SPECIAL REPORT

Screening and Treatment Program to Eliminate Hepatitis C in Egypt

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Chronic hepatitis C virus (HCV) infection is a major global health problem affecting 1% of the world population.[1,2] The Sustainable Development Goals that were adopted by the United Nations General Assembly in 2015 included combating viral hepatitis.[3] In May 2016, the World Health Assembly set targets for the elimination of viral hepatitis,[4] including reaching 90% diagnosis, 80% treatment coverage, and a 65% reduction in related mortality by 2030.[5]

When the targets were set, Egypt had the highest prevalence of HCV infection, a consequence of the prevalence of schistosomiasis and its mass treatment by unsafe intravenous injections in the 1950s to 1980s.[6] In a selected representative sample of the Egyptian population between 15 and 59 years of age in the Demographic and Health Survey (DHS) of 2015, approximately 10% of persons were seropositive for HCV antibodies and 7% had viremia.[7] This amounted to 5.5 million persons with chronic infection, representing a huge health and economic burden.[8,9] With the introduction of effective direct-acting antiviral agents in 2014 to treat HCV infection, the National Committee for Control of Viral Hepatitis (NCCVH) set a national strategy to make treatment paid for by the Egyptian government available for all and to scale up treatment to millions, as described previously.[10] More than 2 million patients were treated by 2018 (representing 40% of the total HCV-infected population), with cure rates above 90%. However, most infected persons remained unidentified. By late 2017, the number of persons with new cases who presented for treatment decreased to less than 5000 a month (Fig. S1 in the Supplementary Appendix, available with the full text of this article at NEJM.org), whereas the model to eliminate the disease by 2030 required diagnosing and treating 360,000 cases a year.[8]

With the decreasing cost of direct-acting antivirals in Egypt (from $1,650 [in U.S. dollars] for 12 weeks of sofosbuvir plus daclatasvir in early 2015 to $85 for local generics in 2018), treatment of more patients and accelerated disease elimination became possible. In early 2018, the Egyptian government decided to embark on a massive effort to identify and treat all HCV-infected persons to achieve disease elimination over the shortest time period possible. Here we describe and present the results of the national screening program in Egypt, which show the feasibility of screening 50 million people for HCV infection to achieve disease elimination.

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METHODS

SCREENING TARGETS

The Ministry of Health set goals to screen everyone in Egypt 18 years of age or older (a target population of 62.5 million) within 1 year and to provide treatment paid for by the state to all those with HCV viremia. Planning started in May 2018. The country was divided into three screening phases, each to be screened over a period of 2 or 3 months. Each phase included 7 to 11 states, 100 to 150 administrative divisions, and a screening target population of 17.9 million to 23.3 million, as detailed in the Supplementary Appendix (Table S2 and Fig. S2).

SCREENING SITES AND STAFF

Screening was conducted in all Ministry of Health hospitals; all primary and rural health units; Egyptian Health Insurance Organization–managed clinics, university hospitals, and military and police hospitals; and all youth centers in all screened areas. Mobile screening teams in specially outfitted vehicles augmented the screening efforts by visiting crowded areas on special occasions (mosques for Friday prayers, churches for Sunday mass, soccer stadiums during game times, and picnic areas and shopping malls on holidays), as well as factories, office buildings, train stations, and subway stations.

Each screening phase had 5800 to 8000 screening teams, each including a physician, a nurse, and a data-entry person. Screening sites were open 12 hours per day, 7 days per week. Training started 2 months before screening launch in each phase, in which 800 trainers were taught how to train the screening teams to use the rapid diagnostic test for the detection of HCV antibodies, to record data and results in the database, and to set further appointments electronically.

TESTS AND PRICES

The World Health Organization (WHO)–approved rapid diagnostic test[11] (SD Bioline HCV, Abbott) was used. Negotiations led to a price reduction to $0.58 per test, including the test kit, the safety lancet, and sharps-disposal containers; the cost also included supply-chain management and delivery to each of 380 central health facilities, which in turn distributed to the screening sites.

HCV RNA levels were measured with the use of a real-time quantitative polymerase-chain-reaction (PCR) assay (Cobas AmpliPrep/Cobas TaqMan HCV Test, Roche Diagnostics). Negotiations resulted in a cost of $4.80 per test, inclusive of the machines and logistics of setting up the machines, training the technicians, connecting the machines to the central database, and transferring the equipment from one phase to the next. PCR machines were set up in one to three laboratories in each state. Samples that were collected in the district referral hospitals were transported by the supplier to the test laboratories.

SCREENING

Population data at the national, state, and district levels were obtained from the Central Agency for Public Mobilization and Statistics 2017 national census.[12,13] The names and national identification numbers of persons 18 years of age or older who were registered in each electoral district were obtained from the National Elections Authority,[14] which automatically registers everyone 18 years of age or older for voting in the district of his or her residence and has a comprehensive database of all persons 18 years of age or older.

Persons could be screened in any phase and any site, regardless of their residence. Participation in screening was voluntary, with no financial or in-kind incentives for participating and no punitive consequences for not participating. Participation in screening was encouraged and emphasized through a massive national advertisement campaign. Television advertisements ran on all channels throughout the screening period, several popular movie and music stars were contracted for the advertising campaign, and television and radio talk shows repeatedly had the national HCV screening program as their main theme. Newspaper advertisements and billboards on many roads were part of the advertising campaign, and millions of text messages were sent to cell phones in each phase.

Immediately before screening, the person's national identification number was electronically checked against the NCCVH database (which includes data on patients previously treated for HCV infection with direct-acting antivirals since 2014). Patients who had been previously treated were not tested for HCV antibodies.

Persons were tested for HCV antibodies with

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the use of a finger-prick rapid diagnostic test, with results available within 20 minutes. Seropositive patients had appointments immediately scheduled electronically for a date within 2 to 15 days in the closest assigned center for evaluation and treatment. At the center, patients received clinical evaluation, underwent abdominal ultrasonography, and had blood drawn for HCV RNA and liver-function tests, as detailed in the Supplementary Appendix. Patients returned for results after 5 days, and treatment was prescribed for those with viremia. All patients were treated with sofosbuvir (400 mg daily) plus daclatasvir (60 mg daily) with or without ribavirin for a duration of 12 or 24 weeks, depending on the presence or absence of cirrhosis and the stage of cirrhosis. The time between screening and the dispensing of medication was usually 10 days but ran to 4 weeks for some patients who were delayed in scheduling or attending follow-up appointments. The shortest time to dispensing treatment was 6 days, and the longest time was 30 days.

Turnout for evaluation was continuously monitored. A call center contacted seropositive persons who did not show up for their evaluation appointments and patients with viremia who did not return for treatment, in order to inquire about reasons for no-shows and to assign new appointments if necessary.

Continuous political support from the Egyptian presidency helped make all necessary resources available. The WHO through its local office monitored the campaign as an independent verification agent.

COMPARISON WITH PREVIOUS PATIENTS

Baseline characteristics and treatment outcomes of patients who were treated in this program were compared with those of patients presenting for treatment before this screening program.[10] (Details are provided in the Methods section in the Supplementary Appendix.)

COST ANALYSIS

Total costs of the HCV components of the program were calculated to estimate costs of identifying a seropositive patient and a patient with viremia. Costs of cure per patient were also estimated.

STATISTICAL ANALYSIS

Details of data that were collected and analyzed are provided in the Supplementary Appendix. The following were calculated at country, state, and district levels: the percentage of persons in the target population who participated in screening and the prevalence of HCV seropositivity among persons screened for HCV antibodies. Confidence intervals for percentages were calculated with the use of the Wilson method in R software, version 3.6.1.

Results in each state and district were compared and analyzed according to sex, age group, and urban or rural residence. State-level prevalence was compared with that in the most recent nationwide survey, the 2015 DHS.[7] Different geographic regions as detailed in Table S1 were compared. For patients with complete data, we analyzed data available as of September 30, 2019, regarding the outcome of evaluation of seropositive patients and the outcome of treatment (incidence of sustained virologic response at 12 weeks after completion of treatment).

All analyses were performed with the use of IBM SPSS Statistics for Windows, version 25.0. All tests of significance were two-sided, and a P value of less than 0.05 was considered to indicate statistical significance.

RESULTS

SCREENING PARTICIPATION

Of a target population of 62.5 million, a total of 49,630,319 persons (79.4%) spontaneously participated in screening between October 1, 2018, and April 30, 2019. Most participants (66.3%) were younger than 45 years of age, and women outnumbered men in all age groups (Table 1 and Table S3).

Participation in screening was significantly higher in women than in men (84.5% vs. 74.6%; difference, 10.0 percentage points; 95% confidence interval [CI], 9.9 to 10.0) and increased with age, from 68.1% of the target population among participants 18 to 24 years of age to 82.5% of the target population among participants older than 65 years of age. Participation was higher in urban areas than in rural areas (83.6% vs. 76.5%; difference, 7.1 percentage points; 95% CI, 7.0 to 7.1) and varied according to state, from a low of 57.8% in Fayoum and 61.9% in North Sinai to more than 90% in Cairo and Ismailia and more than 100% in the South Sinai and Red Sea states (Table S2). Percentages greater than 100% were possible because the denominator included those who were registered in an area, and the numerator included all who

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Table 1. Participation in Screening and HCV Seroprevalence According to Sex.*

Variable	Men	Women	Total
Screening target population — no.†	32,207,165	30,298,399	62,505,564
Participated in screening — no. (%)‡	24,018,428 (74.57)	25,611,891 (84.53)	49,630,319 (79.40)
Previously treated for HCV infection with direct-acting antivirals since 2014 — no. (%)§	692,632 (2.88)	591,739 (2.31)	1,284,371 (2.59)
Screened for HCV antibodies — no. (%)§	23,325,796 (97.12)	25,020,152 (97.69)	48,345,948 (97.41)
HCV seropositive			
No. of adults	1,252,443	976,885	2,229,328
Percent (95% CI)¶	5.37 (5.36–5.38)	3.90 (3.90–3.91)	4.61 (4.61–4.62)

* CI denotes confidence interval, and HCV hepatitis C virus.
† The screening target population included all Egyptian adults 18 years of age or older who had ever been issued a national identification number.
‡ Participation in screening was voluntary. Percentages are relative to the screening target population.
§ Percentages are relative to the number who participated in screening. Persons who had been previously treated with direct-acting antiviral agents were not screened for HCV antibodies.
¶ Percentages are relative to the number screened for HCV antibodies.

were screened in that area, regardless of where they were registered.

HCV SEROPREVALENCE

A total of 1,284,371 patients were identified as having been previously treated for HCV infection with direct-acting antivirals since 2014 and were not tested for HCV antibodies. Overall HCV seroprevalence among the 48,345,948 persons tested was 4.61% (95% CI, 4.61 to 4.62). This varied across states, with the highest prevalence in states in the middle of the Nile Delta (Menoufia, 8.43%; 95% CI, 8.39 to 8.46) and the lowest in the desert states (Red Sea, 2.17%; 95% CI, 2.12 to 2.22). Seroprevalence was higher among men than among women (Table 2 and Figs. S3 and S4), increased with age in all states and districts (Table S4), and was higher in rural areas than in urban areas among both men and women (Table S5 and Fig. S5). As compared with HCV seroprevalence in the 2015 DHS, seroprevalence decreased in all states (Table S6). A significant inverse correlation was found between mean state household income and HCV seroprevalence (Fig. S6).

EVALUATION AND TREATMENT

Seropositive patients who did not show up for evaluation tended to be younger than those who were evaluated and were more likely to be male than female (Table S7). By September 30, 2019, complete evaluation and follow-up data were available for 1,501,307 patients who screened positive with rapid diagnostic testing and were evaluated in NCCVH-related centers: 1,148,346 (76.5%) had viremia, and 91.8% of those with viremia started treatment. Of patients who started treatment, 465,992 reached 12-week follow-up after the end of therapy. Of these 465,992 patients, 386,103 (82.9%) had a known treatment outcome, and 381,491 (98.8%) of those with a known outcome had a sustained virologic response (SVR) (Fig. 1). Of the 93,651 patients with viremia who did not show up for treatment, 53,445 who were reached by telephone indicated that they would be or were receiving treatment in private.

As compared with 216,635 patients treated in 2015 and 2016, when all patients were allowed treatment regardless of the absence or presence of any stage of fibrosis,[10] patients who were identified and treated in this campaign were older, more likely to be female, and presented at an earlier stage of liver disease (mild or no fibrosis, 54.5% of the patients with viremia in our study vs. 38.8% of the patients treated in 2015 and 2016; difference, 15.7 percentage points; 95% CI, 15.5 to 15.9). The percentage of patients with a known outcome after the end of treatment was higher in the 2019 screening cohort than in those treated in 2015 and 2016 (82.9% vs. 69.6%), as was the incidence of SVR (98.8% vs. 97.7%; difference, 1.1 percentage points; 95% CI, 0.9 to 1.2) (Table S8).

PROGRAM COST

The cost of the HCV testing and treatment component of the program amounted to $207.1 mil-

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Table 2. Number Screened for HCV Antibodies and Seroprevalence among Men and Women According to State.*

State	Men		Women		Total	
	Screened for HCV Antibodies	HCV Seropositive	Screened for HCV Antibodies	HCV Seropositive	Screened for HCV Antibodies	HCV Seropositive
	no.	*% (95% CI)*	*no.*	*% (95% CI)*	*no.*	*% (95% CI)*
Urban states						2.95 (2.94–2.96)†
Cairo	3,800,032	3.80 (3.78–3.82)	3,384,783	2.34 (2.32–2.35)	7,184,815	3.11 (3.10–3.12)
Alexandria	1,347,576	2.99 (2.97–3.02)	1,469,937	1.88 (1.86–1.90)	2,817,513	2.41 (2.40–2.43)
Port Said	201,607	3.75 (3.67–3.83)	190,015	2.68 (2.61–2.76)	391,622	3.23 (3.18–3.29)
Suez	192,905	4.64 (4.55–4.73)	191,654	2.81 (2.73–2.88)	384,559	3.73 (3.67–3.79)
Nile Delta states						5.73 (5.72–5.74)†
Damietta	370,322	5.87 (5.80–5.95)	375,718	5.03 (4.96–5.10)	746,040	5.45 (5.40–5.50)
Dakahlia	1,725,097	6.22 (6.19–6.26)	1,855,635	4.97 (4.94–5.00)	3,580,732	5.57 (5.55–5.60)
Sharkia	1,772,297	7.28 (7.24–7.32)	1,877,251	6.24 (6.21–6.28)	3,649,548	6.75 (6.72–6.77)
Kalyoubia	1,265,477	5.20 (5.16–5.23)	1,379,373	3.87 (3.84–3.91)	2,644,850	4.51 (4.48–4.53)
Kafr-El-Sheikh	742,715	5.44 (5.39–5.50)	882,338	4.41 (4.37–4.45)	1,625,053	4.88 (4.85–4.92)
Gharbia	1,184,888	7.28 (7.23–7.32)	1,398,327	5.27 (5.24–5.31)	2,583,215	6.19 (6.16–6.22)
Menoufia	935,365	9.89 (9.83–9.95)	1,090,593	7.17 (7.12–7.22)	2,025,958	8.43 (8.39–8.46)
Beheira	1,381,091	5.11 (5.08–5.15)	1,524,505	3.92 (3.89–3.95)	2,905,596	4.49 (4.46–4.51)
Ismailia	425,067	4.72 (4.65–4.78)	399,788	3.45 (3.39–3.51)	824,855	4.10 (4.06–4.15)
North Nile Valley states						5.28 (5.27–5.30)†
Giza	1,992,201	4.45 (4.42–4.47)	2,114,259	2.82 (2.80–2.84)	4,106,460	3.61 (3.59–3.63)
Beni Sueif	656,744	8.92 (8.85–8.99)	758,356	6.52 (6.47–6.58)	1,415,100	7.63 (7.59–7.68)
Fayoum	498,058	6.83 (6.76–6.90)	605,215	5.14 (5.09–5.20)	1,103,273	5.90 (5.86–5.95)
Menia	1,040,922	7.89 (7.84–7.94)	1,346,109	5.39 (5.35–5.43)	2,387,031	6.48 (6.45–6.51)
South Nile Valley states						3.30 (3.29–3.31)†
Assiut	901,997	4.42 (4.38–4.47)	1,024,212	2.83 (2.80–2.87)	1,926,209	3.58 (3.55–3.60)
Suhag	922,045	4.75 (4.71–4.80)	1,164,810	2.81 (2.78–2.84)	2,086,855	3.67 (3.64–3.69)
Qena	720,751	3.83 (3.78–3.87)	886,076	1.93 (1.90–1.96)	1,606,827	2.78 (2.75–2.81)
Aswan	384,626	4.35 (4.29–4.42)	434,676	2.30 (2.25–2.34)	819,302	3.26 (3.22–3.30)
Luxor	251,801	3.59 (3.52–3.66)	288,132	1.56 (1.52–1.61)	539,933	2.51 (2.47–2.55)
Desert states						2.47 (2.44–2.50)†
Red Sea	214,300	2.51 (2.45–2.58)	106,728	1.49 (1.42–1.56)	321,028	2.17 (2.12–2.22)
New Valley	81,630	2.80 (2.69–2.92)	74,590	1.71 (1.62–1.80)	156,220	2.22 (2.21–2.35)
Matrouh	153,090	2.47 (2.39–2.55)	92,607	2.57 (2.47–2.68)	245,697	2.51 (2.44–2.57)
North Sinai	81,945	3.16 (3.04–3.28)	81,304	1.92 (1.83–2.02)	163,249	2.54 (2.47–2.62)
South Sinai	81,247	3.78 (3.65–3.91)	23,161	2.55 (2.35–2.76)	104,408	3.51 (3.40–3.62)
Total	23,325,796	5.37 (5.36–5.38)	25,020,152	3.90 (3.90–3.91)	48,345,948	4.61 (4.61–4.62)

* Urban states are states formed totally of cities and urban dwellings, with no rural or agricultural areas. Nile Delta states are mainly rural agricultural states with large cities, where agriculture is based on Nile water. North Nile Valley states and South Nile Valley states are mainly rural with smaller cities, where agriculture is based on Nile water. Desert states are sparsely populated in small cities, towns, and desert communities, where the agriculture, which is scarce, is in oases and is based on underground water or little rain (no Nile water irrigation).
† Shown is the seroprevalence across all states in this category.

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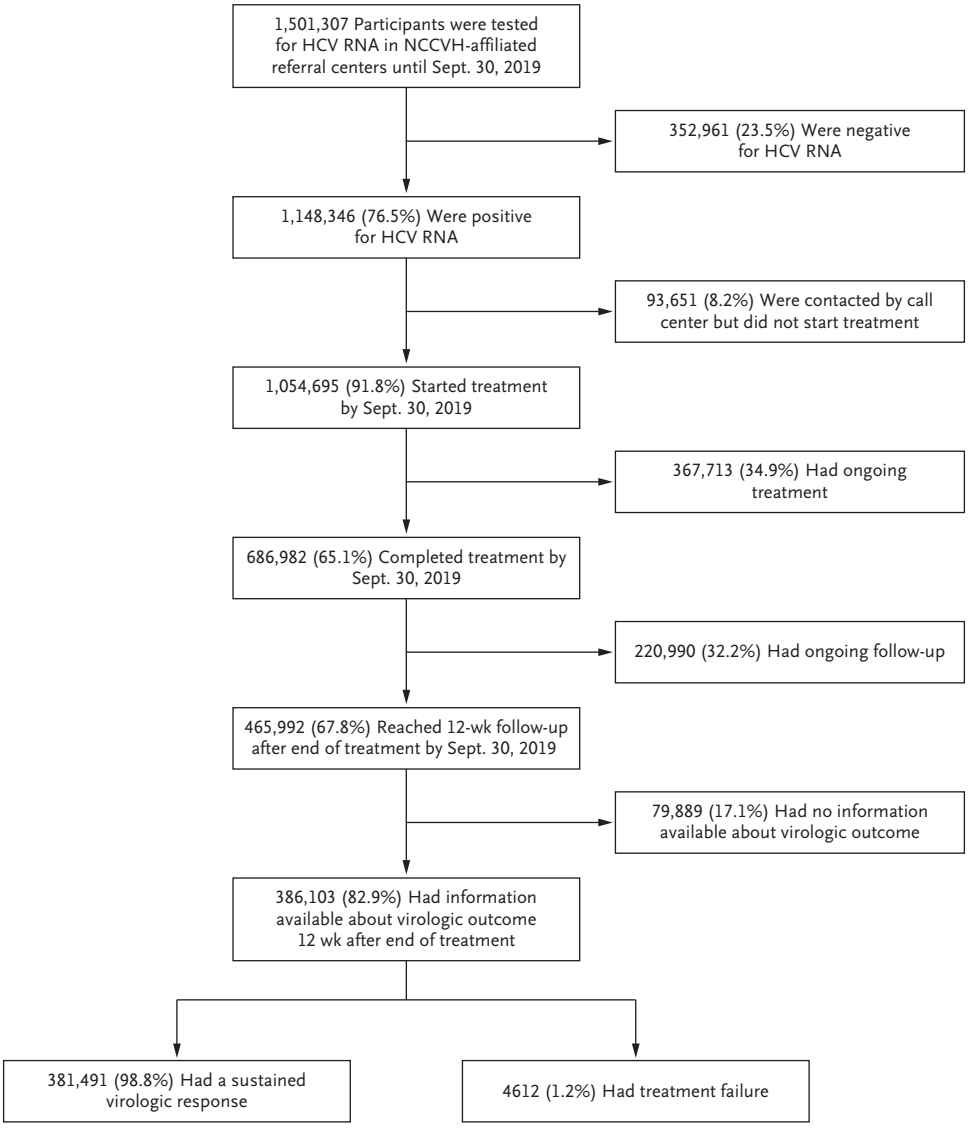

Figure 1. Outcome of Virologic Evaluation and Treatment in NCCVH Centers.

Patients were referred for clinical and laboratory evaluation, hepatitis C virus (HCV) RNA testing, and treatment in National Committee for Control of Viral Hepatitis (NCCVH)–affiliated centers and in Egyptian Health Insurance Organization–managed clinics and hospitals. The data in the chart are for patients with complete data in NCCVH centers.

lion. The cost of identifying a patient with HCV viremia was $85.41, and the cost of identifying and curing a patient was $130.62 (Table 3).

DISCUSSION

Although participation in screening was voluntary, turnout was very high, with 49.6 million persons participating over a 7-month period. To our knowledge, this is one of the largest disease screening campaigns in history. The reasons for nonparticipation are not known, but more men than women and more younger adults than older adults did not participate. The low participation in some states and the lower participation in rural areas than in urban areas probably represents the degree of ease with which people could participate in screening. A person could walk

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Table 3. Cost of the Screening and Treatment Program.*

Variable	Value
Screening	
Staff cost — $	
Medical teams	36,552,528
Administrative staff	15,000
Total	36,567,528
Medical supplies — $	
Rapid diagnostic test for HCV antibodies	27,345,901
Consumables (e.g., gloves, swabs, and staff uniforms)	3,701,062
Total	31,046,963
Information technology and administration — $	4,364,830
Overhead — $	18,787,415
Total cost of HCV screening program — $	90,766,736
No. with HCV seropositivity	2,229,328
Cost of identifying seropositive case — $	40.71
Evaluation	
PCR assay for HCV RNA — $†	14,981,084
Clinical, laboratory, and ultrasonographic evaluation — $‡	31,349,925
Total cost of evaluation — $	46,331,009
No. with viremia	1,605,116
Cost of HCV RNA testing and evaluation per viremic case — $	28.86
Cost of identifying viremic case — $	85.41
Treatment — $	
Total cost of treatment	70,041,432
Cost of treatment per case§	43.64
Total cost	
Total cost of screening, evaluation, and treatment — $	207,139,177
Cure rate — %¶	98.8
Cost of identifying and curing a case — $‖	130.62

* All costs are in U.S. dollars, calculated at the exchange rate at the start of the program in October 2018 (1 U.S. dollar=17.6 Egyptian pounds). Costs of screening include all costs incurred to screen the 49.6 million persons for HCV antibodies. Costs of evaluation and treatment assume that all seropositive patients were evaluated and that all patients with viremia were treated. PCR denotes polymerase chain reaction.

† Included are the purchase cost per test ($4.80) plus 40% overhead, consumables, and staff, multiplied by the number of HCV-seropositive cases identified in the screening program.

‡ Included are the cost of laboratory tests and ultrasonography, consumables, and staff, multiplied by the number of HCV-seropositive cases identified in the screening program.

§ Included is the cost of a 12-week supply of locally manufactured sofosbuvir plus daclatasvir with or without ribavirin.

¶ Shown is the percentage of patients with a known sustained virologic response in the program.

‖ The result is the cost of screening, evaluation, and treatment for the whole program divided by the number of patients with viremia divided by the cure rate.

into a screening site in any phase and any state, regardless of his or her registered residence. Turnout for screening in an area was estimated according to the number of persons registered in that area. The states with the lowest turnout (Fayoum and North Sinai) have high labor and population migration to the states with the highest recorded turnout; similarly, rural labor moves to urban areas for day or permanent jobs.

Although Egypt used to have the highest prevalence of HCV infection in the world, the present results show that the HCV seroprevalence among untreated persons is lower than that reported in the 2015 DHS.[7] The 1.28 million who had been previously treated between 2014 and 2018 and who turned out for screening were not tested for HCV antibodies. Much of the decline in HCV prevalence between 2015 and 2019 reflects the effect of treatment with direct-acting antivirals, and some relates to background mortality and HCV-related mortality.

As shown in most previously published literature, HCV infection in Egypt is more common among men than among women and in rural settings than in urban settings and is most prevalent in the Nile Delta and upper part of the Nile Valley, where schistosomiasis and parenteral antischistosomal therapy were concentrated during the second half of the 20th century.[15-20] We found that HCV seroprevalence in the same state is higher in rural districts, which might be due to the better health care facilities in urban areas.

The relation between HCV infection and household income has been suggested previously[21,22] and could be related to the quality of health care in relation to the income and wealth of the area. Although the screening program did not collect individual income data, we found that HCV seroprevalence at the state level was inversely related to the mean household income of the state.[23] Had the Egyptian government not totally sponsored screening, treatment, and follow-up for all patients regardless of personal income level, many patients in low-income areas where the disease is more prevalent would have found it difficult to access necessary treatment. This is one of the key factors to the success of the elimination program.

As compared with patients treated in 2015 and 2016,[10] seropositive patients who were identified through population screening had earlier stages of liver disease, which might explain the

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higher cure rate in 2019. Treating more patients before the development of cirrhosis is hoped to reduce the occurrence of future complications, the development of hepatocellular carcinoma, HCV-related mortality, and the economic burden of the disease.

The economic burden of HCV infection in Egypt has been calculated previously, and it was estimated that the lifetime direct medical cost and indirect cost of disability and early death for a patient with HCV infection was in excess of $100,000 (in U.S. dollars).[9] The cost of identifying and curing a patient in the current campaign was $131, which clearly shows the magnitude of cost saving by population screening.

The current screening program has shown that, although Egypt had treated more than 2 million patients since 2014, HCV infection was still a major problem by the start of this program in 2018, with 4.6% of the previously untreated adult population seropositive. This still placed Egypt among the 10 countries with the highest HCV burden globally[2] and represented a large health and economic burden. After treating patients identified in this campaign, Egypt has the potential to be the first country with a large HCV burden to meet elimination targets.

The barriers to achieving HCV global elimination targets, including finding asymptomatic patients, linking them to care, and providing access to affordable treatments, were highlighted in a recent review.[24] We found that participation in screening, referral to care, and adherence to treatment were high and that identifying and treating patients through population screening were feasible even with limited resources. We anticipate that this campaign will result in achieving the WHO elimination targets and reduce the prevalence of HCV infection in Egypt to less than 0.5% during 2020. This is expected to have a similar effect on reducing new infections and HCV-related complications and deaths. The results that are presented here, however, still need verification by epidemiologic studies to confirm effects on incidence, residual chronic infection, and complications of HCV-related liver disease and to accurately calculate future cost savings and the effect on disability-adjusted life-years saved.

Our study has limitations. Of the target adult population, 20.6% did not participate in screening. Participation was lower among men than among women and was lower among those younger than 25 years of age than among older persons. The reasons for not participating are not known and merit further studies. However, approximately 10.25 million Egyptians live or work in other countries,[25] and for persons in the target population who did not participate, 10% of screening sites in all states will continue free screening and treatment for 1 additional year. Risk factors for HCV seropositivity other than age, sex, and area of residence were not captured because of the very large sample, which did not permit detailed questionnaires to be filled out. In addition, differences between patients with viremia and those without viremia other than age and sex were not assessed. These risk factors deserve to be evaluated.

The major strength of this campaign is showing the feasibility of massive-scale population screening for HCV in millions. The U.S. Preventive Services Task Force recently recommended screening all U.S. adults 18 to 79 years of age without liver disease for HCV, a change from the previous recommendation of screening adults born between 1945 and 1965.[26] Several key factors drove the success of the screening campaign in Egypt and can guide other countries preparing similar HCV elimination programs. First, political will and support were crucial for initiating and maintaining the program. In this campaign, the Egyptian president adopted the program, aligned the whole government behind it, and maintained continuous support throughout. Second, social pressure was essential to drive policymakers to start and scale up a national treatment program at the expense of the state. The large number of patients with HCV infection, its complications and its related mortality, the many agencies denying employment to HCV-seropositive patients, and the high cost of therapy that most patients had to pay out of pocket but could not afford generated sufficient pressure and were major factors behind public awareness and the high participation in screening. Third, mass procurement through a single negotiating body ensured low prices. The costs of diagnostics and treatment in this campaign could be benchmarks that other low- and middle-income countries could use to reach lower prices. Fourth, sufficient financial and human resources were allocated at the outset to ensure continuity and success.

Fifth, efficient information-technology support with user-friendly application and integration with national databases facilitated planning and pa-

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tient flow during screening, evaluation, and treatment. Immediate results and immediate linkage to care resulted in smooth evaluation and treatment of patients. Simplified management guidelines allowed task shifting to nonspecialist physicians, which was essential to deal with a huge number of patients in such a short time. Most important, providing tests and treatment at no cost to patients was a major factor driving adherence and program success.

Egypt has managed to implement a successful nationwide HCV screening and treatment program. By screening 49.6 million persons over a period of 7 months, we have managed to identify 2.2 million HCV-seropositive persons and refer them for evaluation and treatment. Identifying and treating all infected patients is the major step toward disease elimination in the country that used to have the highest global prevalence and toward the first national-level elimination of HCV infection.

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