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Lessons learned from censuses of the 2020 round

Lessons Learned from conducting a Population and Housing Census in Mexico in the context of the COVID-19 pandemic.

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Summary

A population Census is always a challenging operation for a National Statistical Office. In Mexico, for the 2020 round it involved deploying two hundred thousand enumerators across the 2 million square kilometres of the country to enumerate 126 million persons. Although a traditional census was conducted, mobile devices were used for data collection for the first time in Mexico, and modern technologies were implemented in all census stages. Five days before the beginning of the census, the first case of COVID-19 was registered in the country, bringing new challenges to the completion of a census. The enumeration was concluded before sanitary restrictions were implemented, but the subsequent phases had to be delayed and adapted during the pandemic, requiring flexibility and resilience in all processes. This paper shares the experience of Mexico during the 2020 census, including the lessons learned and how they might be a blueprint for the next population count.

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I. Introduction

1.   In Mexico, with the execution of the 2020 Population and Housing Census (2020 Census), fourteen censuses, two population counts, and an intercensal survey have been conducted; providing statistical information that has allowed us to know about the evolution of the population and housing situation in the country, which is needed for decision making.

2.   The 2020 Census was conducted from 2 to 27 March 2020 (enumeration stage), and its basic results were published on 25 January 25 2021, within the framework of a census round marked by the COVID-19 pandemic.

3.   This document seeks to share Mexico's experience in conducting the 2020 Census, the challenges faced due to the pandemic, and the lessons learned that will be considered in the planning of the next population count, scheduled for 2025.

II. 2020 Census Planning

4.   The population and housing censuses are the largest exercises conducted by statistical offices each decade and, given their complexity, require a long planning process, as well as a significant investment of human, financial, technological, and material resources. Therefore, the preparation of the 2020 Census began in 2017, with a public consultation to identify the information needs.

5.   During 2018 and 2019, the census preparation activities continued, and several tests were conducted, both for the definition of the questionnaires and the operational strategy, paying special attention to the tests that would ensure the correct functioning of the applications for data collection and follow-up.

6.   It was decided that the 2020 Census would be de jure with face-to-face interviews with an appropriate informant. Two types of questionnaires would be used for the data collection; a short one with thirty-eight questions and a long one with 103 questions, which contains all the questions of the short questionnaire and which was applied to a probabilistic sample of four million dwellings. Additionally, a specific questionnaire was used for social assistance institutions, which included the short-form questions for their residents. As projects associated with the 2020 Census, an urban environment questionnaire with twenty-three questions was used to collect, by observation, information about the urban infrastructure and services of each block in urban localities. Information was also collected in the rural localities through a forty-five questionnaire applied to a local authority. To enumerate all the inhabitants of the country, Special Operations were defined for the population living in collective living quarters, the personnel of the Mexican Foreign Service and their relatives who reside outside the country, as well as the population of homeless persons.

7.   The 2020 Census had three methods of data collection: the face-to-face interview, which was conducted mainly with mobile computing devices (MD), and, in exceptional cases, using printed questionnaires. In addition, the population could self-enumerate by Internet or through an assisted telephone interview.

8.   Being the first population census that would use mobile computing devices as the main means for data collection, it was essential to define the characteristics of the equipment and the process for its acquisition. In the case of Mexico, the equipment was acquired by public bidding and allowed considerable savings compared to a paper scenario, in addition to the advantages offered by this type of technology for monitoring and reducing the time for the publication of results.

9.   The multiple tests conducted on the data collection application were also of great importance for ensuring that it operated effectively during the census and that there were no delays or inconveniences due to failures. In addition, innovations were implemented, such as the abandonment of printed training manuals, which were replaced by a training application that included audio-visual materials and evaluation at the end of each topic.

10.   The 2020 Census sought to implement innovations in each of its stages. For example, a staff recruitment application was used which included an online evaluation. There was also a tool for respondents to verify online the identity of interviewers, a platform for daily monitoring of progress in the collection of information, the registration of GPS coordinates in each interview, as well as the website to self-enumerate, with controls based on invitation letters with unique QR codes which were delivered to dwellings after three visits without response.

Figure I
Example of GPS coordinates recorded by a supervisor

Source: Instituto Nacional de Estadística y Geografía (INEGI).

11.   Thus, as of 2 March 2020, the material, technological and human resources (about two hundred thousand people) were available to cover the almost two million square kilometres of the national territory to conduct the enumeration of the population in four weeks. After the enumeration, in response to an increase in the refusal of certain sectors of the population to answer the census, an additional week of operation was planned for non-response follow-up in those places where it was required. In the last week of the enumeration, the verification stage was scheduled to begin, whose purpose was to ensure the correct classification of uninhabited dwellings and, where appropriate, to conduct interviews that had not been completed during the enumeration. Approximately one month after the enumeration, it was planned to conducted the post-enumeration survey in order to produce a measurement of the degree of census coverage.

12.   An important issue to mention is that INEGI includes in its regular processes the detection of and timely attention to risks. For the 2020 Population and Housing Census, 122 risks were identified along with the necessary actions to be carried out in the event of any of these risks materializing. Unfortunately, this assessment did not foresee the advent of a global pandemic such as COVID-19 which, as will be detailed in the following sections, resulted in a need to reframe some of the census stages, to adapt, and to seek to innovate to achieve the goal of providing statistical information on population and housing with the highest level of geographical disaggregation that a census allows.
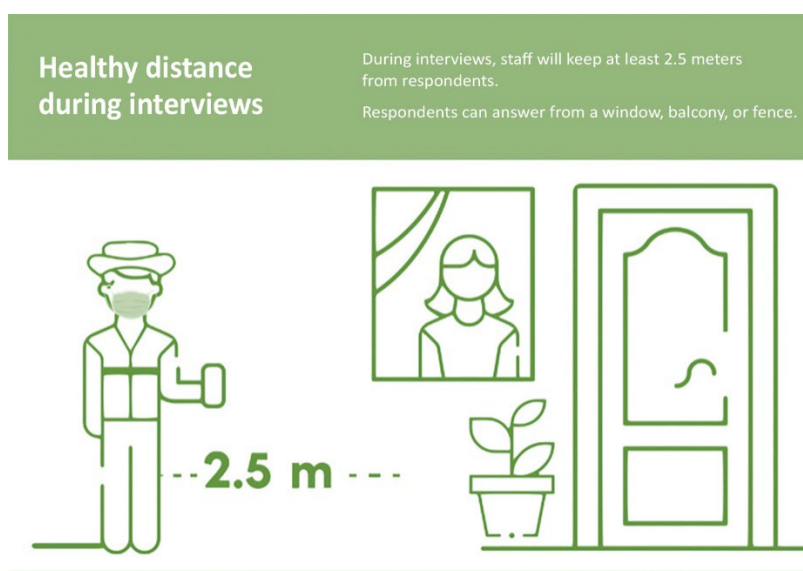
III. Census operations in the context of the COVID-19 pandemic

13. The first case of COVID-19 in Mexico was registered on 27 February 2020, practically at the beginning of the enumeration stage. Therefore right from the start of the census operation, INEGI remained attentive to the instructions of the health authority. By that date all the necessary resources to execute the census had already been deployed throughout the country; the interviewers had been trained and a national communication campaign had been launched to invite the population to respond to the 2020 Census.

14. Beginning in mid-March, preventative measures were put in place to protect both staff and respondents, among which were the mandatory use of face masks and alcohol-based hand gel, for which resources were granted. Interviewers were also prohibited from entering the dwellings or from having any physical contact with respondents. They were also required to keep a distance of at least 2.5 metres from respondents, and to report cases of contagion to their superiors. Staff over 60 years of age were removed from all activities involving contact with respondents, and work meetings were restricted to a maximum of ten people. A staff follow-up form was also introduced to detect cases of COVID-19 infections in a timely manner and to ensure that the appropriate isolation measures were taken.

Figure II
Example of instructions to interviewers for the prevention of COVID-19

Source: "Lineamiento general para la mitigación y prevención de COVID-19 en generación de Información Estadística y Geográfica, Secretaría de Salud, 2021". Translation: *General guidelines for the mitigation and prevention of COVID-19 in the generation of Statistical and Geographic Information, Ministry of Health, 2021*

15. From the third week of the enumeration, an increase in non-response was observed, resulting from a fear of infection among the population. In some isolated cases, mainly in large cities, there were even acts of aggression shown towards the field staff. In the fourth week, staff were instructed to prioritize unvisited areas and to complete the identification and listing of all the inhabited dwellings in the country, even if they resulted in non-response. This was necessary for assessing the census coverage.

16. On 23 March 2020, the country's health authorities announced measures to respond to the pandemic. Under these measures, only essential activities were permitted. The lockdown known as the "National Period of Healthy Distance" (Jornada Nacional de Sana Distancia,
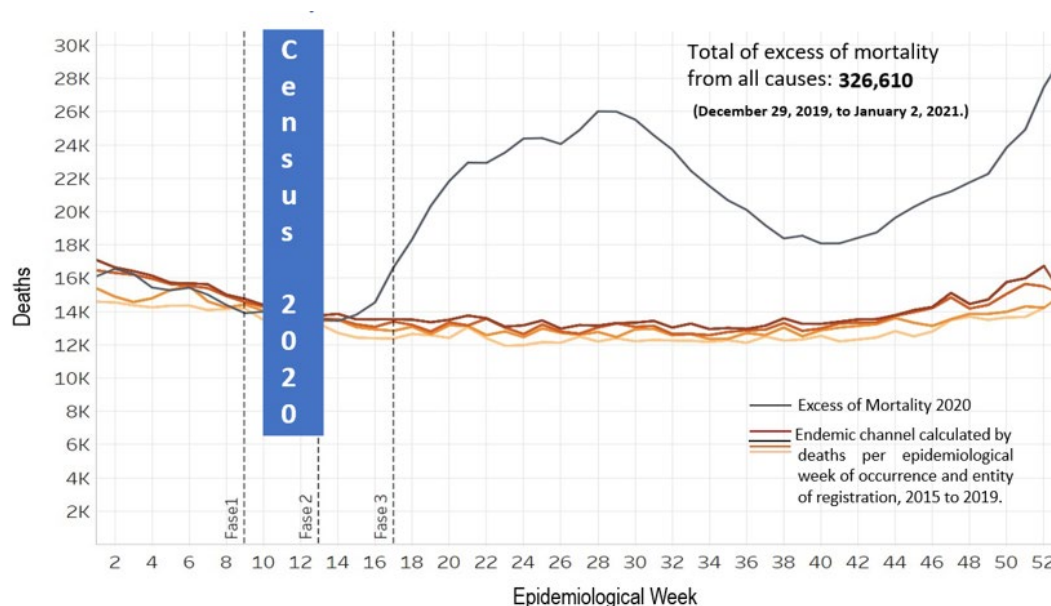
JNSD) was set from 24 March to 19 April 2020, and subsequently the end of restrictions was modified to 30 May 2020.

17.   This period of restriction of mobility for the population coincided with the beginning of the verification stage of the census and with the last week of the enumeration stage. On 31 March the Ministry of Health issued a decree, postponing until further notice all censuses and surveys involving the mobilization of people and physical interaction (face-to-face). This stopped all field and office activities of the census. Consequently, it was not possible to conduct the envisaged additional week of operation to reduce non-response. It was also decided to postpone the verification stage until further notice.

18.   From the beginning of the census, and throughout its progression, INEGI was attentive to the information provided by the health authorities and the evolution of the cases of infection that were occurring in the country. On this basis it was decided to continue with the enumeration activities as planned, since it was considered that they would coincide with the early stage of the contingency (named Phase 1 by the health authorities), where infections are few and there are still no strict measures to follow.

19.   As shown in Figure III, practically at the end of the enumeration period, the government signalled the beginning of Phase 2, characterized by community transmission of the virus; and weeks later came Phase 3, the epidemiological stage where infections with the virus had already reached thousands of persons in several localities.

Figure III
Effect of COVID-19: excess mortality 2020

Source: Inter-institutional group for the estimation of excess mortality from all causes. (2021). Statistical bulletin on excess mortality from all causes during the COVID-19 emergency, 10.

IV.   Activities during the period of restrictions on mobility

20.   By the beginning of April almost the entire country had been visited, identifying all the inhabited dwellings; among which, by that date, there was a 92 per cent response rate. While the majority of staff, principally interviewers, had completed their contracts by this

time, verification interviewers and enumeration supervision personnel were still under contract. Given the impossibility of conducting any field operations, a strategy was designed for these staff to transcribe, in letters of invitation to self-enumerate, the addresses of the inhabited dwellings for which it had not been possible to collect the information during the census due to refusal or absence of the residents. Since the Mexican Postal Service, being considered an essential service, was not subject to mobility restrictions, it was decided to contract its services to send these invitation letters by mail, for the first time in a population census in Mexico. This helped ensure that residents of dwellings who had not responded to the census questionnaire could do so online or by telephone.

Figure IV
Example of an invitation letter to self-enumerate online or by telephone

Source: Instituto Nacional de Estadística y Geografía (INEGI).

21.   About eight hundred thousand invitations were sent during the lockdown and, additionally, a communication campaign was enacted through social networks to invite the population to respond to the 2020 Census online, focusing on the municipalities with the highest rates of non-response. However, the response rate for self-enumeration was only 6 per cent.

22.   Similarly, during this period a virtual revision of dwellings was conducted using satellite images to verify areas in which there were discrepancies between the total number of dwellings planned to be visited and the total number actually visited during the field operation, to identify possible under-coverage.

23.   During this period, the results obtained from the enumeration were analyzed, and based on them, the objective of the second stage of the verification operation was reformulated. This stage was planned to be carried out once the mobility restrictions were lifted. However there was no certainty around when this would happen, since initially the lockdown was put in place until 19 April and was later extended to 30 May. Thus, it was decided that the verification operation would focus its efforts on obtaining information from

the dwellings which had given neither a response to the questionnaire during the enumeration nor a response to the self-enumeration via Internet or telephone. The verification operation also included a sampling of the areas with the largest number of uninhabited dwellings, to verify their correct classification.

24.   To maintain simultaneity, which is one of the guiding principles of population censuses, adjustments were made to the questionnaire so that the information gathered referred to March 2020. Thus the questionnaire recorded those who were resident at the time of enumeration, but also recorded their status of residence during the census reference period. Furthermore, it included people residing there in March 2020 who no longer lived in the dwelling by the time of the enumeration.

V.   Phase II Verification

25.   Once the lockdown was over, field activities were resumed. However, these were limited according to the level of epidemiological risk of each state. In those with a maximum risk level no data collection operations were conducted. This resulted in a Phase II Verification operation with different schedules in the states, with the additional complexity that the level of epidemiological risk was updated weekly, which led on several occasions to suspension of activities. To make the operation more flexible for this stage, various adjustments were made; for example, the hiring of interviewing staff for periods of one week, which, although it involved a greater administrative burden, averted the risk of hiring personnel who could not perform their work due to local mobility restrictions.

26.   For the return to field activities, in coordination with the health authorities, the "General Guideline for the mitigation and prevention of COVID-19 in the generation of statistical and geographical information" was developed, which was published by the Ministry of Health on 2 July 2020. On 17 July this was followed by a decree which allowed censuses and surveys to be carried out in the country regardless of the level of epidemiological risk.

27.   For Phase II Verification, precedence was given to hiring personnel who had already participated in the enumeration or the first verification stage. However, a training period was provided in which the operating procedures were reinforced, and training was given on the changes to the questionnaires to maintain the reference date of the census and on adhering to the "General Guideline for the mitigation and prevention of COVID-19 in the generation of statistical and geographical information". For this training, both online and face-to-face modalities were made available. It was necessary to provide sanitary supplies, i.e. face masks and alcohol-based hand gel, to permit safe conduct of the activities.

28.   When the field operations resumed, between June and August 2020, with a period of two weeks per state, it was found that a considerable percentage of the dwellings in which the response could not be obtained in March 2020 were not inhabited or now had different occupants. This situation occurred, for example, in cities with significant tourist activity, which by that time had not recovered the sources of employment related to these activities, or in areas in which many residents are university students who, due to mobility restrictions and the implementation of online classes, had returned to their places of origin. At the end of the data collection activities, a response had been obtained from 95.5 per cent of dwellings.

29.   For the 2020 Census, 97.7 per cent of the data was collected with mobile computing devices, 2 per cent on paper, and 0.3 per cent by Internet self-enumeration or telephone interviews. A total of 43,903,443 dwellings were visited, of which 35,233,462 (80.3 per cent) were inhabited and 8,669,981 (19.7 per cent) were uninhabited.

VI. Processing

30.   Sanitary restrictions affected not only the activities in the field, but also the subsequent stages of capture and processing, which had to be postponed or modified until staff could return to the offices.

A.   Data Capture

31.   Hiring of staff for data capture from printed questionnaires was suspended, and the questionnaires were stored in warehouses until further notice. It was decided to halt these activities and not to introduce home-based working because the questionnaires contained identifiable information about respondents and their addresses, so the confidentiality of the information could be put at risk. Data capture therefore restarted only once the sanitary conditions permitted, with special measures for the protection of personnel such as having larger and more ventilated spaces, taking people's temperature when entering the facilities, mandatory use of face masks and the daily monitoring of personnel to detect cases of contagion in a timely manner.

32.   Undoubtedly, the limitation of paper questionnaires to exceptional cases only made it possible to reduce the time taken to process the results and, in the context of the pandemic, avoided the concentration of people in enclosed spaces, which would have increased the risk of contagion. The use of mobile computing devices also has a positive impact on the quality of the information, such as the use of digital cartography and GPS for a more precise location, and the implementation of basic validations applied during the interview. It also represented considerable financial savings compared to a paper-only scenario. The use of paper will therefore without doubt be reduced to a minimum in the future.

B.   Data integration

33.   Being based on a multimode data collection strategy (mobile computing devices, Internet, call centre, paper questionnaires) various database schemes were used to receive data. The information was then integrated into a single database to continue with its processing.

34.   Given the different operational strategies implemented because of the pandemic, the integration process required, in addition to extending its operating time, additional processes for prioritizing the data captured through face-to-face interviews, to avoid duplication, and to guarantee the relational congruence of the data.

C.   Coding

35.   Since the personnel responsible for coding collected responses as text did not have access to any information that could identify the respondents or their addresses, it was only necessary to make adaptations to enable the activities to be conducted through any internet connection rather than only through the internal network of INEGI. Assisted coding of the information captured by mobile computing devices could therefore be conducted during the lockdown, with staff working from home. For this purpose, new strategies were put in place to monitor the productivity of the staff and to conduct virtual meetings for follow-up.

36.   During the lockdown it was possible to complete the coding of most of the information. This was important in minimizing the time needed for the publication of results. However, it was necessary to establish a second period for coding the information collected

through printed questionnaires, Internet and telephone, as well as the information gathered during the second phase of verification.

D. Data Editing

37.   The data editing process was conducted to ensure the logical congruence and integrity of the information. It was conducted through the application of criteria and treatments that were designed based on the conceptual framework of the 2020 Census and the structure and content of the questionnaires.

38.   Due to the sanitary conditions, it was necessary to change the operation so the staff could work from home. For example, the computer system used for data editing had to be adapted to guarantee the confidentiality of the information when accessed remotely. Once the sanitary conditions permitted, the activities in the state offices were resumed.

VII. Imputation

39.   In previous censuses, for the dwellings in which it was not possible to obtain an interview, an imputation of three persons per dwelling was made, assigning the sex alternately between men and women and codes of "not specified" for the rest of the characteristics. However, for the 2020 Census, the imputation process was modified and for each dwelling with no response, the missing information was assigned based on the data of a dwelling registered in proximity (within the same Basic Geostatistical Area (AGEB)[1]), selected at random. In this process, the number of residents, their characteristics, and those of the dwellings are considered. However, during the field operation it was not possible to visit some of the planned areas. For these cases, person registers were assigned according to the average number of inhabitants per dwelling at the municipal level, and only the sex was imputed. For the rest of the characteristics, including those of the dwellings, the "not specified" codes were assigned, to avoid bias. In each of the predefined tabulations published, the number of imputed persons is indicated.

40.   Unlike previous events, the verification stage was not conducted immediately after the enumeration due to COVID-19, so the mobility of the population, in terms of their place of residence, between the conclusion of the enumeration and the beginning of the verification was greater than expected. Therefore, an analysis was conducted to maintain as non-response the dwellings which were identified as inhabited during the enumeration, but from which information could not be obtained due to the absence of residents or to refusals, and which were subsequently classified as uninhabited. This maintained the time reference of the census information.

41.   The population censuses of several countries, including Mexico, traditionally exhibit the phenomenon of omission in the declaration of minors. Therefore, an analysis of the population from zero to six years old was carried out in conjunction with information from administrative records. Based on this, imputation of persons under seven years of age was implemented in dwellings in which a woman of reproductive age resided, with surviving children born but not declared as usual residents.

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[1] Territorial extension that corresponds to the subdivision of the municipal geostatistical areas. This constitutes the basic unit of the National Geostatistical Framework.
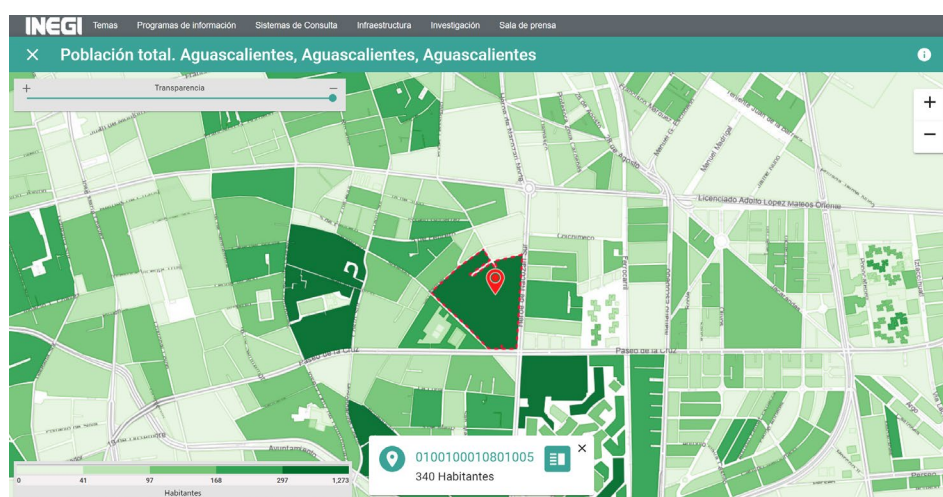
VIII.   Publication of results

42.   At the end of the processing, an analysis of the results was conducted up to the municipal level, taking into account historical trends and other data sources, to ensure that the information was ready for publication and use.

43.   The original calendar of the 2020 Census included a planned date for the publication of the results of 4 November 2020. However, due to the delays in the preceding processes, this had to be rescheduled. It was decided to present the results and products of the Census derived from the short form on 25 January 2021. Additional efforts were made to deliver the census results as rapidly as possible, given the usefulness of the information in a context such as the COVID-19 pandemic; for example, for the distribution of vaccines according to age groups and allowing priority to be given to vulnerable groups.

44.   In a second stage, on 16 March 2021, the results of the long questionnaire and the questionnaires on characteristics of urban environment and locality were published. The System for Consultation of Census Information (SCINCE 2020) was also published in this date. This system allows generation of thematic maps with census information, with disaggregation up to the urban block level.

Figure V
Example of stratification by urban block for the city of Aguascalientes, Mexico

Source: Sistema para Consulta de la Información Censal (System for Consultation of Census Information) 2020 (SINCE 2020), https://gaia.inegi.org.mx/scince2020.

IX.   Conclusions

45.   The series of efforts and adaptations made for the execution of the Population and Housing Census 2020, in the unprecedented context of the COVID-19 pandemic, allowed the basic results to be published on 25 January 2021. This included the announcement that in Mexico there were 126,014,024 inhabitants, among which 64,540,634 (51.2 per cent) women, and 61,473,390 (48.8 per cent) men as of March 2020.

46.   The 2020 Census gives an account not only of the population totals by age and sex, but also of their main sociodemographic and cultural characteristics, and those of their dwellings. The results of the 2020 Census can be consulted with disaggregation up to the level of locality or even urban block, so that decision-makers have information, particularly

in adverse situations like the COVID-19 epidemic. This reiterates the importance of ensuring continuity in the generation of official statistical information.

47.   The incorporation of technologies in all phases of the census, particularly for the data collection and the preparation of all processes, was undoubtedly a key factor in being able to successfully conduct the 2020 Census in an adverse context.

48.   Collecting data using printed questionnaires, in addition to a higher cost, would have implied a considerable delay in the release of results due to the impossibility of concentrating personnel in closed spaces and, therefore, preventing progress in the processing of information. Although for future events the complete elimination of paper questionnaires is not foreseen, their use will be minimized, reserving them for exceptional cases such as device failures or high-risk areas. On the contrary, the need to continue the use of technology in all census processes is clear. Some of the adaptations implemented due to COVID-19 will be continued for future projects, such as remote training.

49.   The experience of this census round undoubtedly offers important lessons, such as the need to have a risk management programme that considers the possibility of this type of event or others that may seem unlikely, and to have an action plan ready in case of its materialization. The importance of maintaining adequate communication between the statistical office, the population, and the authorities of the country, generating confidence and fostering the conditions to execute statistical programmes was also reaffirmed. In the case of Mexico, it is essential to seek mechanisms to increase the participation of the population, either by attending to the interviewers or through self-enumeration, in order to increase the response rates.