baby Alive campaign was also relatively low at 165 GRPs achieving 16.8% prompted recall while the GHW campaign messages achieved 292 GRPs in total with a resultant 47.0% mean prompted recall. Overall recall for the GHW campaign was 66.5% with respondents aware of ≥1 of the GHW campaign messages. However, the higher individual recall attained by the more graphic Throat Cancer message, at much lower GRPs (56.8% recall at only 85 GRPs) identified that only 1.5 rating points increase in message delivery was required to potentially achieve an additional percentage point of recall. Therefore, when the algorithm is applied to the two campaign key variables we find that optimal recall would be achieved with the GHW campaign messages *Or* = 70% at 193 GRPs on average (an increase of 47 rating points on the current media plan of 146 GRPs) and specifically with the Asthma, Mother and Child PSA (*R* = 41.15%) requiring *Or* = 70% at 104 GRPs, while the Throat Cancer PSA message (*R* = 56.8%) only requiring an additional 13 GRPs to achieve *Or* = 70%. However, optimal recall for the lower impact, Baby Alive PSA (*R* = 16.8%) would require an additional 290 GRPs to achieve (an increase of 125 GRPs to the current media plan of 165 GRPs) to attain *Or* = 70%. This identifies the importance of powerful emotive messages on recall at lower GRPs, to achieve greater cost efficiencies.

Subsequent to the stage three analyses, recall of the more highly rated GHW campaign were assessed through bivariate logistic regression to assess the independent contribution of message intensity (number of messages recalled – predictor variable) on dependent variables of attitudes, intentions and cessation related behaviors, which identified a number of significant findings against a number of indicators including; Elaboration (made me stop and think), personal risk perceptions and concerns about impact on family health, discussion of messages with others, self-efficacy to quit, social approval to quit, anticipated regret if didn't quit, and ultimately making a quit attempt (behavioural change); with the findings reported in another journal article.

## Discussion

Tobacco control messages that rate highly in message pre-testing (mean scores across standardised indicators ☐80%), particularly those presenting highly graphic, visceral or emotive content, can contribute to improved "top-of-mind" recall by campaign target audiences, at lower reach and frequencies calculated through GRPs. As such, these more impactful highly graphic and emotive messages may also achieve improved 'cut-through' from other message clutter on TV and resonate with audiences at lower frequencies than less graphic or less emotive campaign messages. High scores for key pre-test indicators that may boost recall and engagement with the tobacco control message include: '*Made me feel concerned about my tobacco use*' '*I'm likely to talk about this message with others*' and '*This message makes me more likely to try to quit tobacco*'; with message types rating highly against these indicators performing considerably better, even at considerably lower GRP counts. This is demonstrated by the higher recall of the more graphic

Throat Cancer message, which achieved more than twice the level of prompted recall of the Asthma, Mother and Child message, at less than half the GRPs, with this case study providing important lessons learned for future campaign messages where high impact and cost-efficiencies are required.

Conversely, media delivery of around 200 GRPs, over a four to six-week programming period, may provide the optimal media weighting in the resource constrained settings of LMICs, like Bangladesh. This is a lower GRP count to that indicated as optimal message delivery for HICs[11,12] which may be due to the less

representative sampling method used by audience media survey agencies in LMICs which predominantly cater to urban audiences, to cater to the needs of advertisers of fast-moving consumer goods. Alternatively, higher message impact and subsequent recall, may be achieved with rural based audiences in LMICs who likely have had little exposure to highly graphic and emotive tobacco control messages highlighting the harms of their tobacco use.

Therefore, sustainable, tobacco control mass media campaigns, using highly rated graphic and emotive appeals (☐ 80% mean scores across standardized indicators), and GRP counts of 150-200 GRPs, over 4 weeks, may provide the most cost-effective, and predictive programming paradigm, to achieve optimal prompted recall (*Or* = 70%) of general target audiences of tobacco users in Bangladesh. Although, GRP counts of more than 200 GRPs may further increase recall rates and may also positively impact on audience attitudes and cessation related behaviors, these higher campaign media weightings may also suffer from a diminishing rate of returns, thus reducing their viability for programming in the resource constrained settings of LMICs.

In conclusion, sustained, synergized, tobacco control mass media campaigns using graphic and emotive messages, which achieve effective reach and frequency (measured through GRPs) of those messages to target audiences, are critical to in building campaign awareness, changing attitudes and beliefs, and supporting tobacco control advocacy and policy initiatives, with the approach consistent with the WHO Best-Buys recommendations and the Tobacco Control Framework Convention (MPOWER). At the same time the higher impact of tobacco control campaigns can also combat the considerable tobacco industry interference identified in LMICs.

Given the importance of evidence-based, best practice approaches to message designs and media plans to provide more efficient and predictive programming delivery models, there is a need to test the approach in other regional LMIC country settings to identify the optimal design and GRP delivery for each country settings. This is particularly important, given the current rudimentary science of media planning using GRPs in a number of LMIC settings, and the ill-considered approaches to achieving effective media delivery and its contribution to mass media campaign recall and behavioural impact. Given the identification of key variables to identify optional recall in Bangladesh, future studies should include cross-country evaluations considering message impact scores and GRP delivery to identify if similar predictions for optimal recall can be achieved across a range of difference country settings.

## Limitations

Limitations to this study include the different sample sizes and geographic locations selected for the two campaign message pre-testing surveys, and the fact that the impact evaluations for the two campaigns only provided self-reported quit attempts. Additionally, there were limitations with not being able to isolate the TV media messages from other messages which audiences may have heard or seen on mass media or community settings, which may have contributed to the message recall. A social media website was also included with messages delivered with the GHW communication campaign, while the Baby Alive campaign did not have a social media presence. Last, is the fact that since the time of this intervention study, survey sample weightings have again changed, confirming the need to constantly review analytical procedures and using multiple indicators to better predict optimal outcomes for mass media campaigns.

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