CareQuest Institute for Oral Health®

RESEARCH REPORT

The Role of Algorithms in Oral Health Care and Disease Prevention and Management

Consumer and Provider Perspectives

SUGGESTED CITATION:
Heaton, Lisa J; Sonnek, Adrianna; Kyomugisa, Angela; Tranby, Eric P; and Mathews, Rebekah. *The Role of Algorithms in Oral Health Care and Disease Prevention and Management: Consumer and Provider Perspectives*: CareQuest Institute for Oral Health, January 2023. DOI: 10.35565/CQI.2023.2001
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Executive Summary

- More than two-thirds of consumers said they support the use of algorithms if the algorithms help both their oral health care provider and health insurance carrier provide them with more personalized care.
- More than two-thirds of consumers agreed that their oral health and primary care medical providers should communicate with each other about their patients' health, and most said they would authorize an oral health care provider to share their medical information with other medical providers. However, fewer than one in five consumers said their oral health provider had ever given them a referral to a primary medical provider.
- The majority of oral health providers agreed that algorithms and other digital tools could help them deliver higher-quality and more patient-centered care, as well as improve patients' oral and overall health outcomes.
- Most providers agreed that an electronic health record (EHR) system could help address barriers to communication between oral health and medical providers, and the majority agreed that bidirectional referral pathways between providers could help improve patients' health.
- The majority of providers agreed that oral health providers should screen their patients for conditions like diabetes, and that an oral health visit can be an initial point of care in chronic disease prevention and management. Furthermore, nearly all providers agreed that it is important to have digital health tools to help them identify patients at risk for chronic disease.
- Patients and providers alike stand to benefit from algorithmic tools that will facilitate medical-dental integration at the point of care by screening at-risk patients for chronic conditions like diabetes. Responses from both the patient and provider perspective reveal readiness and receptivity for such digital health tools to be utilized by their providers and their health plans.

Introduction

Algorithms in health care are mathematical models that use machine learning to look for patterns in large data sources to predict the likelihood that a patient will develop a specific medical condition, like diabetes, or whether a patient would benefit from a particular treatment. While algorithms alone don't make health care decisions, they can be used by health care providers and health insurance companies to help efficiently sort through large amounts of data to inform decisions for individual patients. Many health care stakeholders agree that predictive algorithms and similar digital health tools, such as electronic health records (EHRs), can provide more efficient and effective health care delivery.

Algorithms have been used in oral health care to predict tooth loss and dental caries (decay), as well as to provide toolkits for school oral health programs. Programs like Oralytics™ use predictive algorithms to identify individuals at risk for systemic disease and to facilitate care that integrates oral health with primary medical care. When oral health and medical providers collaborate to identify, screen, refer, and treat individuals with chronic health conditions, benefits extend to patients, providers, and the entire health care system.

The goal of this study was to survey both consumers and oral health care providers regarding their attitudes toward algorithm use for clinical decision-making and for health insurance companies to develop benefits. Additionally, both groups were asked about their feelings toward and experiences with providers sharing information to improve patients' health. Lastly, the survey asked consumers and providers how they feel about oral health providers identifying at-risk patients and screening these patients for chronic conditions like diabetes.

Many health care stakeholders agree that predictive algorithms and similar digital health tools, such as electronic health records (EHRs), can provide more efficient and effective health care delivery.

Methods

Two surveys conducted by CareQuest Institute for Oral Health examined consumer and dental provider attitudes toward the use of algorithms and EHRs for medical-dental integration. Additionally, consumers and providers expressed their feelings about the use of algorithms and EHRs to better treat health conditions like diabetes. CareQuest developed both the consumer and provider surveys. Qualtrics, LLC recruited participants who consented to participate and then completed the surveys online. Consumers (n=1,175) included adults ages 18 and above who had a dental visit within the previous two years. Oral health providers (n=215) included general dentists and dental specialists (excluding pediatric dentists). Data was collected from both cohorts in December 2021. All surveys were conducted in English and took 5–10 minutes to complete.

Table 1 summarizes the demographic characteristics of the 1,175 consumers who participated in the survey.

Table 1. Demographic Characteristics of the Consumer Sample (N=1,175)

	N	%
Age		
Under 25	184	15.7%
25–34	284	24.2%
35–44	245	20.9%
45–54	183	15.6%
55–64	163	13.9%
65–74	95	8.1%
75–84	21	1.8%
Gender		
Female	774	66.4%
Male	379	32.5%
Other	6	0.5%
Prefer not to say	7	0.6%
Race		
White	726	62.9%
Black	156	13.5%
Hispanic	79	6.8%
Other	176	15.3%
Prefer not to say	17	1.5%
Employment		
Full-time	514	44.2%
Part-time	163	14.0%
Unemployed	198	17.0%
Retired	147	12.6%
Other	119	10.2%
Prefer not to say	23	2.0%

	N	%
Education		
Some HS or less	59	5.0%
HS diploma	258	22.0%
Some college	320	27.2%
College graduate	394	33.5%
Graduate or professional degree	132	11.2%
Prefer not to say	12	1.0%
Income		
Less than $25,000	220	18.7%
$25,000–$49,999	341	29.0%
$50,000–$74,999	208	17.7%
$75,000–$99,999	141	12.0%
$100,000–$124,999	82	7.0%
$125,000–$149,999	40	3.4%
$150,000–$174,999	28	2.4%
$175,000 or more	49	4.2%
Prefer not to say	67	5.7%
Location		
Rural	254	21.8%
Suburban	544	46.7%
Urban	331	28.4%
Prefer not to say	35	3.0%

Table 2 provides a summary of the demographic characteristics of the 215 providers who participated in the survey.

Table 2. Demographic Characteristics of the Provider Sample (N=215)

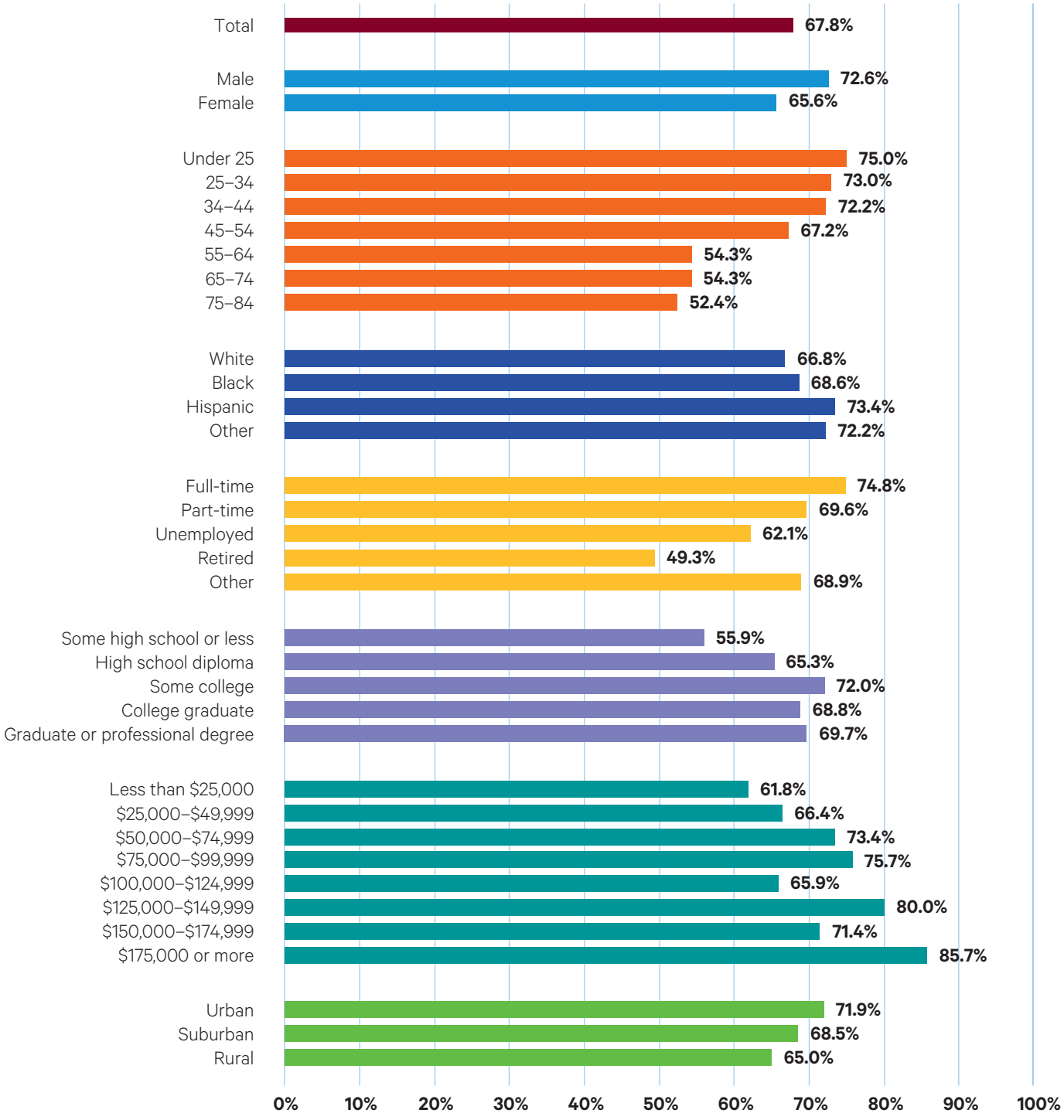
	N	%
Gender		
Female	180	83.7%
Male	35	16.3%
Race		
White	117	54.4%
Black	37	17.2%
Hispanic	27	12.6%
Other	33	15.3%
Prefer not to say	1	0.5%
Practice		
Private, multiple locations	37	17.3%
Private, single location	119	55.6%
FQHC	12	5.6%
Univ/training facility	6	2.8%
Franchise	23	10.7%
Other	5	2.3%
Don't know	12	5.6%
Location of practice		
More than one location	7	3.3%
Urban	66	31.0%
Suburban	109	51.2%
Rural	28	13.1%
Don't know	3	1.4%
Practice Years		
1–5 years	70	32.6%
6–10 years	51	23.7%
11–15 years	33	15.3%
16–20 years	11	5.1%
21+ years	22	10.2%
Prefer not to say	28	13.0%
Employment		
Full-time	174	80.9%
Part-time	29	13.5%
Limited-term contract	2	0.9%
Self-employed	8	3.7%
Other	2	0.9%

Consumer Perspectives

Consumers were asked how they felt about their oral health providers using algorithms in their clinical decision-making, about their oral health and primary medical providers communicating with one another, and whether they would want their oral health provider to screen them for chronic conditions that have oral health connections, such as diabetes. The term "algorithm" was defined for participants as "a set of steps that are followed in order to solve a mathematical problem or to complete a computer process [that provides] predictive capabilities (such as probability or likelihood that you are at risk for chronic diseases like diabetes)."

With respect to the use of algorithms in clinical decision-making, more than half (59.1%) of consumers answered yes to the question, "Are you comfortable with the use of scientific algorithms with predictive capabilities (such as probability or likelihood that you are at risk for chronic diseases like diabetes) to aid in medical decision making by your oral health provider?" Meanwhile, more than two-thirds of consumers (67.8%) supported the use of algorithms if their use "can help your oral health providers find the best personalized care options for your specific needs." More than half of consumers (54%) indicated that they would be extremely or somewhat likely to choose a dental provider who offered chronic disease risk screening and prevention using algorithms.

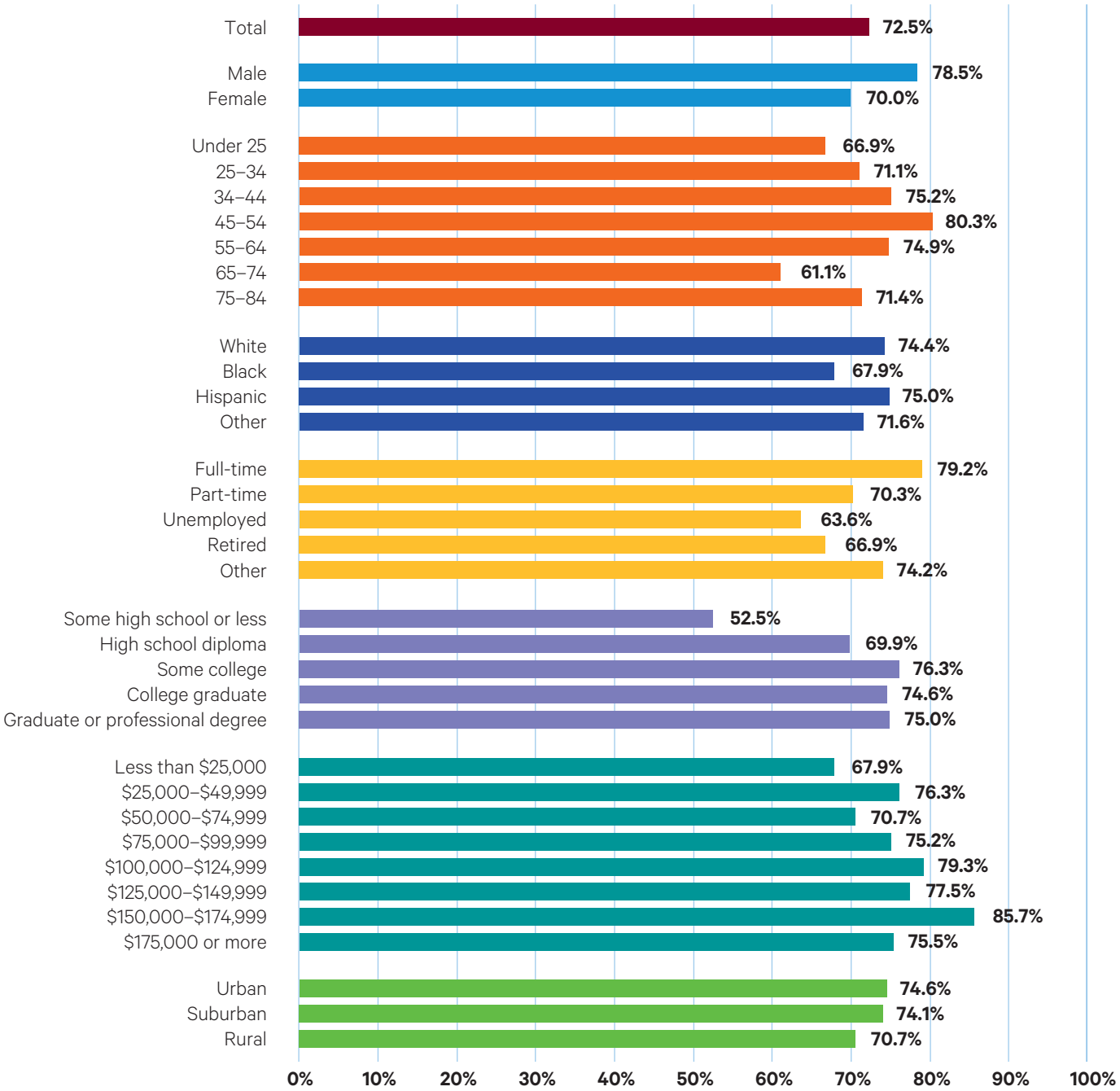
Consumers' support for use of algorithms to help oral health providers find the best personalized care options



More than two-thirds (67.8%) of consumers said yes to the question, "Do you think your oral health provider and primary care doctor should communicate or share medical information to manage your overall health?" The majority of consumers (84.0%) said they would authorize an oral health provider to share their medical information with other medical providers (see Appendix, Figure A).

Only one in five (19.8%) consumers reported that their oral health provider had ever given them a referral to a primary medical doctor. More than half of those who received a referral indicated that the referral was made via a direct phone call to the physician's office (30.8%) or through an electronic referral (26.9%). A majority of consumers (72.5%) agreed with the following statement: "The patient, the primary care provider, the dental provider, specialists, and other administrative staff in the provider's office involved in your care should access your medical data or information electronically to fully manage your medical care." Finally, just over half (53.8%) of consumers said it was extremely, very, or moderately important to have medical screenings (such as for blood glucose or A1C) at their dental office.

Consumers' agreement with statement: The patient, the primary care provider, the dental provider, specialists, and other administrative staff in the provider's office involved in your care should access your medical data or information electronically to fully manage your medical care.

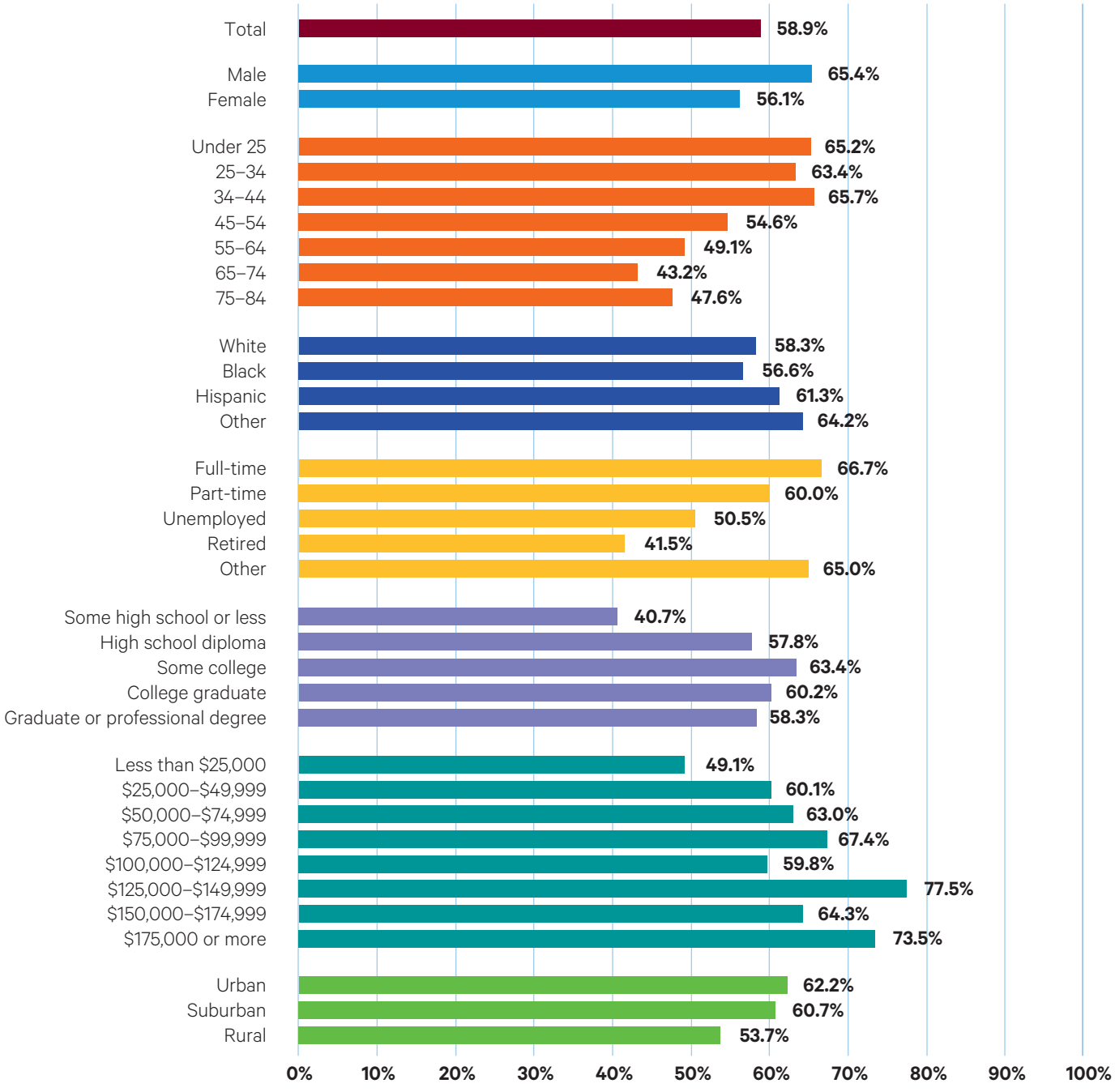


Tools Used by Insurance Carriers

Consumers were asked how they felt about their insurance carriers using algorithms to create insurance benefits, whether their current insurance carrier shares their health information with their oral and medical providers, and whether they would want their health insurance carrier to provide targeted coverage for treatments that improve chronic conditions with oral health connections, such as diabetes.

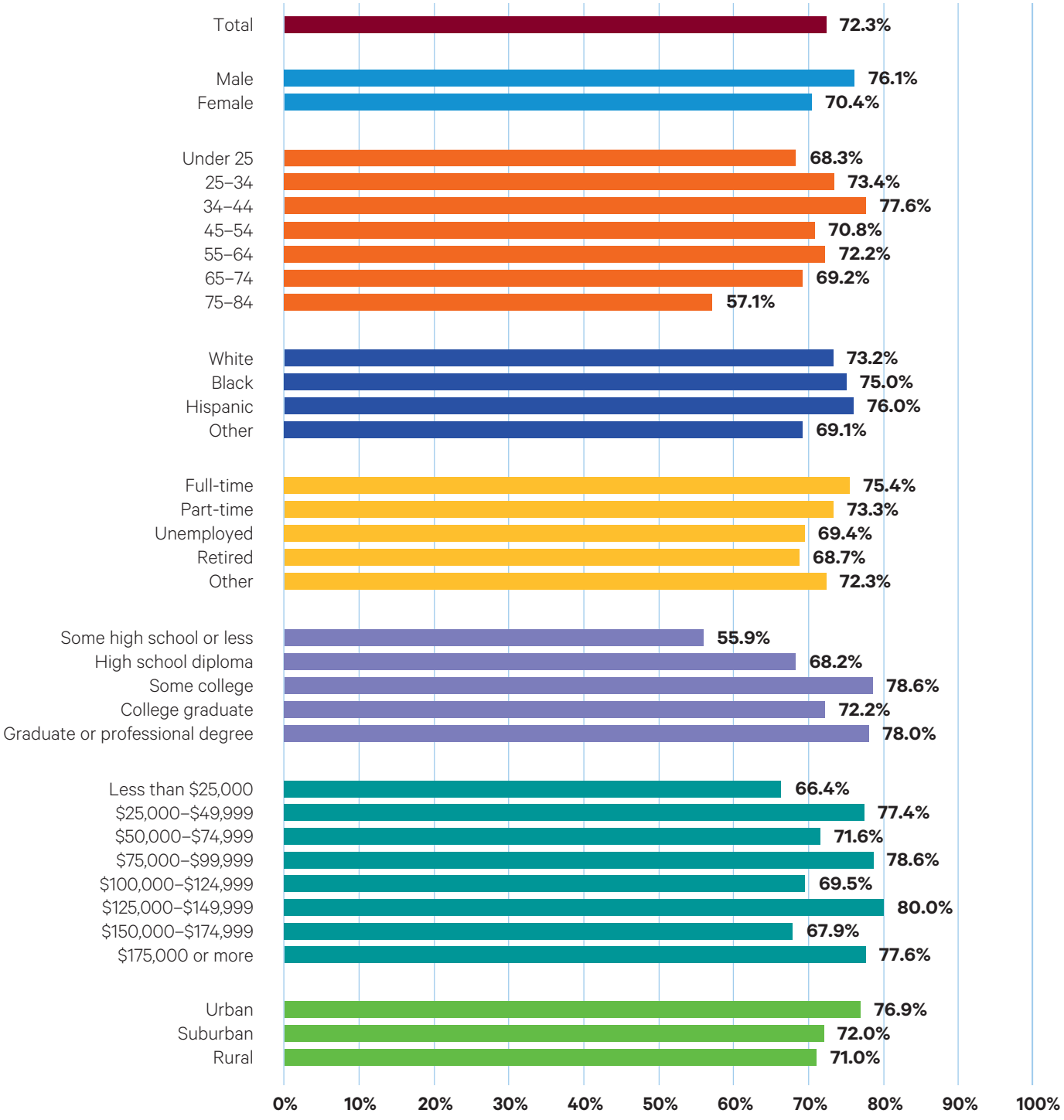
Just over half of consumers (58.9%) indicated they were "comfortable with the use of scientific algorithms with predictive capabilities (such as probability or likelihood that you are at risk for chronic diseases like diabetes) to aid in creating dental benefits by your dental insurance provider." When asked, "If algorithms can help your dental insurance plan find the best personalized benefits options for your specific needs, do you agree with their use?", nearly two-thirds (65.7%) of consumers responded yes. A majority of consumers (62.7%) said they would be extremely or somewhat likely to choose a dental insurance plan that offered chronic disease risk screening and prevention using scientific algorithms.

Consumers' support for the use of scientific algorithms with predictive capabilities (such as probability or likelihood that you are at risk for chronic diseases like diabetes) to aid in creating dental benefits by your dental insurance provider



Just over half (52%) of consumers said they did not have any concerns about what their dental insurance plan does with their oral health data and information, as long as the plan complies with all of the rules and regulations protecting data and information (see Appendix, Figure B). A majority of consumers (84.4%) said it would be extremely, very, or moderately important to "have a dental insurance plan that can identify you as a diabetic in order to give you special dental cleanings to help lower your blood sugar level." Most (72.3%) consumers agreed that "being enrolled in a health insurance plan that provides this level of customized care targeted to your health needs would effectively make you healthier."

Consumers' agreement with statement: Being enrolled in a health insurance plan that provides this level of customized care targeted to your health needs would effectively make you healthier.



Provider Perspectives

Providers were asked questions about their attitudes toward using algorithms to improve their patients' health, the use of EHRs in communicating with other health care providers, and the role of oral health care providers in screening patients for chronic health conditions such as diabetes.

Tools Used by Oral Health Providers

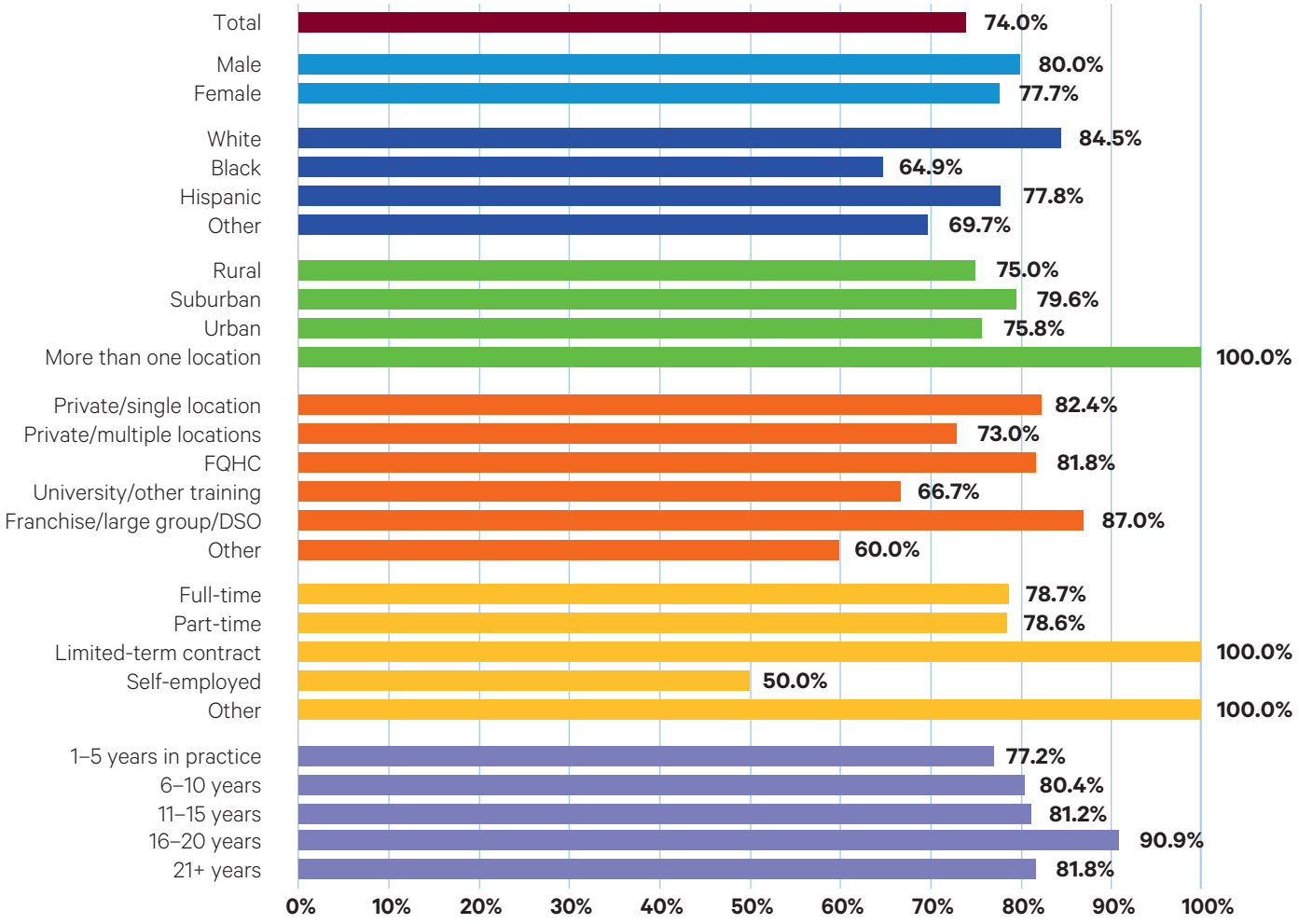
Nearly all providers (95.8%) agreed that "with data-driven decision support technologies, providers can provide better patient-centered options." The majority of providers (84.7%) agreed with the statement, "Health care data analysis, algorithms and machine learning can help providers deliver better care and improve oral health and therefore overall health outcomes" (see Appendix, Figure C).

A majority of providers (89.8%) said that adult patients (18+) who present at their dental offices with additional medical concerns are usually referred to their primary care physicians.

Of the 193 providers who referred patients to their primary care doctors, the most common type of referral (42.5%) was electronic, followed by verbal communication (25.4%), paper referral (16.6%), and a direct telephone call to the physician (15.5%). Nearly all providers (94.4%) indicated agreement that "oral health providers should be able to refer their patients to a primary care provider if they do not have one."

Most providers (91.6%) said yes when asked, "Do you agree that an electronic health record system or practice management system with medical-dental integration as a feature could help you address some of the barriers to relationship building with primary care?" The majority of providers (74%) strongly or somewhat agreed that "enhanced care pathways like bidirectional referrals between primary care and oral health providers can help address early diagnosis, intervention and continuation of care for chronic disease management can help improve overall health."

Enhanced care pathways like bidirectional referrals between primary care and oral health providers can help address early diagnosis, intervention and continuation of care for chronic disease management can help improve overall health (strongly or somewhat agree)

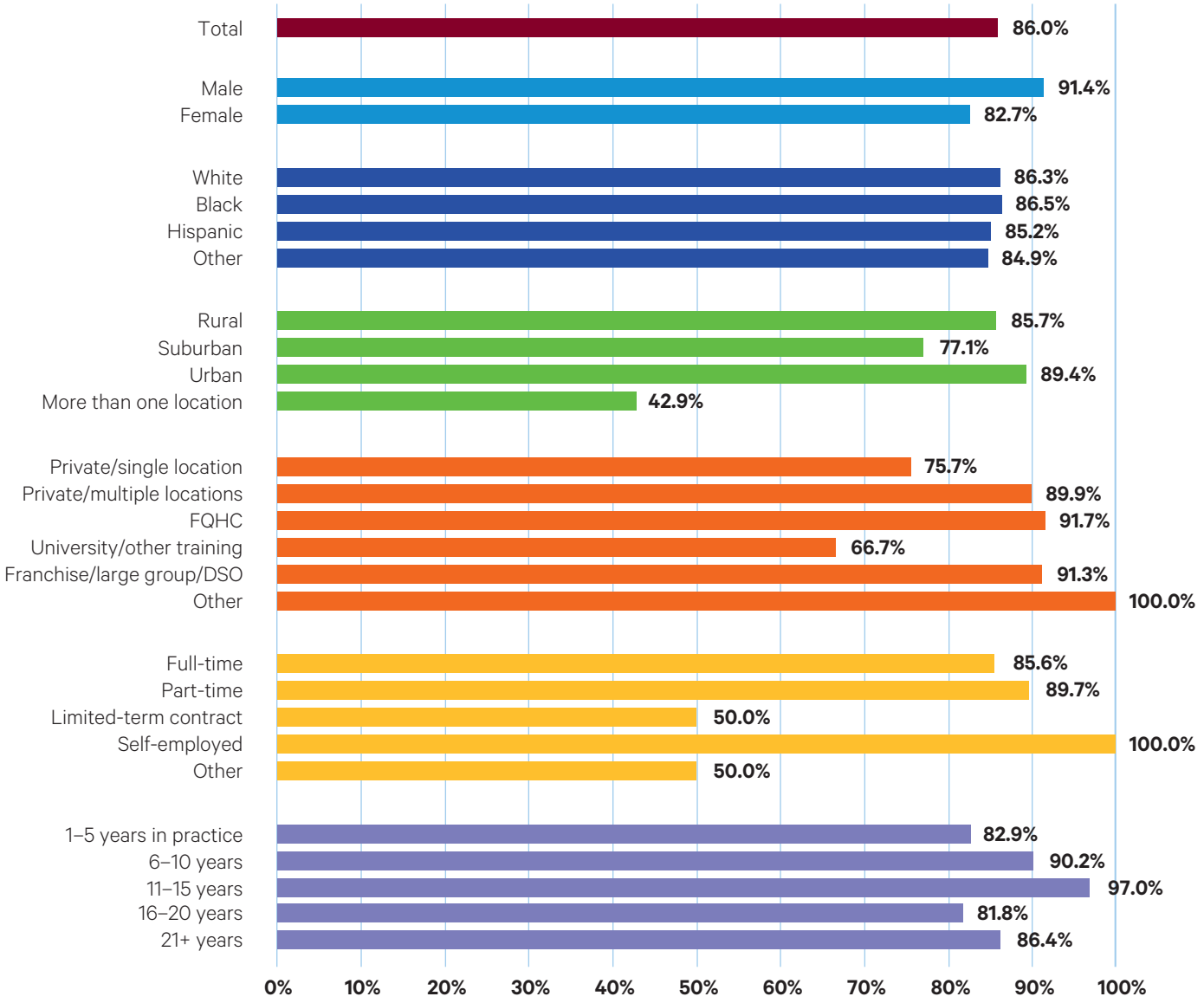


Providers were presented with the following statement: "Research shows relationships between chronic illnesses such as diabetes and heart disease can be managed through improving oral health." Most providers (86%) agreed that "an oral health visit can be the first point of care of chronic disease prevention and management." The majority of providers (88.4%) also agreed that oral health providers should screen their patients for diabetes, given the oral-systemic connection to periodontal disease. Finally, providers were asked, "How important would it be for your practice to have digital health tools that can identify patient risk for diabetes and other chronic illnesses?" Nearly all providers (94.4%) said it was extremely, very, or moderately important to have such digital health tools.

Tools Used by Insurance Carriers

A majority of providers (72.6%) said they would be extremely or somewhat likely "to contract with a dental plan that utilizes predictive analytics and algorithms to screen for or predict members' risk for chronic oral health disease risk and alert the provider with clinical decision support options" (see Appendix, Figure D). Approximately a third (36.7%) responded "yes" to the question, "Would you pay for consultative services to enhance your practice's clinical decisions and patient-centered services?" Meanwhile, more than half of providers (55.4%) responded "maybe" (see Appendix, Figure E).

Providers' agreement that an oral health visit can be the first point of care of chronic disease prevention and management



Conclusions

As the use of algorithms and other digital tools in health care increases, it is essential to understand how receptive health care consumers and providers are to their use. In these surveys, most consumers and providers supported the use of algorithms by both providers and health insurance companies to deliver more personalized, patient-centered care. Most consumers and providers agreed it is important for providers and health insurance plans to identify patients at risk for chronic diseases, and for there to be bidirectional screening and referral pathways between oral health and medical providers to improve patients' health.

Algorithms and other digital tools have the potential to facilitate patient-centered and personalized care within both oral and overall health care, and to enhance the integration of oral health and medical care. Recommendations for optimal use of clinical algorithms include making these decision-making systems effective, providing patients with choices, disclosing the decision-making process to patients and providers, and allowing patients to personalize the process to account for their personal preferences. To ensure that the use of algorithms in oral health care does not exacerbate racial inequities, care must be taken to include diverse teams of professionals in developing the algorithms.

Consumers and providers both agree that oral health and primary medical providers should be able to communicate with one another about patients' health. However, only one in five consumers said their oral health care provider had ever referred them to a primary medical provider. Each year, approximately 35% of individuals visit an oral health provider but not a physician. This figure represents approximately 108 million individuals yearly who could benefit from an oral health provider screening them and identifying a need for a medical referral. The optimal use of clinical algorithms in identifying those at the highest risk for chronic diseases relies on a strong baseline of care coordination infrastructure between oral health and medical providers. Patients and providers alike stand to benefit from algorithmic tools that facilitate medical-dental integration at the point of care by screening at-risk patients for chronic conditions like diabetes. Survey responses from both patients and providers exhibit readiness and receptivity for such digital health tools to be utilized by their providers and their health plans.

Appendix

Figure A. Consumers who said they would authorize an oral health provider to share their medical information with other medical providers

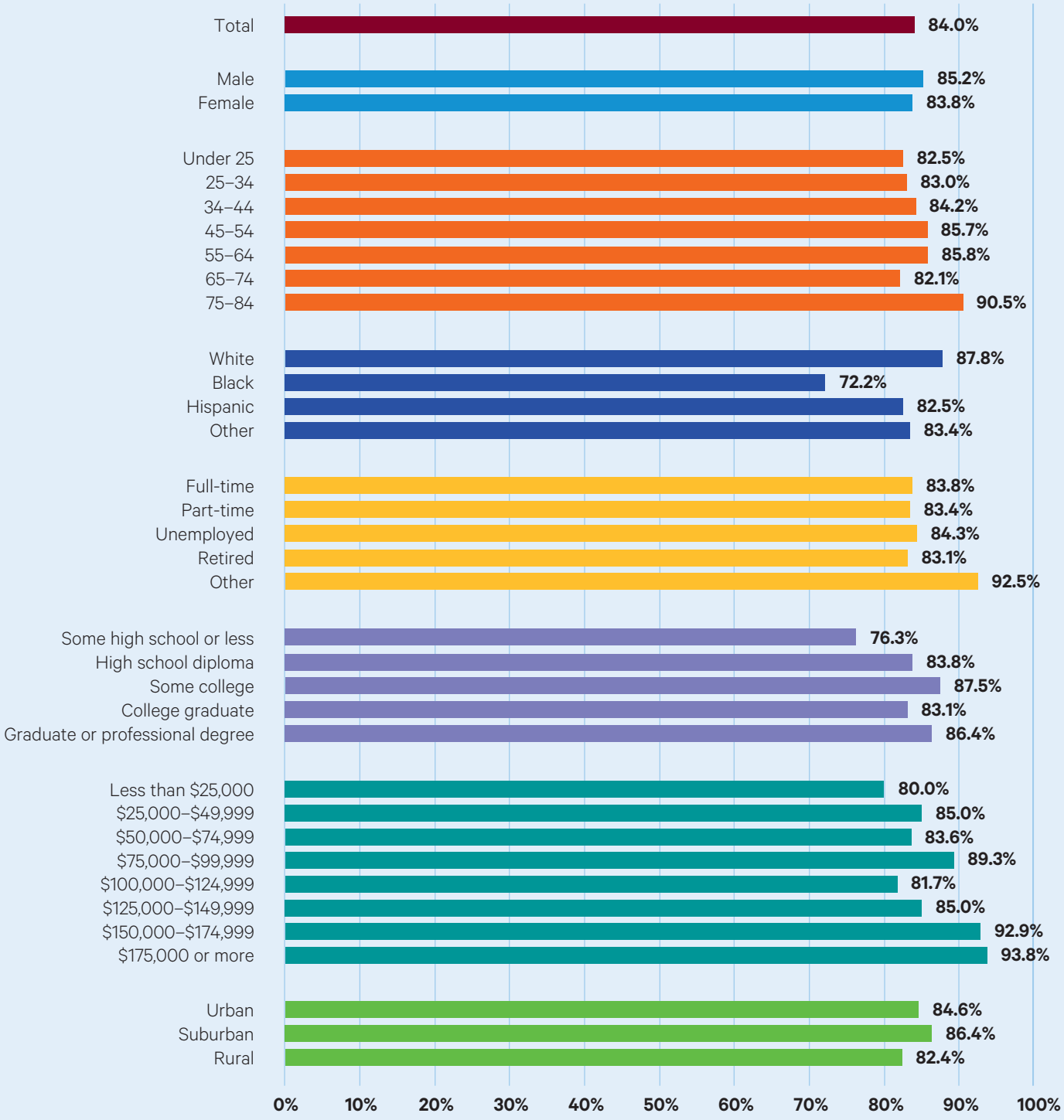


Figure B. Consumers who responded "no" to the question, "Do you have any concerns about what your dental insurance plan does with your oral health data/information as long as they are complying with all of the rules and regulations that protect your data?"

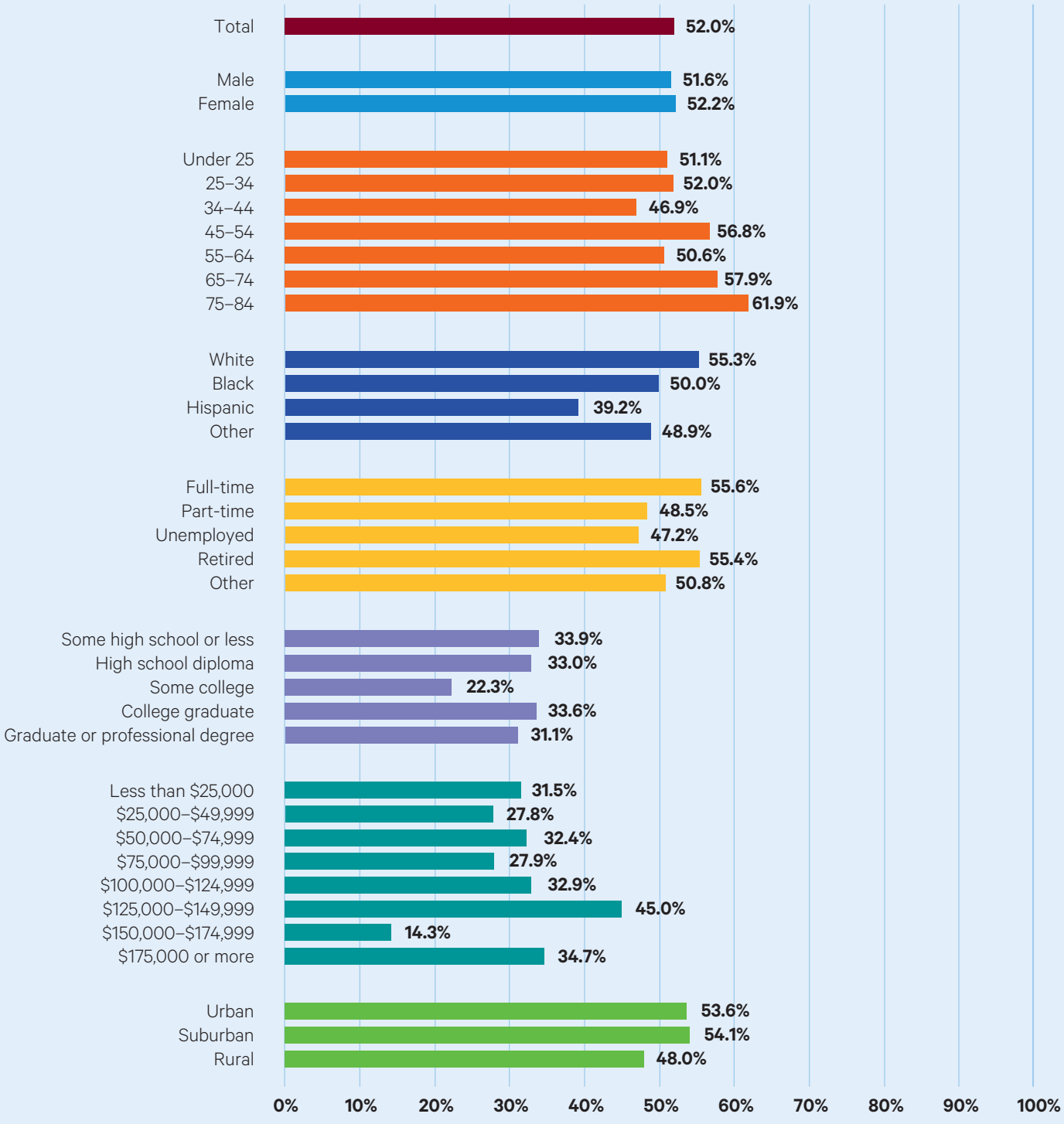


Figure C. Providers who agreed that health care data analysis, algorithms, and machine learning can help providers deliver better care and improve oral health and therefore overall health outcomes

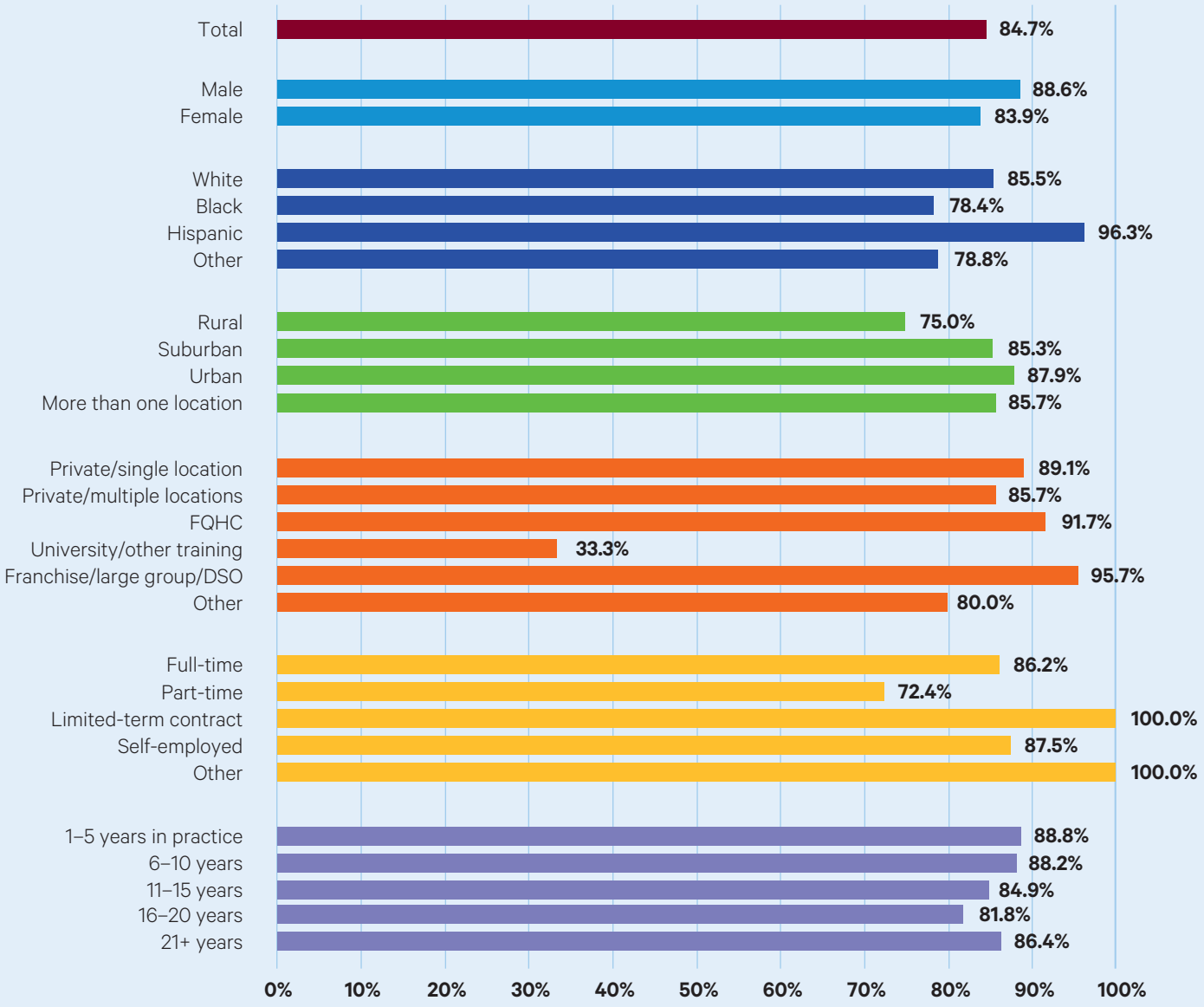


Figure D. Providers who said they were extremely or somewhat likely to contract with a dental plan that utilizes predictive analytics and algorithms to screen for or predict members' risk for chronic oral health disease risk and alert the provider with clinical decision support options

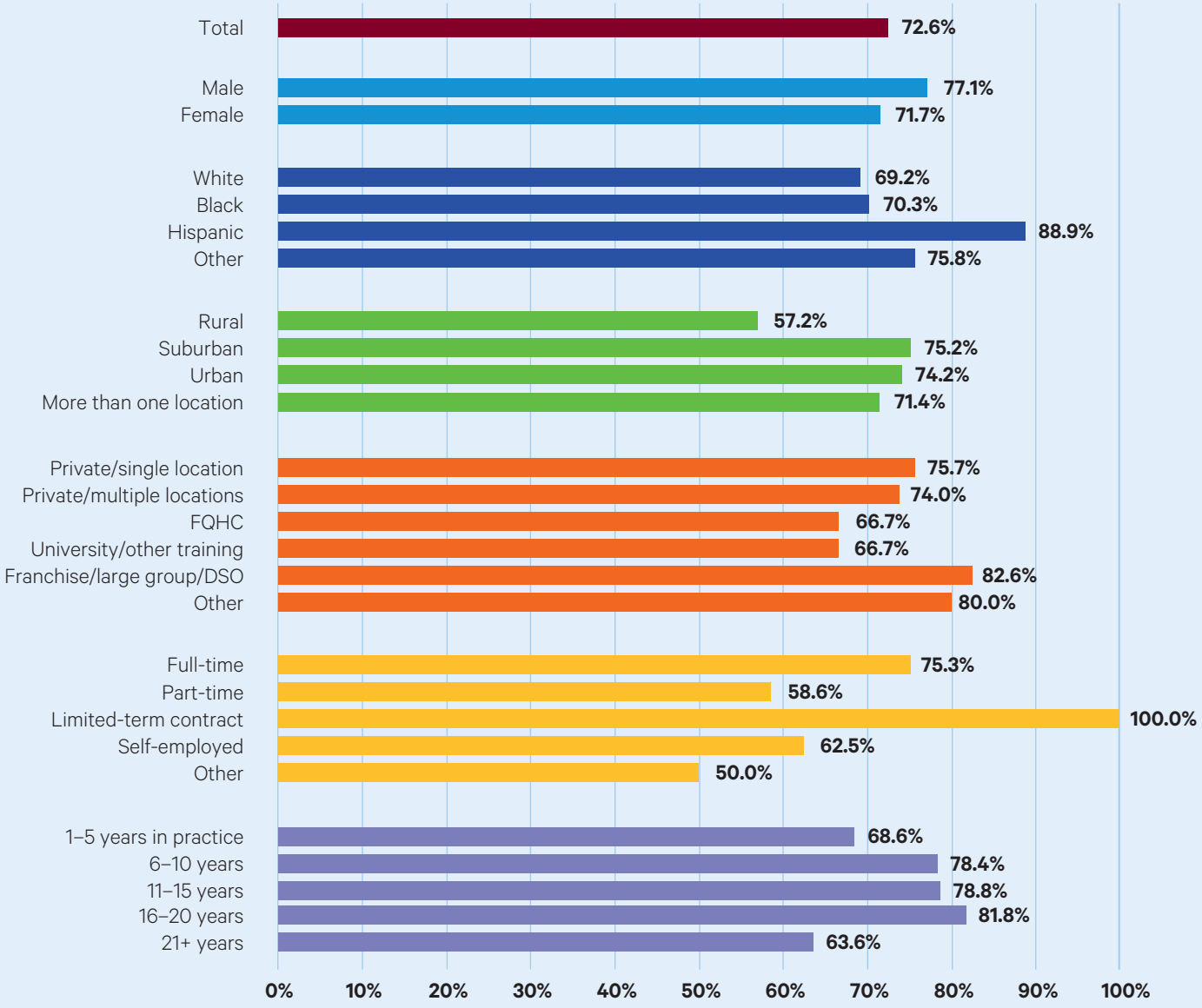
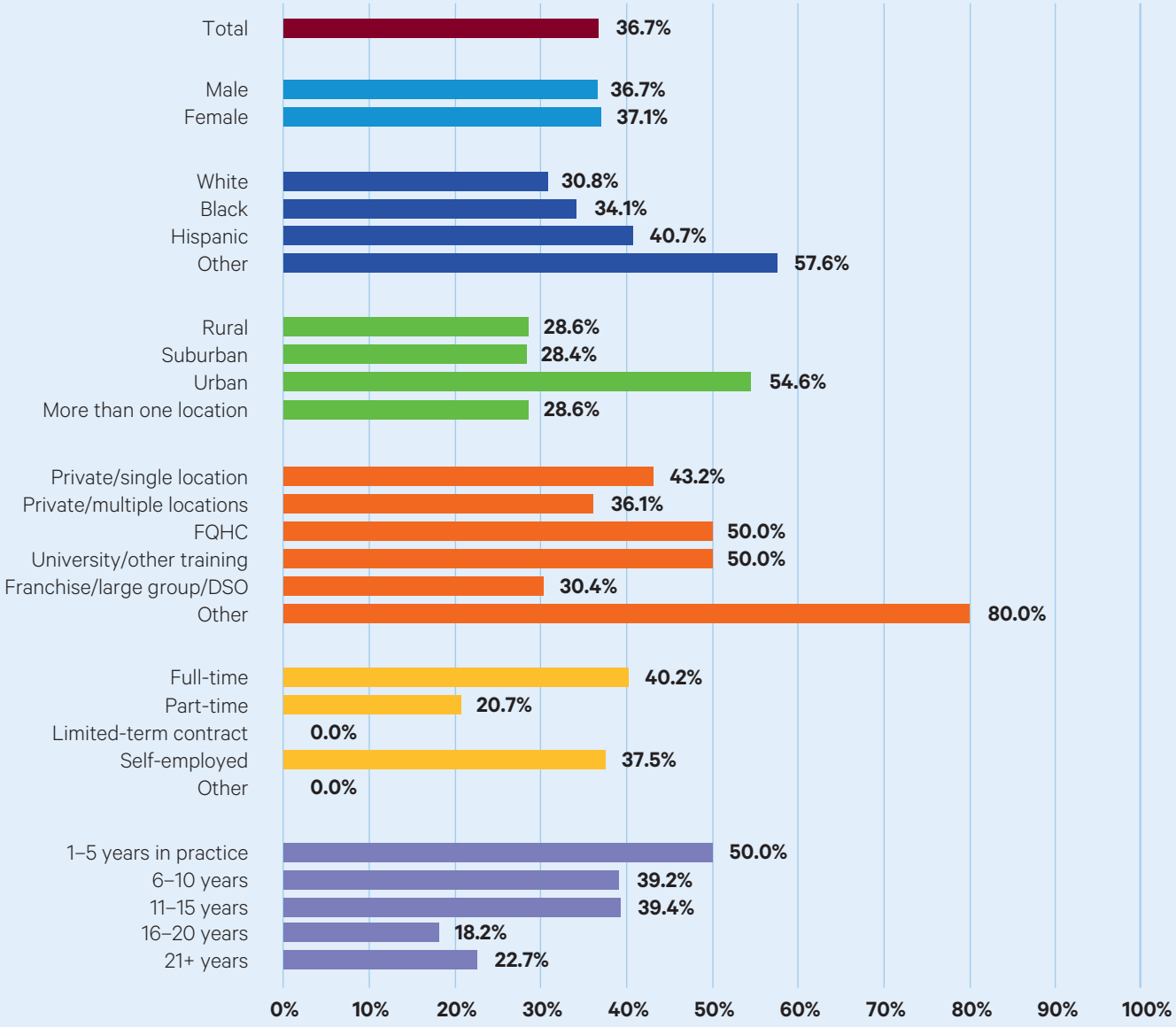


Figure E. Providers who said they were willing to pay for consultative services to enhance their practice's clinical decisions and patient-centered services



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