Knowledge and Adoption of Community Mitigation Efforts in Mexico During the 2009 H1N1 Pandemic

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Background: The public's ability and willingness to adopt community mitigation efforts during a pandemic are debated in the literature.

Purpose: Awareness and adoption of community mitigation efforts in Mexico during the 2009 pandemic influenza A (H1N1) (pH1N1) outbreak were measured to evaluate if the population received, understood, and acted on public health messages.

Methods: A cross-sectional representative household survey in Mexico City; San Luis Potosi (high case ratio); and Queretaro (low case ratio) was conducted in May and June 2009. Accounting for the complex survey design, percentages and 95% CI for answers to all questions were generated and compared based on living inside or outside Mexico City, high versus low prevalence of infection in the community, and perceived severity and knowledge of the virus.

Results: Greater than 90% of respondents received community mitigation messages and adopted one or more community mitigation efforts. There were few differences among cities. Respondents reported high cost of masks, soaps, and gels as barriers to community mitigation-effort adoption. Nearly one fifth of respondents, disproportionally from the lower socioeconomic tertile, found some messages confusing. Half of all households reported a negative economic impact resulting from the outbreak.

Conclusions: Mexico's community mitigation campaign reached the majority of the population in three surveyed cities. Confusion regarding messages and economic barriers to community mitigation-effort adoption were sometimes reported.
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Introduction

Early in a pandemic, before effective vaccine(s) or treatments are readily available, community mitigation measures, including isolation and treatment of patients, social distancing, and use of enhanced hygiene practices, are implemented to limit spread of illness. The public's ability and willingness to adopt com-

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munity mitigation efforts, and the effectiveness of such efforts to reduce the severity of a pandemic, are debated in the literature.[1] Analyses of historical data and mathematical modeling of pandemic influenza transmission suggest[2–4] that early and sustained implementation of community mitigation efforts can reduce peak mortality rates. An earlier study[5] found that patient isolation, frequent hand-washing, and facemask use were associated with decreased transmission of SARS virus. Another study[6] reported a reduction in intrahousehold influenza transmission among households provided with hand hygiene and facemask instruction and supplies as compared to control households; however, the authors also noted low levels of adherence to these short-term, intrahousehold interventions. Community mitigation measures, such as social distancing, might be impractical to sustain on a long-term basis without having a negative impact on societal functioning.[7,8] Given that effective vaccines or

antiviral medications might not be widely available early in a pandemic, and are often not available in resource-limited settings,[5,7,9–11] and that judicious use of antiviral medications is recommended to prevent widespread emergence of antiviral resistance, community mitigation efforts are an important defense against pandemic spread.

In response to the outbreak of 2009 pandemic influenza A (H1N1) (pH1N1) in mid-April, 2009, Mexican authorities began implementing a comprehensive public health campaign to mitigate the spread of the virus. Examples of public health messages can be found at the Mexican Ministry of Health website (http://origin. promocion.salud.gob.mx/dgps/interior1/materiales2.html). Government actions included mandatory closure of schools, daycares, and non-essential businesses/services throughout the country and identifying, isolating, and treating people with influenza-like illness (ILI). An intense mass media campaign advocating personal action emphasized frequent hand washing, covering sneeze/cough, using facemasks, social distancing, seeking care if ill, and discouraging self-medication.[12–16] The reach of the public health campaign and the population's understanding of and compliance to recommended behavior, especially outside of Mexico City and in areas with low case ratios, was unknown.

> See related Commentary by Elder in this issue.

This investigation was conducted in Mexico City (high pH1N1 case ratio) and two distant cities, one with a high and one with a low case ratio, in order to (1) estimate and compare the level of household awareness and adoption of community mitigation efforts in each city; (2) compare adoption of community mitigation efforts by individual-level perceived severity of the virus and knowledge of pH1N1 symptoms; and (3) describe barriers to adopting community mitigation efforts.

Methods

Study Design

From May 22 to June 19, 2009, a population-based, representative, face-to-face household survey in three cities was conducted: Mexico City, San Luis Potosi (SLP), and Queretaro. Mexico City is the most populous city (8.8 million) and the political, economic, and industrial center of Mexico. It was the center of the federal implementation of community mitigation efforts and had a high confirmed pH1N1 case ratio (14.1 per 100,000)[17] at the initiation of the survey. SLP is an urban center of approximately 1 million people, located 418 km north of Mexico City, and had a high case ratio (16.0 per 100,000).[17] Queretaro is an urban center of similar size to SLP, located 200 km north of Mexico City, which had a relatively low case ratio (1.6 per 100,000) at the time of survey.[17]

Sample Size and Selection

A representative sample of households was selected in each city using a three-stage sampling design. In the first stage of sampling, 10 census tracts in Mexico City and 11 census tracts each in SLP and Queretaro were selected with a probability proportional to size.[18] In the second stage, 10 city blocks per census tract were selected with a probability proportional to the number of inhabited housing units. In the third stage, 10 households per city block were selected systematically. The adult with the most knowledge of household health issues was invited to represent the household. Collective housing units such as military installations and hotels were excluded from the sample.

The minimum number of households necessary to detect a 50% adoption of recommended behaviors with a precision of 5% and $\alpha=0.05$ was 769. Because there was no estimate of design effect, a conservative value of 2.0 was used. The estimated level of response was approximately 75% in Mexico City and 70% in SLP and Queretaro. In Mexico City, 1000 households were recruited, and in SLP and Queretaro 1100 households were recruited.

Data Collection

The National Institute of Public Health, Mexico (INSP), hired, trained, and supervised personnel to conduct all fieldwork. Pairs of data collectors administered questionnaires using laptop computers. Households were visited three times before being classified as nonrespondents. Data collectors read a consent statement and received verbal consent before beginning the survey.

Questionnaire

The questionnaire (Appendix A, available online at www.ajpm-online.net) included questions on household demographics; sources of information on pH1N1; perceived severity of pH1N1; knowledge of transmission and symptoms of pH1N1; and awareness, adoption of, and barriers to adoption of community mitigation efforts. Questions were asked retrospectively and covered the time period from the respondent first hearing of pH1N1 to the interview date. The survey included questions on ILI symptoms experienced by household members between March 01, 2009, and the interview date. All questions on sources of information, knowledge of pH1N1, and adoption of community mitigation efforts were open-ended (unaided recall) to avoid social-desirability bias. Questions on perceived severity of pH1N1 and barriers to adopting community mitigation efforts were close-ended (aided recall). Respondents could report multiple answers to each question regarding sources of information, knowledge of pH1N1, adoption of community mitigation efforts, and barriers.

Data Reduction and Analysis

Data analysis was conducted from June to August, 2009. Crude percentages and 95% CIs were calculated by city for each response, accounting for the complex survey design. Differences in percentages were significant if the 95% CIs did not overlap.[19] ILI and correct identification of symptoms of pH1N1 were defined as fever plus at least one other symptom: headache, cough, or sore throat. Similar to methods previously used in household surveys in Mex-

Table 1. Demographic characteristics of household survey respondents in three cities in Mexico, 2009 (*n*=2498)

Characteristic	Mexico City	San Luis Potosi	Queretaro
Households surveyed (*n*)	837	951	878
Expanded household sample based on sample weights (*n*)	6,793,288	584,415	603,122
Households surveyed with demographic information on respondent (*n*)	791	921	786
Age (years, M [95% CI])	45.9 (43.7,48.1)	40.4 (37.4,43.4)	41.0 (39.2,42.7)
Female	58.7 (52.6,64.5)	70.9 (68.2,73.5)	66.2 (63.3,69.0)
Education			
Less than primary school	8.3 (5.0,13.7)	7.3 (4.9,10.8)	7.9 (5.3,11.7)
Primary	19.1 (14.9,24.1)	20.5 (15.8,26.0)	15.9 (13.8,18.2)
Middle school or equivalent	21.8 (17.9,26.3)	33.4 (26.0,41.9)	30.2 (25.5,35.4)
High school or equivalent	27.3 (22.4,32.8)	25.6 (20.7,31.2)	28.7 (24.6,33.3)
University degree or higher	23.2 (15.0,34.1)	13.2 (8.5,19.9)	17.1 (13.7,21.2)
Employment			
Employed outside of home	54.7 (47.2,62.1)	50.2 (45.8,54.5)	51.7 (48.1,55.2)
Homemaker	24.7 (18.5,32.1)	36.7 (31.3,42.4)	32.9 (29.3,36.7)
Unemployed	6.0 (4.1,8.7)	3.5 (2.1,5.8)	3.7 (2.1,6.4)
Retired	7.9 (5.8,10.7)	4.3 (2.4,7.6)	4.6 (2.8,7.4)
Other	6.5 (4.8,8.6)	5.4 (3.9,7.3)	7.2 (5.2,9.8)
Tertiles of SES[a]			
Lowest	35.2 (25.9,44.5)	36.1 (27.2,44.9)	29.3 (20.0,38.6)
Middle	26.4 (21.1,31.8)	37.6 (28.6,46.5)	32.4 (25.5,39.3)
Highest	36.1 (23.4,48.8)	25.2 (15.8,34.6)	33.0 (27.1,38.9)

Note: Values are % (95% CI) unless otherwise noted.
[a]SES calculated by principal components analysis based on household building materials and possessions[18]

ico, a principal components analysis, including the entire sample from all three cities, was used to derive an index of SES based on household possessions and housing material.[20] The data from the three cities were combined and households divided into tertiles based on SES index. The adoption of community mitigation efforts in the entire sample by SES tertile, perceived severity, knowledge of pH1N1, household presence of ILI, and contact with a pH1N1 case were compared. The protocol received a nonresearch determination by the CDC and was approved by the Research, Ethics, and Biosecurity Commissions of the INSP.

Results

Demographics

The survey was completed by a total of 2666 households, including 83.4% of selected households in Mexico City, 86.5% in SLP, and 79.8% in Queretaro. Using sample weights, the expanded sample of households per city was 6,793,288 in Mexico City, 584,415 in SLP, and 603,122 in Queretaro. Demographic information was available for

93.6% (*n*=2498) of household respondents. Respondents were significantly older in Mexico City (aged 45.9 years, 95% CI=43.7, 48.1) relative to SLP (aged 40.4 years, 95% CI=37.4, 43.4) and Queretaro (aged 41.0 years, 95% CI=39.2, 42.7), and there were significantly fewer female respondents in Mexico City (58.7%, 95% CI=52.6%, 64.5%) relative to SLP (70.9%, 95% CI=68.2%, 73.5%) and Queretaro (66.2%, 95% CI=63.3%, 69.0%). Most respondents had less than a high school or equivalent education (Table 1). There were no differences among cities in the distribution of household SES.

Communication Channels Regarding pH1N1

Television and radio were the most common sources of pH1N1 information. More than 90% of respondents reported receiving pH1N1 information from the TV, and more than 30% from the radio (Appendix B, available online at www.ajpm-online.net) regardless of city or SES

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Table 2. Reported community mitigation efforts adopted to protect against pH1N1 in Mexico, 2009 (*n*=2666), % (95% CI)

Mitigation activity	Mexico City (*n*=837)	San Luis Potosi (*n*=951)	Queretaro (*n*=878)
Frequently washing hands with soap/water	89.3 (86.5,91.6)	81.1 (78.7,83.3)	76.1 (73.1,78.9)
Using a mask	63.4 (60.3,66.4)	64.7 (60.7,68.6)	50.0 (45.3,54.7)
Using hand sanitizer/gel	30.1 (25.6,35.0)	30.3 (26.3,34.6)	27.0 (21.7,33.1)
Covering cough/sneeze with tissue or elbow	21.5 (17.7,25.8)	14.1 (12.1,16.3)	16.0 (13.3,19.1)
Avoiding crowds/public gatherings	19.5 (15.8,23.8)	29.5 (26.1,33.3)	24.0 (20.3,28.0)
Ventilating the home	19.9 (16.1,24.3)	17.3 (14.7,20.3)	14.8 (11.6,18.6)
Avoiding shaking hands/kissing when greeting	11.7 (9.7,14.0)	16.1 (12.5,20.4)	18.6 (15.5,22.2)
Avoiding close contact with symptomatic people	10.4 (7.8,13.6)	11.4 (8.5,15.2)	11.9 (8.9,15.6)
Keeping away from other people	9.0 (6.9,11.6)	8.5 (7.0,10.4)	8.6 (7.2,10.3)
Avoiding sharing drinks or utensils	3.1 (1.8,5.4)	4.6 (3.7,5.8)	3.8 (2.5,5.9)
Limiting the number of visitors to our home	3.0 (1.8,5.0)	1.6 (0.9,3.0)	1.3 (0.7,2.7)
Seeing a doctor/healthcare practitioner	1.3 (0.7,2.3)	2.9 (2.0,4.2)	2.3 (1.5,3.5)
Taking medicine prescribed by a doctor	1.0 (0.5,1.9)	0.5 (0.3,1.1)	0.6 (0.2,1.7)
Self-medicating	0.7 (0.2,2.5)	0.3 (0.1,0.9)	0.9 (0.4,1.8)
Leaving town to try and avoid the illness	0.6 (0.2,1.7)	0.2 (0.0,1.2)	0.4 (0.2,0.9)
Did not do anything	2.3 (1.6,3.2)	1.5 (0.9,2.7)	6.5 (4.3,9.7)

tertile. The third most commonly cited source was newspaper in Mexico City (16.6%, 95% CI=12.2%, 20.9%); posters/flyers in SLP (18.8%, 95% CI=16.4%, 21.1%); and family/friends in Queretaro (10.9%, 95% CI=9.1%, 12.8%). Fewer than 7% of respondents reported accessing information from the Ministry of Health website; however, significantly more respondents in the highest SES tertile (10.5%, 95% CI=7.7%, 13.3%) relative to the middle (5.0%, 95% CI=3.2%, 6.9%) and lowest (2.4%, 95% CI=0.1%, 4.7%) SES tertiles reported this source. Significantly more respondents in SLP (8.6%, 95% CI=6.6%, 10.7%) relative to Mexico City (2.8%, 95% CI=1.7%, 3.8%), but not Queretaro (6.1%, 95% CI=3.7%, 8.6%), reported not receiving any information on pH1N1. Differences among SES tertiles (data not shown) were not significant.

Knowledge of pH1N1

More than 85% of respondents correctly identified close contact with infected people, approximately 30% identified contact with contaminated surfaces, and approximately 10% identified sharing eating utensils as modes of pH1N1 virus transmission (Appendix C, available online at www.ajpm-online.net). Few respondents (<1.5%) reported the erroneous belief that handling pork products would transmit infection. A greater percentage of respondents in the lowest SES tertile reported not knowing any

mode of transmission (4.4%, 95% CI=1.8%, 7.1%) relative to the middle (0.7%, 95% CI=0.0%, 1.4%) and highest (1.1%, 95% CI=0.0%, 2.1%) SES tertiles.

With unaided recall, >70% of respondents could cite fever plus at least two additional symptoms associated with pH1N1 infection: Fever (>80%); headache (>70%); cough (>40%); and sore throat (~20%) were most commonly cited. Relative to Mexico City (9.4%, 95% CI=7.4%, 11.9%), more respondents from SLP (15.9%, 95% CI=13.2%, 19.0%) and Queretaro (16.2%, 95% CI=12.9%, 20.0%) could not identify any symptom of pH1N1.

Adoption of Community Mitigation Efforts

Respondents reported more-frequent hand-washing (>75%); wearing a facemask (>50%); and using of hand sanitizer/gel (>25%) as protective behaviors adopted to avoid contracting pH1N1 illness (Table 2). Other commonly reported behaviors were covering cough with tissue or elbow (>14%); avoiding crowds (≥24%); ventilating the home (>14%); avoiding shaking hands or kissing when greeting (>11%); and avoiding symptomatic people (>10%). Fewer than 1% of respondents reported self-medicating or leaving town to avoid contracting pH1N1 illness. Although very few respondents reported taking no specific action(s) to protect themselves or their household members, the percentage was greater in Queretaro

Table 3. Reported barriers to adoption of community mitigation efforts in three cities in Mexico, 2009 (*n*=2666), % (95% CI)

Barrier	Mexico City (*n*=837)	San Luis Potosi (*n*=951)	Queretaro (*n*=878)
Masks too expensive	46.8 (41.4,52.3)	68.5 (65.7,71.2)	52.4 (46.7,58.0)
Soap/gel too expensive	36.8 (31.6,42.2)	45.7 (43.4,48.1)	38.3 (32.7,44.2)
Recommendations being contradictory or confusing	19.3 (16.1,23.0)	18.1 (16.6,19.8)	15.7 (13.2,18.6)
No water available to wash hands	10.9 (5.9,19.2)	17.2 (13.7,21.2)	7.7 (5.3,11.1)
Lack of information about what can be done	7.0 (4.9,9.8)	10.4 (8.0,13.4)	5.9 (4.4,7.9)
Masks not available	55.3 (50.9,59.6)	67.3 (63.6,70.8)	62.8 (57.8,67.5)
Could not stay home because had to work	21.7 (19.0,24.7)	31.3 (27.1,35.8)	32.8 (28.6,37.3)
Could not keep kids home because of lack of child care	1.9 (1.2,3.1)	4.0 (2.9,5.4)	4.9 (3.3,7.2)
No room to isolate sick	0.3 (0.1,1.0)	0.7 (0.3,1.4)	0.3 (0.1,1.1)

(6.5%, 95% CI=4.3%, 9.7%) relative to Mexico City (2.3%, 95% CI=1.6%, 3.2%) and SLP (1.5%, 95% CI=0.9%, 2.7%).

Respondents perceiving pH1N1 to be very severe or severe more frequently reported avoiding crowds (29.1%, 95% CI=2.4%, 35.5%) than those perceiving pH1N1 to be not very severe or not severe (18.8%, 95% CI=15.9%, 22.2%). More respondents who could correctly identify symptoms of pH1N1, relative to those who could not, reported washing their hands frequently (90.4%, 95% CI=88.0%, 92.5% vs 77.8%, 95% CI=72.4%, 82.4%); using a mask (65.2%, 95% CI=61.7%, 68.5% vs 52.3%, 95% CI=48.0%, 56.7%); using hand sanitizer/gel (33.0%, 95% CI=28.7%, 37.7% vs 17.2%, 95% CI=13.8%, 21.3%); and keeping away from other people (10.0%, 95% CI=8.0%, 12.5% vs 4.5%, 95% CI=2.7%, 7.4%). The adoption of community mitigation efforts by prevalence of reported ILI or contact with a pH1N1 case could not be compared because of the low prevalence of these events (<5%).

Barriers to Adopting Community Mitigation Efforts

More than 35% of respondents reported that the cost of purchasing soap or hand sanitizer/gel was a barrier to hand hygiene practices (Table 3). Fewer respondents in the highest SES tertile (37.6%, 95% CI=31.3%, 43.8%) relative to the middle (51.8%, 95% CI=45.6%, 58.1%) and lowest (52.5%, 95% CI=47.6%, 57.5%) SES tertiles reported the cost of masks being a barrier to their use.

Although community mitigation messages were widely disseminated, received, and actions adopted, a greater percentage of respondents in the lowest (24.1%, 95% CI=18.6%, 29.5%) and middle (19.4%, 95% CI=17.1%, 21.8%) SES tertiles relative to the highest SES tertile (11.8%, 95% CI=8.2%, 15.3%) reported that com-

munity mitigation recommendations were contradictory or confusing. More respondents in the lowest SES tertile reported lack of information on how to protect themselves and their families as a barrier (9.9%, 95% CI=6.9%, 12.9%) compared to the highest SES tertile (4.6%, 95% CI=2.4%, 6.9%). There were no other significant differences in reported barriers by SES tertile (data not shown).

Household Economic Impact

Fifty percent (95% CI=43.6%, 53.4%) of households in Mexico City; 44.8% (95% CI=39.7%, 50.0%) in SLP; and 43.9% (95% CI=39.6%, 48.1%) in Queretaro reported an economic impact resulting from the government's closing of schools and non-essential businesses. Of those reporting an economic impact, 83.1% (95% CI=79.8%, 86.3%) in Mexico City; 89.6% (95% CI=86.1%, 92.9%) in SLP; and 89.1% (95% CI=85.8%, 92.4%) in Queretaro reported losing wages because of working fewer hours or having fewer clients and 12.8% (95% CI=9.1%, 16.4%) in Mexico City; 9.8% (95% CI=6.7%, 12.9%) in SLP; and 9.8% (95% CI=6.2%, 13.4%) in Queretaro reported someone in the household losing a job.

Discussion

This manuscript describes the first known assessment of household awareness and adoption of community mitigation efforts based on representative sampling of three cities in Mexico during the outbreak of pH1N1. The Mexican government's rapid and comprehensive response to the pandemic emphasized community mitigation measures including government-mandated actions paired with personal action. The WHO praised the Mexican government's actions, including communication outreach to the population, to mitigate the spread of pH1N1.[21]

The extensive reach of the media campaign was evident from the >90% of respondents who reported receiving information on pH1N1 since the beginning of the pandemic. There were few differences among cities and no pattern of responses that indicated greater or lesser reach in any one city relative to the others. Thus, the campaign was successful at reaching most of the population regardless of (1) living inside or outside of Mexico City and (2) high versus low pH1N1 incidence in the community. TV was the predominant source of information. Nonetheless, the impact of risk-communication messages is dependent on not only reach but also the public's trust of the source, understanding, and accuracy of messages.[22–24] Measuring the influence of each communication channel or message was beyond the scope of this investigation. Formative research should be conducted now to identify the most effective communication channels and messages to promote awareness and adoption of community mitigation efforts to prepare for future pandemics.

The success of the campaign was demonstrated also by the overwhelming majority of respondents correctly identifying some pH1N1 transmission mode and some symptom(s) associated with infection. Messages associated with events of local importance versus those perceived as distant are more readily remembered by the population.[25] There was little difference in knowledge and no pattern of greater or lesser knowledge of pH1N1 transmission or symptoms between Mexico City and the other cities. Messages reached urban areas outside of the center of the federal government's response efforts and successfully alerted the public to the importance of the situation.

Message order appeared to influence the public's recall. Mass media and health communication campaigns emphasized transmission of pH1N1 via person-to-person contact (always listed first on health communication materials); contact with contaminated surfaces; and sharing of utensils. Educational materials listed fever as the first symptom of pH1N1 infection, followed by headache, body aches, cough, and nasal congestion, with sore throat and additional symptoms further down the list. The order of the pH1N1 facts listed on messages corresponded to the frequency with which respondents reported those facts. These results are consistent with studies reporting that people have difficulty remembering more than a few main messages from news media,[25] and that people in circumstances that cause high levels of concern, such as a pandemic, have impaired ability to process information effectively, further hindering recall ability.[23] This investigation provides data collected during a pandemic supporting the theoretic model that messages should be prioritized, simplified, and listed on materials in order of priority to maximize public recall of the most important messages.

The majority of respondents (>90%) reported adopting some behaviors and personal hygiene practice(s) promoted by the government to protect themselves and their families. Adoption of community mitigation efforts differed more by knowledge of pH1N1 symptoms than perceived severity of disease. The results of this manuscript are consistent with data from the SARS epidemic of 2003, which suggested that self-protective behavior was based on knowledge, not emotion.[26] The results are also consistent with the risk-communication goal of empowering the public through knowledge to take action in order to mitigate fear and the risk of illness.[22]

Respondents cited financial and logistic constraints as barriers to adopting community mitigation efforts. A telephone survey assessing actions U.S. adults would take during a hypothetic influenza epidemic, found financial and logistic constraints as likely barriers to adherence to community mitigation efforts.[27] During this outbreak, it was found that cost of masks, soaps, and gels; lack of availability of masks, water, and soap; and inability to stay home from work were logistic and financial barriers to adopting community mitigation efforts. In addition, nearly half of households reported a negative economic impact because of the government's closing of schools and businesses.

These findings underscore the need to provide feasible community mitigation recommendations that minimize negative impact on economic and social functioning and to allocate resources to address logistic and financial barriers to adoption of community mitigation measures. Data on household-level costs associated with adoption of community mitigation efforts were not available; however, these results emphasize the economic impact associated with community mitigation efforts. Further evaluation of the cost–benefit and cost effectiveness of community mitigation efforts is warranted and should be planned.

Although most respondents found community mitigation messages to be clear, nearly one fifth of respondents, disproportionally from the lowest SES tertile, reported that messages were contradictory or confusing. Message understanding is related to life experience and general knowledge, and people of lower SES are more likely to have lower literacy levels and reduced ability to interpret messages.[22,25] Audience segmentation, commonly practiced in social marketing, divides the population based on social, demographic, and economic backgrounds in order to tailor messages to the most vulnerable.[22] Future community mitigation campaigns should dedicate resources toward audience segmentation or an alternative approach to ensure messages are targeted and reach people of lower SES and other vulnerable subgroups. Message targeting should be combined with co-

ordinated, consistent, and simplified messages regarding adoption of community mitigation practices.

This investigation relied on individual recall, which may be subject to recall and/or social-desirability bias. One adult represented each household, so responses may not accurately reflect the knowledge, actions, and experiences of all members of the household. In addition, the results from an urban sample may not be generalizable to the entire population.

The Mexican government rapidly implemented a comprehensive community mitigation campaign that emphasized both government actions and personal responsibility. The majority of the population received the community mitigation messages and adopted some recommended behaviors. There were few differences among cities in adoption of community mitigation efforts, demonstrating that the campaign's success was not influenced by (1) being inside or outside of the center of the federal government's response (Mexico City) or (2) having a high or low case burden. The closure of schools and non-essential businesses, even for a relatively short period of time, had a negative household economic impact. In addition, some people, largely of lower SES, reported that some messages were confusing and they were unsure how to protect themselves or their families.

The results from this investigation highlight that even during this very successful, comprehensive campaign, it is difficult to reach the entire population and that additional resources are needed to minimize barriers to adopting community mitigation efforts. The descriptive results provide insight into the awareness and adoption of community mitigation efforts at the population level during a pandemic of influenza, and further research is warranted to investigate potential effect modifications, confounders, and subpopulation results. Furthermore, formative research and study protocols are needed to evaluate the effectiveness of government and individual community mitigation efforts to prepare for responding to future pandemics.

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Appendix

Supplementary data

Supplementary data associated with this article can be found, in the online version, at doi:10.1016/j.amepre.2010.07.011.