Paycheck Protection Act Testing Plan: Michigan

Question One (2,000 word limit)

Describe the overarching testing strategy in your state or jurisdiction: State plans for testing of SARS-CoV-2 should explicitly detail how a minimum of 2% of the state's population will be tested each month beginning immediately; as well as plans to increase that number by Fall 2020. Please provide the requested information to illustrate the specific details of your jurisdictionwide SARS-CoV-2 testing plan. The jurisdictional strategy should address the following topics:

- a) How you will maximize the use of testing platforms (with an indication of which ones are high throughput), venues, and expanded workforce across your jurisdiction (e.g. public health labs, private, hospital, commercial, academic, etc.) to rapidly scale testing to accommodate an increased demand for SARS-CoV-2 tests, including utilizing point-of-care or other rapid result testing for local outbreaks?
- b) Detail your approach to provide testing at non-traditional laboratory sites (e.g., retail sites, community centers, residential medical facilities, or pharmacies).
- c) Describe your strategy for serology testing, if applicable.
- d) Describe how you will communicate, collaborate and coordinate with the broad testing community within your state to ensure alignment in approach and progress toward jurisdictional goals. Plan should include regular outreach to testing partners to monitor test kits, supply, and reagent inventory and staffing levels.

Response

Michigan conducted over 420,000 diagnostic tests in May, just under 435,000 diagnostic tests in June, and has plans to expand testing substantially from here. As of early July, the state is averaging approximately 19,000 tests per day. The state had set a near-term goal of reaching 15,000 diagnostic tests per day and a medium-term goal of reaching 30,000 diagnostic tests per day (approximately 900,000 individuals per month or about 9 percent of the state's population). This level of testing will allow the state to rapidly identify new cases, including among asymptomatic individuals, contain COVID-19 spread, and protect high-risk settings.

Michigan carefully monitors testing levels and trends on a daily basis using our public health reporting infrastructure. Electronic laboratory referrals of testing results are received through infrastructure developed in support of the Michigan Disease Surveillance System (MDSS). Laboratories (and settings utilizing rapid point-of-care tests) are required to report results from all positive and negative COVID-19 diagnostic and serologic tests to the Michigan Department of Health and Human Services (MDHHS). While most laboratories transmit real-time results of structured HL7 messages, those that do not have that capacity are given to the opportunity to report batched results in a .csv format. Positive test results are consumed by the MDSS and produce confirmed case referrals for follow up by local public health agencies. All submitted test

results are also evaluated on a daily basis to better describe the status of COVID-19 status in Michigan, including the geographic distribution of testing, testing capacity, and trends in positivity as well as the performance of submitting laboratories. In concert, all of the information contributes to an assessment of the pandemic status for the State and jurisdictions in terms of disease spread, detection and impact, that serves to better define and direct appropriate public health mitigation efforts.

a) Michigan is maximizing use of testing platforms by partnering with a wide range of laboratories to conduct testing. Over 70 entities in the state have some testing capability, whether as a CLIA high-complexity laboratory conducting PCR tests or as a CLIA waived entity conducting point-of-care tests. Together, these entities report capacity to test over 45,000 per day if corresponding supplies were available; however, supply shortages continue to significantly restrict Michigan's testing capability.

At least 57 hospital laboratories, 15 in-state commercial laboratories, four tribal partners, and six public health laboratories, including the State of Michigan Public Health Laboratory, have COVID-testing capabilities. Michigan medical providers also regularly send specimens to national commercial laboratories like Quest, LabCorp, and BioReference.

The Michigan State Laboratory has strategically worked to ensure that high-throughput instruments in the state are fully utilized. This includes providing technical assistance to laboratories as they validate tests on that equipment, working directly with test kit manufacturers to ensure allocation of materials to those labs, and providing specimen collection materials when needed to maximize throughput on those machines. For example, Roche high-throughput instruments are in use at McLaren Flint and Sparrow (Lansing) hospitals; the State Laboratory has an overflow contract with Sparrow, so that extra samples from public health uses are testing using their high throughput equipment. Similarly, high-throughput Thermo Fisher equipment is used by NxGen commercial laboratory and others throughout the state. Michigan works directly with Thermo Fisher on allocation strategy to supply these machines and ensure corresponding specimen collections. Finally, the State Laboratory is currently in the process of validating a test on the Hologic Panther system, with capacity to process several hundred tests per day.

For rapid point-of-care testing, four hospital systems in Michigan have received allocations of Abbott ID NOW tests (McLaren, Spectrum, Ascension, and St. Joseph's), as well as the City of Detroit. The State itself has received modest allocations of the kits and has distributed them to regional public health laboratories, state hospitals, and the Department of Corrections. While these tests have made an important contribution to the state's testing capacity, and could be quite valuable for rapid testing in high-risk scenarios (e.g., new admissions to congregate care settings), the state has not been able to purchase sufficient supplies to distribute to these settings, though the state continues to receive allotments for them through the CDC IRR, as instructed. Based on conversations with hospital systems that have received larger allocations, many hospitals have opted to use the kits for hospitalized patients, those in the emergency department, or similarly acute situations.

The State is simultaneously pursuing several approaches to expand testing capacity:

- 1) Continuing work to procure needed supplies, match supply types allocated by FEMA to laboratories able to accept them (e.g., Michigan's first May shipment of foam swabs), and optimize the match of collection materials from FEMA, test kits and reagents from manufacturers, and specimen collection staff from various sources.
- 2) Continuing to provide technical assistance to laboratories working to validate COVID-19 testing on their platforms, including new commercial laboratories and academic laboratories, and discussing with all laboratories the types of supplies with stronger supply chains versus those with interruptions. Funding from the Paycheck Protection Act will also be utilized to help bring online five regional public health laboratories for COVID-19 testing, using Hologic Panther systems. Four of these laboratories are expected to be online by fall flu season. A sixth regional public health laboratory is planned to assist rural populations of the upper peninsula though it is expected to take longer to onboard.
- 3) Contracting with laboratories, including out-of-state and national commercial laboratories, to purchase additional testing capacity and supplies as needed. Michigan has recently finalized a contract with Honu/mLife, a Texas-based laboratory, to assist with on-site testing for vulnerable populations, as discussed further below.
- b) Michigan has supported test sites across a very wide range of entities; over 300 test sites currently operate in the state. The vast majority of Michigan's testing capacity consists of PCR tests rather than point-of-care tests, so these sites largely consist of specimen collection, which is sent to a laboratory for processing.

Settings include:

- 1) Hospital-affiliated, urgent care, and primary care test sites: numerous hospitals across the state manage drive through test sites that serve the broader community and utilize the hospital's laboratory to process samples. Similarly, many urgent care and primary care settings, including over 70 federally qualified health centers, operate test sites, serving general symptomatic individuals with a particular focus on low-income populations. As the COVID-19 response evolves and transitions into a longer-term state, Michigan will work to substantially expand testing in primary care settings, especially as hospitals transition their staff and laboratory capacity to support screening of patients coming in for general procedures.
- 2) National retail pharmacy sites: Michigan has worked with CVS, Kroger, Rite Aid, Walgreens, and Walmart to support approximately 20 specimen collection sites across the state. Some of these operate as large-scale drive through sites. Others operate as smaller-

scale drive through sites at retail pharmacies. Finally, a few operate as drive-up sites at grocery or big box stores, with a pharmacist coming out to the car to supervise specimen collection.

The variety of these sites provide Michiganders with diverse testing options to meet their needs. The State has also consulted with each pharmacy around geographic areas that need additional testing resources, to site locations where they will be most impactful.

Moving forward, Michigan will continue to explore the role that pharmacies can play in a longer-term testing access strategy and, as recommended by federal HHS, work with current pharmacy sites to transition to an insurance-based reimbursement model after federal funding ends on August 30th.

3) Congregate care facilities: Michigan is working to facilitate broad testing within several types of congregate care facilities, including skilled nursing facilities, adult foster care, prisons, jails, homeless shelters, and settings that host migrant agricultural workers. The Michigan National Guard has assisted with specimen collection throughout the prison system, jails, and long-term care settings (in addition to community-based testing). Michigan has also partnered with federally qualified health centers to conduct testing at agricultural facilities and migrant worker camps. Finally, the State has recently promulgated testing requirements for skilled nursing facilities, in line with CDC and CMS recommendations for testing; facilities have the option of completing the testing on their own, with external laboratory partners, or seeking assistance from the Michigan National Guard to conduct testing.

Moving forward, Michigan has developed a sustainable system to plan and implement vulnerable populations testing. Specifically, each of the state's local health departments will submit biweekly testing plans to the state, identifying congregate care facilities, atrisk settings like high-risk workplaces or dense housing facilities, and community-based settings that are priorities for testing based on public health factors and local epidemiology. The Michigan Department of Health and Human Services will review the plans, determine which requests the state can fulfill (ideally enough to reach 3,030 tests per million per day in every jurisdiction), and deploy state testing assistance to the identified locations. Currently, the Michigan National Guard provides state testing assistance. Michigan has recently completed a contract with Honu/mLife to provide this service (as well as laboratory processing of the specimens) on an ongoing basis, including after the National Guard mission ends.

In addition to this regular testing planning process, the vendor will have the capability to conduct rapid-response testing for outbreaks. This will entail MDHHS working closely with local health departments to monitor both facility-based outbreaks and areas of increasing community spread. When facilities or communities in need are identified,

Honu/mLife will deploy to conduct testing within 36 hours, either on-site at a facility or via pop up community-based testing sites.

Finally, the state remains committed to helping facilities and local health departments identify testing resources and laboratories, independent of options directly provided by the state, to develop sustainable relationships for regular testing.

- 4) Neighborhood testing locations: Michigan plans to establish at least 20 neighborhood testing sites, serving approximately 100 people each per day, sited in marginalized communities based on epidemiological analysis of rates of comorbid conditions, other risk factors, distance from existing test sites, and limited household access to vehicles. Together, this information suggests that the specific ZIP codes selected face high risk of COVID-19 infections and little access to existing test sites. Each site will partner with one or more community organizations (e.g., neighborhood centers, faith-based organizations, etc.) to host the site and serve as a trusted ambassador to the community to encourage underserved populations to access testing.
- 5) Mobile testing: To supplement the fixed-site locations highlighted above, Michigan is also working to expand a successful mobile testing pilot, which currently operates at a variety of sites in Detroit and nearby cities each day. Mobile testing complements other aspects of the strategy in several ways: by filling access gaps in fixed-site locations, by providing a flexible and nimble approach that can respond to emerging hotspots over time, and by partnering closely with community organizations to create convenient testing options for underserved communities.
- 6) Sentinel surveillance: Michigan is using the influenza-like illness (ILI) sentinel surveillance network to monitor a semi-random sample of flu-negative patient specimens from participating medical providers for COVID-19 across the state. Currently, this encompasses approximately 250 samples per week but will ramp up to 1,200 samples per week in the medium term.
- c) The State Public Health Lab of Michigan is working with several academic partners to plan potential serological surveillance studies of COVID-19 presence in the population. Given the utility and limitations of serology testing, the State is interested in using it to understand patterns of COVID-19 spread and potential implications for population health or immunity, based on evolving scientific research. Please see Question 2d for detail on the state's serology strategy.
- d) Michigan has several ongoing touch points with the testing community in the state to align on overall strategy and implementation.

Most notably, the State hosts a weekly call with laboratories statewide to share information and discuss the state's testing strategy. In advance, each laboratory submits information on their average daily throughput, maximum possible throughput with existing supplies, and maximum

possible throughput with unconstrained supplies, to provide a statewide picture of laboratory processing capacity. Each laboratory also submits information on supply status for collection materials, test kits, and reagents to provide a similar statewide picture of supply needs. Personnel and staffing have not been challenges noted by laboratories during the pandemic. Laboratories are also able to submit supply requests to the State Laboratory in at any time, and the State Laboratory fulfills these requests using FEMA supplies and occasional ad hoc solutions to prevent any laboratory from running out.

The State is also in ongoing communication with additional partners in testing, including the Michigan Health and Hospital Association and local health departments. These partners are included in the state's pandemic response work groups and thus are directly involved in planning the response together.

MDHHS has also undertaken public communications activities to promote testing. The department launched a social distancing mass media campaign at the beginning of April. This campaign has included television, radio, print, digital and social media advertisements that make the public aware of the risks related to COVID-19 and the importance of social distancing measures, including sheltering at home.

As the State of Michigan increased its COVID-19 testing capacity and encouraged individuals to get tested more broadly, MDHHS has added new content and messaging to the campaign asking that eligible individuals get tested. We currently have multiple TV and radio spots running that encouraging testing and targeted social media ads promoting the availability of testing at specific locations. MDHHS expects to continue and enhance these activities utilizing Paycheck Protection Act funding on an ongoing basis.

Question Two (2,000 word limit)

Describe your public health department's direct impact on testing expansion in your jurisdiction. The narrative response should address the following topics:

- a) Describe how the health departments will directly expand testing capacity through their public health labs, contracts, partnerships, and other arrangements (e.g. adding testing capacity in local health departments, contracting with new labs, partnering with academic and community-based organizations, establishing drive-thru testing sites, etc.). Provide specifics about planned expansions of existing capacity, including procurement of new testing equipment or device platforms.
- b) How testing needs of vulnerable and at-risk populations will be prioritized, including the elderly, disabled, those living in congregate settings including nursing homes and prisons, racial and ethnic minorities, healthcare workers, and among persons experiencing homelessness.

- c) How barriers to efficient testing will be identified and overcome, including those related to underutilization of available assets and supply-chain difficulties, and considerations with end-to-end logistics of testing (from sample collection to reporting to public health and CDC).
- d) Describe the strategy for serology testing through the public health labs, if applicable, including specific platforms intended to be used.
- e) Describe the health department's plan for resource utilization and how the jurisdiction will manage testing and alignment with SARS-COV-2 community mitigation policies, including sentinel surveillance for vulnerable populations.
- f) Describe the health department's plan to expedite and streamline procurement, hiring, and onboarding of new staff. Should include planned steps and ability for the jurisdiction to acquire supplies, reagents, test kit, collection materials required for expanding testing indicated in table #2 (below)

Response

a) Over 70 entities in the state have some testing capability, whether as a CLIA high-complexity laboratory conducting PCR tests or as a CLIA waived entity conducting point-of-care tests. Together, these entities report capacity to test over 45,000 per day if corresponding supplies were available; supply shortages continue to significantly restrict Michigan's testing capability. That includes numerous hospital laboratories, commercial laboratories in-state, and public health laboratories. To maximally utilize available capacity, Michigan is working closely with each of these labs to allocate available collection materials, to monitor ability to procure test kits and reagents from manufacturers, and to collect them with medical providers conducting testing, if needed.

Michigan plans to expand capacity in several ways. First, and most significantly, the State continues to work tirelessly to procure needed supplies to ensure that laboratory capacity available can be utilized. Second, the State Laboratory continues to provide technical assistance to new laboratories working to bring testing online, including plans to bring online five regional public health laboratories by fall. Longer-term plans include a sixth regional public health laboratory being established. Third, the State has established relationships with several national commercial laboratories and out-of-state laboratories with significant capacity, allowing us to nimbly purchase additional capacity and ramp up quickly where needed. Fourth, the State is working with external partners to pilot new testing materials, specifically working with a commercial company on manufacturing viral transport media and working with hospital laboratories to pilot the use of 3D printed swabs.

b) As discussed in question one, the State is currently utilizing the National Guard to conduct broad-based testing in congregate settings. This includes testing all state prisoners, offering to test all jail inmates, and offering to test long-term care facilities as needed, working closely with

local health departments that have already tested long-term care facilities in some counties. The State expects that the National Guard will be a key resource in testing additional congregate settings, including adult foster care settings and homeless shelters. The State has established a contract with an external vendor to provide this services on an ongoing basis, once the Guard mission ends, and has also established a process with local health departments to plan these testing activities (see detailed description in Question One response). Finally, the State is working to expand testing for migrant agricultural workers, partnering with local health departments, federally qualified health centers, and employers.

For skilled nursing facilities in particular, in June the State promulgated testing requirements for these facilities, in line with CDC and CMS recommendations. This includes requirements for: initial testing of all residents and staff, testing of all new or returning residents on intake, weekly testing of all residents and staff in facilities with a positive case (until 14 days after the last positive case identified), and weekly testing of all staff in regions of medium or high risk (based on epidemiological factors and the state's reopening plan). Facilities may conduct testing themselves, with external laboratory partners and state reimbursement for costs not covered by insurance or may request state assistance to provide supplies or conduct the testing directly. These requirements are currently being implemented, are expected to raise overall testing levels in the state, and (based on initial anecdotes) have already uncovered cases among asymptomatic individuals in facilities.

In terms of other populations, health care workers in hospitals remain a top testing priority, and hospitals have taken the lead in ensuring their testing. Health care workers in other settings are also a priority population; staff have been offered testing during National Guard testing visits and may also access drive through test sites to secure testing.

Finally, racial and ethnic minorities have been a key focus of Michigan. Governor Whitmer has established a Racial Disparities Task Force to recommend actions to reduce observed racial disparities in COVID-19 outcomes. The Task Force is highly involved in efforts to expand neighborhood test sites, which focus on underserved and majority-minority ZIP codes, expand mobile testing, increase connections to primary care during testing, and provide safe isolation options for individuals with COVID-19 exposure.

c) The State monitors barriers in both sample collection sites and in corresponding laboratory capacity. For sample collection sites, the State conducted a survey of all test sites in operation, including their average daily number of patients served, daily maximum capacity with existing supplies, and daily maximum capacity with unlimited supplies, as well as information on the site's practices and supply chain. Importantly, the survey asked sites to identify barriers to reaching full capacity, if running below capacity.

The State is working to resolve many of the barriers identified in the survey, for example by broadening the types of medical providers that can order COVID-19 testing, by advertising sites with available capacity, by partnering with community organizations to help drive more patient

traffic to locally-available sites, and by simplifying the patient journey to test sites, increasing the clarity of public information, and expanding resources available to help patients navigate the testing process (e.g., call center staff, one-stop-shop website for finding test site and scheduling appointment). The State has recently launched a new test site locator website, is working on a feature to allow direct scheduling of appointments from that website, and has launched a partnership with 211 to offer telephonic assistance finding a site or scheduling an appointment. The 211 partnership has served 1,600 individuals in the first 10 days. These services will also provide sources of ongoing information around interest in or demand for testing. Going forward, the State is assessing the cadence and subjects of ongoing information collection to help navigate patients to test sites with capacity.

In terms of laboratory capacity challenges, the State has several means of monitoring laboratory throughput and supply chain challenges and some ability to work with sites to resolve challenges, specifically by allocating swabs provided by FEMA. The State has made significant strides in matching sample collections with available laboratory capacity and is broadly making efficient use of available laboratory capacity (when corresponding supplies are available). The State also publishes a list of laboratories with capacity to process additional samples each day and willingness to partner with new medical providers or congregate care facilities conducting sample collection. Based on initial anecdotes, this resource has allowed congregate care facilities to locate laboratories with whom they can partner for testing.

d) Michigan plans to expand capacity and develop successful strategies for serology testing in several ways. The first is through a data coordination team comprised of the state public health lab, clinical, and commercial partners. The team members will each be sharing collected serology data from the platforms available at their site. This team will identify potential pitfalls and help address testing concerns from outside entities. The state will ensure an array of testing availability, namely by clinical lab partners, is available for populations deemed appropriate for surveillance, at risk of exposure due to a known encounter, or as possible pre-PCR screening. The state public health laboratory intends to use the two-tier testing approach to serology surveillance. This will entail two different protein regions (i.e. spike vs nucleocapsid) via different platforms. If a surveillance sample from a congregate care facility, high-risk individual, or underserved member of the community is sent to the state lab for testing, the serology will reflex to the second platform following any positive on the first platform. This will help ensure high quality data for use in the tested populations. The greatest immediate interest is in determining seroprevalence of specific populations. Although the state's public health laboratory assessed multiple FDA EUA approved ELISA options, two high throughout options (BioRad and Siemens) were selected for the two tiers.. Clinical lab partners in the coordination team are known to be using Roche and Abbott systems currently.

Michigan is intending to perform a large-scale, longitudinal cohort, seroprevalence survey beginning in fall and carrying forward until the end of the next respiratory season. Cohort groups of healthcare workers, first responders, child-care workers, critical infrastructure workers, corrections employees, and general public will be recruited for participation under an approved

public health research study format. Study parameters will allow for collection of both molecular and serum over set time points. Collaborating partners at Michigan State University and University of Michigan are expected. Positive molecular results will have viral sequencing performed and tracked to determine risk to the state's population of changes that may affect immune status in future years.

Michigan will closely monitor the national body of research in regard to utility of serology, specifically tied to either naturalizing antibody status, use as a diagnostic aid, or for possible "return to work / immune passport". Educational information regarding serology will be developed and released to various interest groups such as healthcare providers, general public, first responders, students, and others as requested.

- e) The Michigan Department of Health and Human Services (MDHHS) plans to use the resources provided by the Paycheck Protection Act to support testing and contact tracing in several primary areas:
 - 1) Direct testing costs for vulnerable populations. The State will cover the costs of testing key vulnerable populations that either lack insurance, have testing costs not covered by insurance (e.g., asymptomatic individuals), or for whom the State is directly providing specimen collection. This includes incarcerated individuals, homeless individuals, individuals in skilled nursing facilities or adult foster care facilities, migrant agricultural workers, and high-risk workplace settings like food processing facilities. Broad-based testing in these settings will provide surveillance information to quickly identify and contain COVID-19 outbreaks.
 - 2) Outbreak response. In addition to the regular testing schedule of vulnerable populations outlined above, the state and vendor partners will maintain a capability for rapid-response testing in facilities with emerging outbreaks. This will entail MDHHS working closely with local health departments to monitor both facility-based outbreaks and areas of increasing community spread. When facilities or communities in need are identified, a contracted vendor (Honu/mLife) will deploy to conduct testing within 36 hours, either on-site at a facility or via pop up community-based testing sites.
 - 3) Expanding community-based testing. The State will also use the funds to support expanded drive through testing sites in key cities, providing high-volume and no-cost testing capacity for lower-risk populations like asymptomatic critical infrastructure workers. The State will also support 20+ neighborhood testing sites targeted to underserved and marginalized communities and expanded mobile testing with 10+ teams and vehicles focused on emerging "hotspots" and areas with limited testing access. Together, these tactics will support a high volume of daily testing, multiple testing options depending on each individual's needs, and testing services for typically underserved communities to ensure that all Michiganders have access to testing.

The sites will both expand the state's overall sample collection capacity and support a transition to community-based and primary care-based specimen collection as hospitals begin restarting non-essential procedures, shifting staff and laboratory capacity currently utilized for COVID-19 to those activities. Broad-based testing in these settings will provide surveillance information to quickly identify COVID-19 community spread.

- 4) Expanding laboratory capacity. The State will utilize Paycheck Protection Act funding to directly expand laboratory capacity by hiring additional personnel at the State Laboratory, funding new instruments and personnel at five regional public health laboratories, and purchasing consumable testing supplies for all public health laboratories. Together, these laboratories are expected to have capacity to conduct approximately 4,000 tests per day by late fall 2020, assuming no supply chain shortfalls.
- 5) Expanding the contact tracing workforce and technology capabilities. Funding will support hiring approximately 1,000 staff to expand the contact tracing workforce, in partnership between MDHHS and local health departments. Funding will also support technology to assist contact tracing, namely a text messaging system to automate outreach to case contacts and to provide 14 days of symptom monitoring for individuals who opt in.
- 6) Additional projects to come. The State continues to plan for how funding could most impactfully expand COVID-19 testing, contact tracing, and isolation and expects to add additional workstreams.

Testing per population and percent positivity are two core metrics that affect appropriate community mitigation policies. The Governor's <u>MI Safe Start plan</u> outlines six phases of the pandemic and the metrics that the State will closely watch to determine when regions have safely transitioned between phases. Public health capacity, alongside epidemiological indicators and health system capacity, is core to these determinations.

The Governor has set a near-term goal of completing 15,000 tests per day across the state and a medium-term goal of completing 30,000 tests per day. The regional distribution of testing and the distribution of testing across populations within a region (e.g., congregate care v. community testing) will help to measure how well testing in a given region could identify new community spread. This helps inform determinations about community mitigation practices needed to prevent uncontrolled growth or persistent spread.

f) During a declared State of Emergency, Michigan's typical procurement laws do not apply. The State has successfully completed several very rapid but competitive bid processes in recent weeks, to balance the need to move expeditiously with ensuring high-quality and cost-effective services. Supplies and services moving forward may utilize similar practices. In general, procurement policies have not presented a barrier to moving quickly during the pandemic, including for purchases of supplies, collection materials, test kits, and reagents.

The State will similarly prioritize competitive but urgent hiring where needs arise. In some instances, this may involve partnering with outside staffing firms or external contractors with expertise in human resource management. In other cases, this may involve expedited hiring through the State's typical channels.