IQVIA INSTITUTE
FOR HUMAN DATA SCIENCE

Trends in Global Adult Vaccination: A View from Five Global Cities

RESEARCH BRIEF

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Contents

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Overview

BACKGROUND

Adult immunization is a critical public health strategy for promoting healthy ageing by reducing the burden of vaccine-preventable diseases and enabling sustainable health systems. The United Nations (UN) Decade of Healthy Ageing and progress on Universal Health Coverage (UHC) have brought greater focus on the need to enhance immunization strategies for the ageing population, while the World Health Organization (WHO) Age-friendly Cities framework demonstrates the importance of local infrastructure and policies in addressing healthy ageing.

Despite the proven benefits of vaccination, infectious diseases such as seasonal influenza, pneumococcal diseases, pertussis, diphtheria, tetanus, and herpes zoster continue to place a burden on society. Developing informed policies on adult immunization requires regular and timely local data on vaccine coverage; however, there are few global consolidated sources of vaccine coverage rates for adult immunization. Where data is available, adult vaccination rates are generally sub-optimal and substantially lower than pediatric vaccination rates. Vaccination rates can vary substantially even within a city. Adult vaccination data at a sub-national level — city, state or regional – remains highly limited — meaning that specific barriers to uptake, social determinants of health and inequities within communities, and particular opportunities to improve upon access and infrastructure for adult immunization programs are difficult to identify.

The policy focus on adult immunization at a global level is severely limited. Adult vaccination lags behind childhood vaccination in terms of coherence in policies, such as recommendation schedules, and large gaps exist between adult immunization goals and actual vaccination rates.

A host of social and structural determinants, ranging from access and reimbursement to social, cultural, and demographic dynamics, can cause the underutilization of adult vaccines. Informed policymaking, particularly at a sub-city level, requires regular, timely and detailed data on vaccination rates and other factors at a local level, which is often missing. This study aims to fill this gap by combining several IQVIA and public data sources to analyze vaccine consumption and factors impacting them at a sub-city level in five cities: Bangkok, Brussels, Chicago, Manchester, and New York City.

CITY CASE STUDIES: REIMBURSEMENT AND ADMINISTRATION

The process of vaccination from reimbursement to administration varies substantially across the cities studied. An example of the difference in reimbursement policies can be seen in the case of influenza vaccines. In the U.S. in many states, these vaccines are recommended and reimbursed for all insured adults, while in other countries, reimbursement is generally limited to elderly patients and high-risk groups. The person who can administer a vaccine also differs across cities; for example, pharmacists can administer most adult vaccines in the U.S., while other countries generally require administration at physician offices.

KEY FINDINGS

Brussels

- Adult vaccine use per 10,000 adults varies across districts, with the highest district seeing nearly four times the vaccine use per 10,000 adults compared to the lowest vaccine-using district
- Reimbursement of vaccines, ease of access to pharmacist, and transport play a crucial role in adult vaccine use

Manchester

- Adult vaccine use per 10,000 adults varies across wards, with the highest ward seeing nearly seven times the vaccine use per 10,000 adults compared to the lowest vaccine using ward
- Once a vaccine is in the National Immunization Programme, access points (General Practitioners and Pharmacies) for vaccine administration are crucial for enhancing adult vaccine use

Bangkok

- Adult vaccine use varies substantially across district groups, potentially driven by the presence of hospitals and clinics
- Adult vaccine use in a district is correlated with the number of vaccination points, such as hospitals and clinics, as well as with indicators of economic growth in the district, such as the number of new retail and wholesale entities selling goods in a district

Chicago

- Adult vaccine use per 10,000 inhabitants varies across counties in Chicago, with the highest county (Dupage) seeing nearly 70% more vaccine use per 10,000 inhabitants compared to the lowest vaccine using county (Kane)
- Household income, education and median house value are highly correlated with vaccination rates across all vaccines studied; Race and ethnicity can also impact vaccination rates in some cases

New York

- Adult vaccine use per 10,000 inhabitants varies across boroughs in New York, with the highest borough (Manhattan) seeing over 1.5 times the vaccine use per 10,000 inhabitants compared to the lowest vaccine using borough (Bronx)
- Household income, education and median house value are highly correlated with vaccination rates across all vaccines studied; Race and ethnicity can also impact vaccination rates in some cases

This sub-city level research showcases that vaccine use varies substantially even within cities and that urban policies are important for ensuring equitable access to adult vaccines. Demographic factors that vary within cities can also impact vaccination coverage, and accounting for these factors will be important for achieving equity of vaccine use. Optimal use of adult vaccines can be potentially enhanced with a focus on tracking adult vaccination data regularly at national and sub-national levels, ensuring financial considerations do not impact vaccine uptake, increasing the number of vaccinators, ensuring that vaccine policies account for sub-city level differences in vaccine use, and providing the basis for a growing and robust market that has incentives for ongoing innovation.

The importance of understanding adult immunization

ADULT IMMUNIZATION IS A KEY COMPONENT OF DISEASE PREVENTION AND HEALTH PROMOTION AND A CRITICAL PUBLIC HEALTH STRATEGY FOR PROMOTING HEALTHY AGEING BY REDUCING THE BURDEN OF VACCINE-PREVENTABLE DISEASES AND ENABLING SUSTAINABLE HEALTH SYSTEMS

There are now more adults over 65 than children under five years globally, and the number of adults over 65 years is expected to increase from 0.7 billion in 2020 to 1.5 billion by 2050.[1] The ageing immune system increases susceptibility to diseases, resulting in older adults becoming especially vulnerable both to infectious disease and chronic conditions including cardiovascular, osteoporosis, cancer, and neurodegenerative diseases.[2] Adult vaccines are important tools that can help prevent the spread and impact of infectious disease as well as potentially confer secondary benefits, such as cardiovascular protection.[3] Adult vaccination also provides economic benefits, which are critical for promoting sustainable health systems. As an example, one estimate for the Netherlands reported that every €1 invested in adult vaccination commencing at 50 years would yield €4.02 of future economic revenue for the government over the lifetime of the cohort.[4]

Vaccine-preventable diseases (VPDs) impose a significant economic and clinical burden on individuals, healthcare systems, and society at large.[5,6] Maximizing the uptake of vaccines among adult populations can help to reduce disease-associated outcomes and can contribute to improved health and reduced healthcare costs.[7,8] Adult vaccines are an important part of overall disease prevention and health promotion. Regular uptake of adult vaccines can also enable an environment where incentives exist for the development of new vaccines and enhancement of existing ones.

THE UNITED NATIONS (UN) DECADE OF HEALTHY AGEING AND PROGRESS ON UNIVERSAL HEALTH COVERAGE (UHC) HAVE BROUGHT GREATER FOCUS ON THE NEED TO ENHANCE IMMUNIZATION STRATEGIES FOR THE AGEING POPULATION, WHILE THE WORLD HEALTH ORGANIZATION (WHO) AGE-FRIENDLY CITIES FRAMEWORK DEMONSTRATES THE IMPORTANCE OF LOCAL INFRASTRUCTURE AND POLICIES IN ADDRESSING HEALTHY AGEING

The UN Decade of Healthy Ageing, which extends from 2021 to 2030, aims to bring together key stakeholders from within and outside the health system to improve the lives of older people.[9] Ensuring healthy lives for people at all ages is important for the Decade of Healthy Ageing and is a key discussion point within the UHC conversations.

The role of adult immunization has been repeatedly acknowledged as a major component of healthy ageing in these discussions. The WHO Age-friendly Cities framework also demonstrates the importance of local infrastructure and policies in this discussion.[10] Adult Immunization can work with childhood immunization to create a health and economic infrastructure for a Life Course Immunization approach.

HOWEVER, DESPITE EFFORTS BY VARIOUS STAKEHOLDERS, THE LIMITED DATA AVAILABLE ON ADULT VACCINE UPTAKE INDICATES THAT PUBLIC HEALTH TARGETS LARGELY REMAIN UNMET. UPTAKE CAN VARY SUBSTANTIALLY WITHIN CITIES AND TARGETED POLICY POSITIONS THAT ADDRESS LOCAL CONTEXTS REQUIRE DATA

Despite the proven benefits of vaccination in infectious diseases such as seasonal influenza, pneumococcal diseases, pertussis, diphtheria, tetanus, and herpes zoster, they continue to place a high burden on society. The potential to prevent these diseases and associated complications through the use of vaccines becomes even more critical to consider in the context of an ageing population.[11] More recent innovation for vaccines to prevent Respiratory Syncytial Virus (RSV) (for Children and Older Adults) further underscores the need and opportunity.

A recent IQVIA Institute report also highlighted there were 100 million doses of adult vaccines potentially missed during 2021 and 2022[12], compounding already low rates and spotlighting the need to continue prioritizing prevention of VPDs among adults globally. An OECD blog post based on this research stated, "The potential value of adult vaccination has never been greater, yet it appears that uptake is headed in the wrong direction.[13]" The COVID-19 pandemic highlighted the urgent need for efforts and investment to strengthen health system resilience, which includes protecting underlying health through enhanced preventative care, development and maintenance of vaccination campaigns, and investment in effective health surveillance systems. COVID-19 also provided several lessons on how to achieve vaccination across populations in a relatively equitable manner.

Developing informed policies on adult immunization requires regular, timely local data on vaccine coverage. However, there are few globally consolidated sources of vaccine coverage rates for adult immunization.

Even at an individual country level, publicly available data across adult vaccines can be sparse; data on influenza vaccines are more readily available than other adult vaccines. Vaccination rates can vary substantially even within a city. Adult vaccination data at a sub-national level — city, state or region – remains highly limited, meaning that specific barriers to uptake, social determinants of health and inequities within communities, and particular opportunities to improve upon access and infrastructure for adult immunization programs are difficult to identify.

Where data are available, adult vaccination rates have been shown to be generally sub-optimal and substantially lower compared to pediatric vaccination rates. While influenza vaccinations are not a reliable correlation for other adult vaccination, they provide a good example to showcase the differences in adult and child vaccination. In a study of 44 countries, 100% achieved >70% vaccination coverage rates with Diphtheria tetanus toxoid and pertussis (DTP3), compared to only 18% of countries for adult influenza vaccination. Only 50% of countries achieved an adult influenza vaccination rate of >50%.[14] Studies in the U.S. suggest that vaccination rates for some other adult vaccines, such as those for herpes zoster, are likely to be even lower.[15]

The policy focus on adult immunization varies substantially but, at a global level, is severely limited. Adult vaccination lags behind childhood vaccination in terms of coherence in policies — such as recommendation schedules — and prevailing social norms, and large gaps exist between adult immunization goals and actual vaccination rates.[3,16] For example, a 2018 WHO study noted that less than 10% of countries had an adult immunization program for pneumococcal compared to just under 60% for influenza.[14]

MULTI-DIMENSIONAL SET OF SOCIAL AND STRUCTURAL DETERMINANTS CAN CAUSE THE UNDERUTILIZATION OF ADULT VACCINES, AND ADDITIONAL DATA IS NEEDED TO BETTER UNDERSTAND THE IMPACT OF THESE FACTORS ON LOCAL BEHAVIORS AND VACCINATION RATES

National immunization programmes have been identified as key drivers for improving adult immunization rates. In countries where vaccines are easily accessible and partially or fully reimbursed, immunization rates are higher in comparison to countries where access or reimbursement are less evident.[14] Studies from various jurisdictions show that allowing pharmacists to vaccinate increases uptake.[17,18]

In addition to vaccine access and reimbursement, enhancing the rate of adult vaccination also requires an understanding of a host of social, cultural, and demographic factors. These include infrastructure barriers and enablers, the culture of vaccine promotion among physicians, and general population education and attitude toward vaccines – including awareness of schedules and the risks and consequences of vaccine preventable diseases.[3,9] Other identified social determinants of vaccine coverage include economic status, gender level of education, comorbidities, disability, insurance coverage, marital status, urban/rural environment, regional deprivation, religion, ethnicity, and migrant status.[20–23] Another important determinant of adult vaccination can be the lack of focus on ensuring the optimal use of these vaccines in the elderly population. This set of factors are multifaceted and point to a complex rationale for — and opportunities to mitigate — inequities in vaccine coverage on a local level.

INFORMED POLICY MAKING REQUIRES REGULAR, TIMELY AND DETAILED DATA ON VACCINATION RATES AND OTHER FACTORS AT A LOCAL LEVEL. THESE CASE STUDIES AIM TO TAKE STEPS TOWARD FILLING THIS GAP BY COMBINING SEVERAL IQVIA AND PUBLIC DATA SOURCES

Policies and efforts at a city level are a crucial component of enhancing adult immunization. These policies require relevant and timely data to understand where resources and time should be utilized.

The following research into five city-level case studies across four countries intends to highlight the importance of local data by investigating the differences in vaccination uptake at the sub-city level and identifying associations with known determinants. Severe limitations in data availability in much of the world, notably low- or middle-income countries, precludes certain regions and restricts the choice of cities for this report. Despite limitations in the data for these selected cities, the existing data allow for a nuanced understanding of vaccination consumption trends and complement information on vaccine reimbursement and administration. This research is intended to serve as a potential pilot for future city-level case studies in other regions.

Five cities were selected for this pilot: Bangkok, Brussels, Chicago, Manchester, and New York City. These cities were chosen based on global representativeness and data availability. Most of these also belong to the WHO's global network of Age-friendly Cities and Communities.[24] This research was undertaken with a combination of local IQVIA vaccine data assets, public vaccination data, and public and third party socio economic and sociodemographic data.

The adult vaccinations tracked as part of this analysis were for tetanus, diphtheria and pertussis (TDaP), herpes zoster, hepatitis B, influenza, and pneumococcal.

Understanding adult immunization: Views from five global cities

POLICIES REGARDING REIMBURSEMENT AND ADMINISTRATION OF ADULT VACCINES VARY SUBSTANTIALLY ACROSS ALL CITIES STUDIED

The process of vaccination from reimbursement to administration varies substantially across the cities studied. An example of the difference in reimbursement policies can be seen in the case of influenza vaccines. In the U.S., these vaccines are recommended and reimbursed for many adults, excluding those without any insurance, while in other countries, reimbursement is generally limited to elderly patients and high-risk groups. The person who can administer a vaccine also differs across cities; for example, some countries, such as the U.S., and the cities in them allow pharmacists to administer adult vaccines, such as pneumococcal vaccines, without the need for a prescription in most states. Other countries, such as Belgium, require the person to go to a doctor, usually a GP, for a prescription, then purchase the vaccine from a pharmacist and return to the GP for administration in the case of certain adult vaccines. More details can be seen in Exhibit 1.

Exhibit 1: Summary of adult vaccine recommendation, reimbursement and administration policies

								
	Reimbursement	**Vaccinator**	**Reimbursement (National Immunization Program)**	**Vaccinator**	**Reimbursement**	**Vaccinator**	**Reimbursement**	**Vaccinator**
Hepatitis B	Partial – Population with risk factors	Doctor/ nurse	Yes – for medical and public health workers	Doctor/ Nurse (only with doctor present in facility)	Yes for people with chronic liver or kidney conditions, haemophilia	Doctor/Nurse	Yes, all adults age 19 through 59 years, and adults aged 60+ years with risk factors for hepatitis B infection	Doctor/Nurse /Pharmacist^
Herpes zoster	Partial reimbursement for certain risk groups*		No	Doctor/Nurse	Yes (65+ years, or immuno -compromised)		Yes (50+ and 18+ years immuno -compromised)	
Influenza	Partial - Vulnerable patients, pregnant women, age 65 or above and those working in care	DoctorNurse /Pharmacist**	Yes - Pregnant women, senior citizens aged 65+ years, and individuals with chronic medical conditions, etc.	Doctor/Nurse	Yes, 65+ years, pregnant women, long term health conditions, people working in care, living with vulnerable person	Doctor/Nurse /Pharmacist^	Yes, everyone 6 months and older	
Pneumococcal	Partial reimbursement for certain risk groups*	Doctor/nurse	No		Yes, 65+ years	Doctor/Nurse	Yes (65+ years, 19–64 years with certain risk conditions)	
TDaP	Partial - as catch up, or pregnant women	Doctor/nurse	Yes- dT vaccine for pregnant women and adults aged 20 years and above (every 10 years)		Yes, for pregnant women		Yes, for pregnant women and boosters for adults every 10 years	

Sources: Brussels, European Centre for Disease Prevention and Control[A]; Bangkok, Department of disease control, Ministry of Public Health[B]; Manchester, UK Government[C] and NHS[D]; U.S. CDC

Notes: TDaP: tetanus, diphtheria and Pertussis. Cells in green show full reimbursement; yellow is partial reimbursement only (some co-payment); red is full out of pocket. These are shown in the context of adult vaccination. Reimbursement refers to payment coverage by public or government insurers. Some of these vaccines may be purchased out of pocket or reimbursed by private insurers.

*not reimbursed at the time of the data extraction, however they recently received partial reimbursement in pre-defined risk groups: Sept 2023 (Apexxnar) and Nov 2023 (Shingrix); **changed in Oct 2023, can be administered by Pharmacists without doctor's prescription; ^Varies by state, pharmacist interns and technicians may also be allowed to administer vaccines in certain states.

Case Studies — Belgium/Brussels

VACCINATION PROGRAM

Belgium's vaccination programs are organized at the subnational level

Disease prevention in healthcare, and hence immunization policy, is a duty and responsibility of the Communities (Flemish, French and German) and the Regions (Flanders, Wallonia and Brussels capital). At the national level, the Superior Health Council (SHC) provides independent scientific advice on vaccinations and formulates recommendations. These recommendations serve as a basis for the vaccination programs set up by the three Belgian regions. General vaccine campaigns to inform and increase awareness (brochures, press-releases, etc.) are organized by the three Communities.

For adult immunizations, the general practitioner (GP) is usually the key vaccinator and pharmacists play a limited role as a supplier of the vaccine

Adults generally go to a doctor (primarily GP) for a prescription, then to a pharmacist to purchase the vaccine and schedule another appointment with the GP for the administration of the vaccine. Some employers offer influenza vaccination (at no out-of-pocket cost) at the workplace through their occupational health services, on a voluntary basis. In addition, since April 2016, nurses have been allowed to administer physician prescribed vaccines without the presence of a doctor.[25] As of 2021, an adult can purchase an influenza vaccine at the pharmacist without a prescription and since Oct 2023, pharmacists can administer influenza vaccines, as was already the case for the COVID-19 vaccine in 2022. Vaccines for Diphtheria, Tetanus, Pertussis, influenza and pneumococcal diseases are recommended for adults (See Exhibit 1).[26] Influenza vaccination coverage in eligible population is 59.1%.[27] The pertussis vaccine is also recommended for specific high-risk groups in Belgium.

REIMBURSEMENT AND COVERAGE

Adult vaccination reimbursement coverage significantly lags behind child vaccinations. Some adult vaccinations are partially reimbursed and others require out-of-pocket payment

In Belgium, adult vaccines are reimbursed as follows –

- Partially reimbursed vaccines: Hep B (Engerix & HBVaxpro), Influenza (Alpharix-tetra, Influvac tetra, Vaxigrip tetra, Efluelda) and TDaP (Boostrix).
- Non-Reimbursed vaccines: herpes zoster (Shingrix§); pneumococcal: PCV 13, PCV 15, PCV 20*, PPV23, Tdap (Triaxis), RSV (Arexvy**)

Reimbursement for adult vaccines only applies to predefined Superior Health Council risk groups for each vaccine and can only be permitted if the pharmaceutical specialty in question is prescribed by a doctor or, in the case of pregnant women, by a doctor or a midwife. The adult vaccination rates vary considerably compared to child vaccinations which are largely funded by the national health system and coverage is very high (Diphtheria, Tetanus & Pertussis 3rd dose, 98%; Haemophilus influenzae type B 3rd dose 97%; Measles 2nd dose 83% [2022 figures]).[28] In comparison, vaccination coverage of adults over 65 for influenza is 57.3% (2021).[29]

DATA SOURCE AND STUDY METHODOLOGY

Belgium's capital Brussels with its population of 1.24 million is divided into 15 districts, broadly in line with the city's municipalities. These districts vary in character as well as in socio-economic status, housing quality and many other factors, some of which are illustrated in the appendix. IQVIA Xponent data (which is based on pharmacy panel of 66% of all Belgian pharmacists selling this data) has been used to aggregate vaccination sales volumes from IQVIA's panel of pharmacies for the 15 districts.

* Apexxnar obtained partial reimbursement as of Sept 2023
§ Shingrix only recently received reimbursement since Nov 2023, but sales data beyond Nov 2023 were not available yet at the time of this report
** Recently received EU regulatory approval, under review

Correlation analyses to identify associations between vaccine consumption per 10,000 adults and sub-city variables were conducted. Volumes were captured for September 2022 to August 2023 using IQVIA's Xponent pharmacy panel.

FINDINGS

Overall Adult Vaccine Use

Adult vaccine use per 10,000 adults varies across districts, with the highest district seeing nearly four times the vaccine use per 10,000 adults compared to the lowest vaccine using district

Highest volumes were recorded in Woluwe and Brussels Haut and lowest in St-Gilles and Forest, with influenza accounting for just over half of volumes (Exhibit 2).

Drivers of Vaccine Use

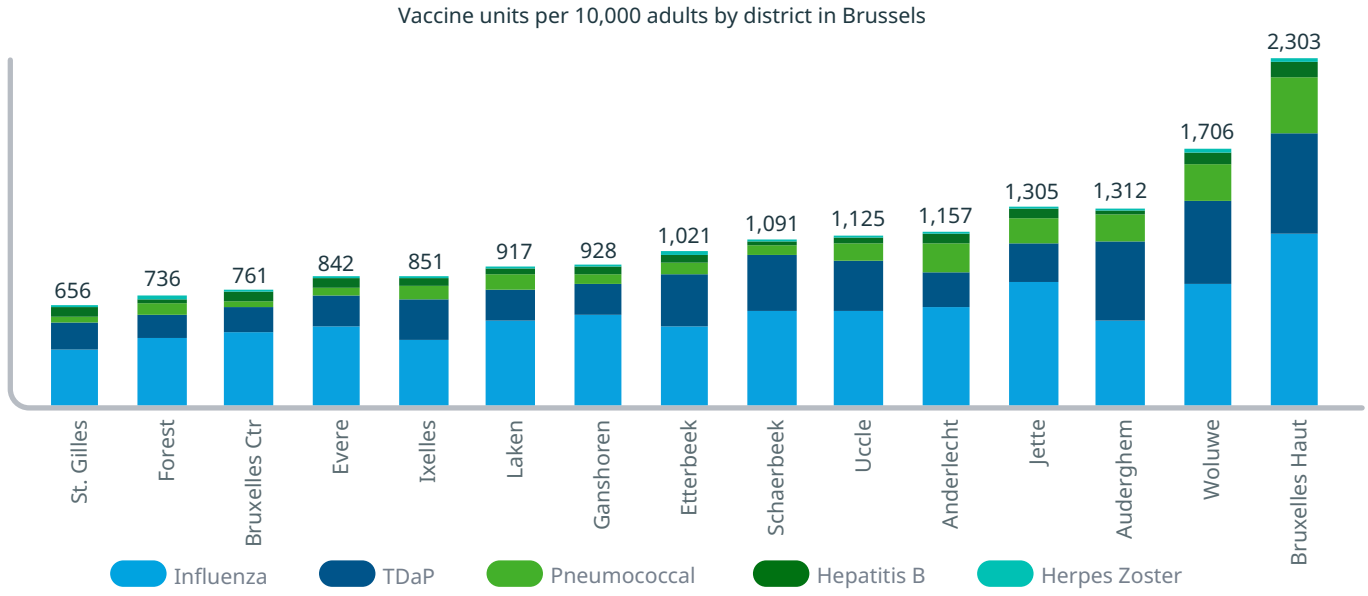
The density of pharmacies and the availability of transport are consistently correlated with higher adult vaccine use; socio-economic factors such as income and education appear to play a lesser role for more established and (partially) reimbursed vaccine's use

Across all vaccines, vaccination doses per population are most commonly correlated with number of pharmacies per 10,000 inhabitants and transport (measured as number of bus stops per 10,000 inhabitants).

TDaP vaccine additionally shows the most signs of inequity with size of house and employment status being positively correlated with vaccine doses per 10,000 adults, while household size (number of co-inhabitants) negatively correlated. Notably and positively, vaccination volumes do not appear to relate to nationality (Belgian versus non-Belgian), nor was income found to be associated with differences in vaccine units per 10,000 population (Exhibit 3).

Since adult vaccines are recommended for patients at risk due to co-morbidities such as chronic heart disease, chronic kidney disease, diabetes and immune deficiences, receipt of vaccines by patients receiving medications for these was further investigated using IQVIA LRx (anonymized patient lingitudinal) data.

Exhibit 2: Vaccine use in each Brussels city district by type



Source: IQVIA Xponent selling out data, September 2022 to August 2023.
Notes: Vaccine units per 10,000 adults by district in Brussels. Includes influenza; diphtheria, tetanus and pertussis (TDaP); hepatitis B; herpes zoster and pneumococcal. Diphtheria, tetanus and pertussis vaccinations in combination with polio or hepatitis B are not included. Only hepatitis B doses of 1mL or larger were assumed for adult use, and only Shingrix and Zostavax included in Herpes zoster. Volumes are divided by the total adult population per city district.

Exhibit 3: Correlations of vaccine use and socioeconomic and sociodemographic variables in Brussels

	MEASURE	TDAP	INFLUENZA	HERPES ZOSTER	PNEUMOCOCCAL	HEP B
	Square footage of house	***0.5***	0.3	0.3	0.4	-0.0
	Household size	-0.5	-0.1	-0.5	-0.3	-0.2
	% Employed	***0.6***	0.1	0.4	0.3	0.0
	% with higher education	0.4	-0.1	0.5	0.1	-0.3
	% Married	0.2	0.5	0.0	0.3	0.2
	Nbr pharmacies per 1000	***0.5***	***0.5***	0.4	***0.6***	***0.6***
	Nbr bus stops per 1000	***0.7***	***0.7***	0.4	***0.8***	***0.6***

Correlation -1 +1

Source: IQVIA Xponent selling out data, September 2022 to August 2023.
Notes: Only variables showing statistically significant correlations (P value of ≤0.1) are displayed. Only values with P value ≤0.1 are in color. Correlations strength and direction is indicated by colour as shown in the scale for those with P value ≤0.1. Correlations with P-value of ≤0.05 are displayed in bold, italic type. White cells show correlations that are not statistically significant.
Abbreviations: Hep B, Hepatitis B; TDaP, diphtheria, tetanus and pertussis; Nbr, number.

Education level was the most common variable positively correlated with differences in vaccination levels across the city, as was income level, but these associations with the variable were not evident for all vaccines. Mariatal status was also a factor (see Appendix Brussels Co-medication correlations).

DATA-BASED IMPLICATIONS FOR LOCAL POLICY INTERVENTIONS

Reimbursement of vaccines, ease of access to pharmacist and transport play a crucial role in adult vaccine use

Vaccine use varies across districts in Brussels and while adult immunization needs to be improved across all districts, it will be important to ensure that the existing disparity is accounted for in any future policies.

- Given the correlations seen at a sub-city level in Brussels, a greater discussion on the role of a pharmacist may be warranted. Pharmacists already play an important role in the vaccination process as patients pick up their vaccines at these sites. Pharmacists also often educate adults in vulnerable populations regarding vaccines. Currently, the permission for pharmacists to administer vaccinations without a prescription is limited to influenza vaccines, and this change in legislation (Oct 2023) is too recent to be captured in this case study; however, the impact of this policy should be monitored closely.
- Transportation access is also important, especially since patients have to travel to multiple locations to get their prescription and subsequent vaccination. Ensuring that adults across districts have sufficient transport options will help address potential inequity concerns.
- For vaccines which have not yet received any reimbursement, such as for those for herpes zoster*, uptake across districts is very low. This suggests that there may be potential financial barriers that need to be overcome as part of adult vaccination strategies.

* Shingrix did not have reimbursement for the time period when the research was conducted. It currently has partial reimbursement for certain risk groups

Case Studies — England/Manchester

VACCINATION PROGRAM

Vaccine provision in the UK is through the National Immunisation Program (NIP)

In England, the responsibility for immunization is based on a tripartite agreement between the Department of Health, UK Health Security Agency (UKHSA) and National Health Service England (NHS England). The Joint Committee on Vaccination and Immunisaiton (JCVI) provides advice or recommendations on whether vaccines should be adopted nationally, which population groups should receive vaccination, and what dosage schedules are appropriate. This guidance is applied throughout the UK via the National Immunisation Programme which is overseen by UKHSA and delivered by the National Health Service (NHS).[30] Within this programme, three vaccines for adults (influenza, pneumococcal polysaccharide vaccine, and herpes zoster) and nine main vaccines for children are recommended (6-in-1, rotavirus, MenB, Pneumococcal, MMR, Hib/MenC, childrens influenza, HPV MenACWY and 3-in-1 Td/IPV).[14,3]

Vaccines are administered in General Practitioner clinics, usually by practice nurses, but some vaccines can be administered at pharmacies for certain risk groups

Vaccine administration does not require a prescription in the UK. Vaccines available via the NHS (i.e., those included in the National Immunisation Program) are usually administered in community based General Practitioner (GP) clinics by practice nurses.[31] Some NHS vaccines can also be administered in pharmacies. For example, the influenza vaccine is available in community pharmacies and can be administered under the supervision of pharmacists to eligible patients in clinical risk groups. Pharmacies were also crucial for the COVID-19 vaccine roll-out. Last year, pharmacies provided five million flu vaccines, nearly 25% of all flu vaccines provided in the UK.[32] Despite their interest in supporting NHS vaccination, pharmacies face obstacles, such as the lack of full access to patient records and the requirement for most vaccines to be written into pharmacy and GP contracts, which can be challenging at times for pharmacies.

REIMBURSEMENT AND COVERAGE

Vaccines included in the NIP do not have out-of-pocket costs at the point of delivery for the recommended population

Vaccines included in the NIP do not have out-of-pocket costs at the point of delivery for both recommended children and adult populations. Vaccines not available on the NHS, e.g., travel vaccines and vaccines for people who are not eligible to receive vaccination under the NIP, can receive vaccines through pharmacies privately for a fee.

DATA SOURCE AND STUDY METHODOLOGY

Manchester has a population of 552,000 (as per 2021 census). NHS vaccine data was collected from NHS Digital — GP Contract Services 2022–23 release[33] from April 2022 to March 2023. Data for five adult vaccines was collected: Pneumococcal polysaccharide, Influenza and herpes zoster as well as Hepatitis B and DTaP for pregnant women. Data on vaccines paid for out-of-pocket was also collected. Socio-demographic data were collected from Manchester City Council.[34,35] This includes elements on: population & life expectancy (2020); employment, education, residents born in the UK and language spoken data (2021); and income data (2022). The data show variation across the wards in multiple socio-demographic elements, as is illustrated in the appendix. Correlation analyses were then performed to identify associations in vaccine usage with socio-demographic variables.

FINDINGS

Overall Adult Vaccine Use

Adult vaccine use per 10,000 adults varies across wards with the highest ward seeing nearly seven times the vaccine use per 10,000 adults compared to the lowest vaccine using ward* (Exhibit 4)

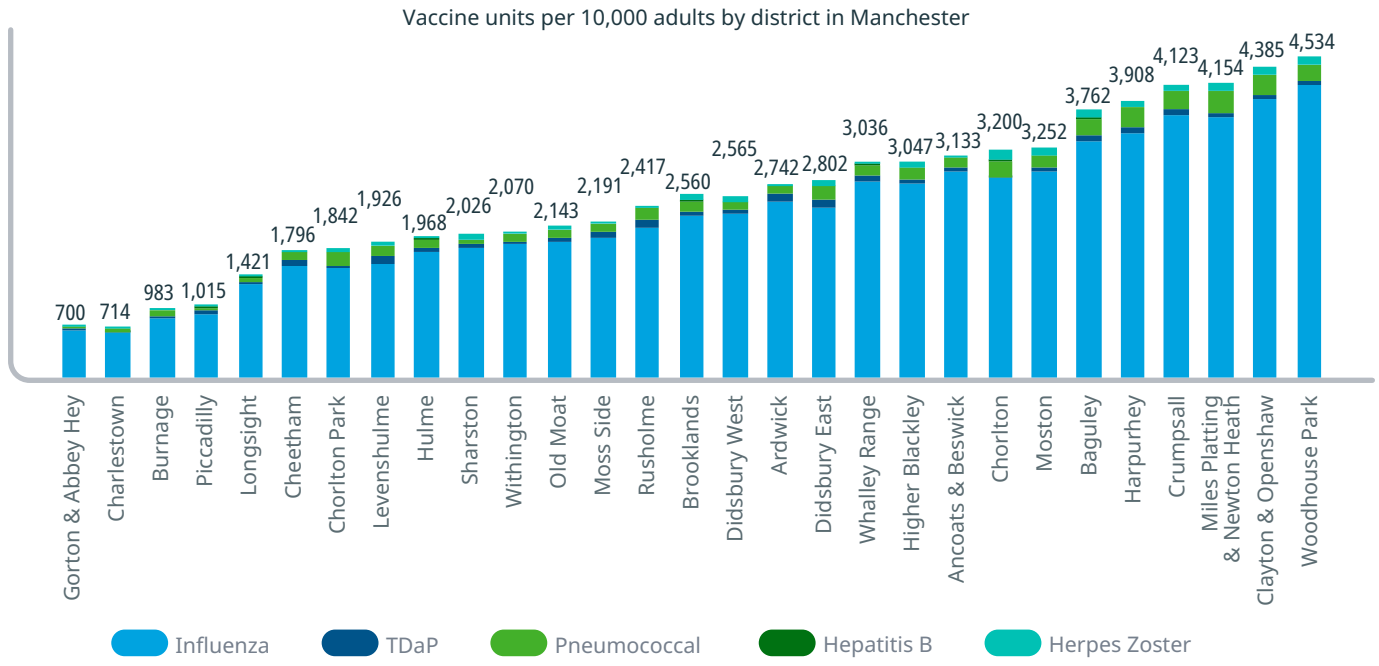
Drivers of Vaccine Use

The density of pharmacies and GPs is consistently correlated with higher adult vaccine use

Positive and statistically significant correlations were seen between adult vaccination rates and number of pharmacies per 10,000 inhabitants or number of GP practices per 10,000 inhabitants for the three main vaccines (Pneumococcal polysaccharide, influenza and herpes zoster) — Exhibit 5. Pneumococcal vaccination is also positively correlated with population aged 65+, which is aligned with the NHS indication for the pneumococcal vaccination in adults. Interestingly, the index of multiple deprivation, which is a multi-dimensional measure of relative deprivation that includes education, health crime among others, shows a positive correlation with two of the vaccines. The reasons for this may be multifold — for example, highly deprived areas may have a greater policy or education focus. This needs to be explored further.

* Wards in the United Kingdom are electoral districts at sub-national level represented by one or more councilors.

Exhibit 4: Vaccine use in each Manchester city ward by type



Source: NHS Digital – GP Contract Services April 2022 to March 2023 and IQVIA Supply Chain Manager for September 2022 to August 2023.
Notes: DTaP (diphtheria, tetanus and pertussis) refers to use among pregnant women. No volumes were captured for Northenden and very low volumes for Deansgate, which are smaller districts with no or few GP practices. Fallowfield also had low volume and is excluded from the figure above.

Exhibit 5: Correlations of vaccine use and socioeconomic and sociodemographic variables in Manchester

		TDAP PREGNANT	INFLUENZA	SHINGLES	PNEUMO-COCCAL	HEP B	OOP VACCINES
	Inhabitants	0.1	-0.3	***-0.5***	-0.3	0.1	-0.1
	Male inhabitants	0.1	-0.2	***-0.5***	-0.3	***0.5***	***0.5***
	Inhabitants aged 0–16	0.2	0.3	***0.4***	***0.4***	***-0.5***	***-0.6***
	Inhabitants aged 65+	0.0	0.3	***0.6***	***0.4***	***-0.4***	-0.3
	Life expectancy - females	0.0	-0.3	-0.2	-0.3	***0.5***	***0.6***
	Life expectancy - males	0.1	-0.1	0.1	-0.1	0.1	0.3
	Index of multiple deprivation	0.0	0.3	0.2	0.3	-0.4	***-0.5***
	Population Employed	-0.2	-0.2	-0.2	-0.3	***0.5***	***0.5***
	Residents with education level > A	-0.1	-0.3	-0.3	-0.3	***0.4***	***0.4***
	Residents born in UK	-0.3	0.1	***0.4***	0.1	-0.1	0.0
	Main language - English	-0.3	0.1	***0.4***	0.1	-0.1	0.0
	Number of GP practices (per 10k)	***0.5***	***0.7***	***0.5***	***0.7***	-0.3	***-0.4***
	Number of pharmacies (per 10k)	0.3	***0.6***	***0.6***	***0.6***	-0.1	0.0

Source: NHS Digital – GP Contract Services April 2022 to March 2023 and IQVIA Supply Chain Manager for August 2022 to August 2023.
Only variables showing statistically significant correlations (P value of ≤0.1) are displayed. Only values with P value ≤0.1 are in color. Correlations strength and direction is indicated by colour as shown in the scale for those with P value ≤0.1. Correlations with P-value of ≤0.05 are displayed in bold, italic type. White cells show correlations that are not statistically significant.
Abbreviations: Hep B, Hepatitis B; TDaP, diphtheria, tetanus and pertussis; Nbr, number; OOP, out of pocket vaccines (includes Engerix B, Ixiaro, Menveo, Rabipur, Stamaril and Ticovac).

DATA-BASED IMPLICATIONS FOR LOCAL POLICY INTERVENTIONS

Once a vaccine is in the NIP, access points for vaccine administration are crucial for enhancing adult vaccine use

- As shown in the correlation table, the results suggest that a lack of local pharmacies and GP practices can lead to inequality of adult vaccine use within certain parts of Manchester for most vaccines considered.
- Notably and positively, there was no strong evidence of inequality relating to gender, age, life expectancy, employment, or education across adult Manchester vaccination rates in the NHS; however, out-of-pocket vaccines use was correlated with the index of multiple deprivation, which suggests that local policies need to consider financial barriers in certain areas to ensure vaccination is used optimally.

Case Studies — Thailand/Bangkok

VACCINATION PROGRAM

Thailand's National Immunization Program provides influenza vaccines to certain groups of adults (pregnant women, senior citizens and individuals with chronic diseases), with additional coverage opportunities for adult vaccines through the private channel.

In Bangkok, vaccine access can be categorized into public and private channels. For the public channel, Thailand's National Immunization Program (NIP) is the national-level policy to increase coverage of vaccine for the Thai population. In addition to NIP, private insurers also provide coverage for specific vaccines. For example, AIA, one of the largest private health insurers in Thailand, offers reimbursement for influenza, hepatitis B and HPV vaccines.[36] The NIP currently prioritizes access for population in the high-risk groups (including children, pregnant women, and the elderly).[37] The focus is largely on children's vaccines. Among adult vaccines, influenza vaccines are provided to pregnant women, senior citizens, and individuals with chronic medical conditions. Other adult vaccines require private insurance or out-of-pocket payments.

The focus of future immunization efforts under the NIP remains largely on childhood vaccines. Some new vaccines that will be prioritized for NIP inclusion are[3]:

- Tdap for pregnant women; currently, only dT vaccines are covered for pregnant women
- Combination vaccine (DTwP-HB-Hib-IPV) for children under five years; currently, children are administered DTwP-HB-Hib and IPV separately under the NIP
- Pneumococcal vaccine for children under five years (not yet covered in the NIP).

Hospitals and clinics are the main vaccination points, accounting for more than 90% of the vaccination channels for patients in Thailand. Other potential vaccination points, such as at the workplace or at pharmacies, are relatively less utilized.

DATA SOURCE AND STUDY METHODOLOGY

Bangkok has a population of around 5.5 million and is divided into 50 districts as defined by the Bangkok Metropolitan Office. For this study, neighboring districts with the same zip code have been combined, resulting in 26 district groups. The district groups vary in sociodemographic characteristics, such as population size, income, and commercialization (i.e., new retail and whole entities), some of which are illustrated in Figure 1 in the appendix. Vaccine sales volumes from IQVIA panel of hospitals and clinics were aggregated to the level of the 26 district groups and correlation analysis was performed to identify the associations between percentage of vaccinated patients and district variables. An important caveat to note here is that the data assesses where vaccines were given, some adults may be travelling from one district group to another to receive their vaccine; hence, the data may not be representative of the location of the patient. Sales volume of in-scope vaccines is based on IQVIA drug distribution data. The data covers the year 2022. IQVIA sales data covers 90% of vaccine sales volume across public/private hospitals and clinics.

FINDINGS

Adult vaccine use varies substantially across district groups, potentially driven by the presence of hospitals and clinics

Adult vaccine use is concentrated in a few district groups likely due to the presence of vaccination points (Exhibit 6).

Adult vaccine use in a district is correlated with the number of vaccination points as well as indicators of economic development, such as new retail and wholesale entities

For each of the in-scope vaccines, statistically significant correlations were identified for several variables, including number of vaccination points (hospitals and clinics) per 10,000 population, number of deaths per 10,000 population, number of newborns per 10,000 population, capital of new retail entity per 10km^2 area, and capital of new wholesale entity per 10,000 population, and other variables.

Sub-city differences were more evident for the herpes zoster vaccine. In addition to the above variables, positive correlations were also found for wealth-related factors (land and housing tax per household) for herpes zoster. Exhibit 7 shows the overall summary of the correlations.

DATA-BASED IMPLICATIONS FOR LOCAL POLICY INTERVENTIONS

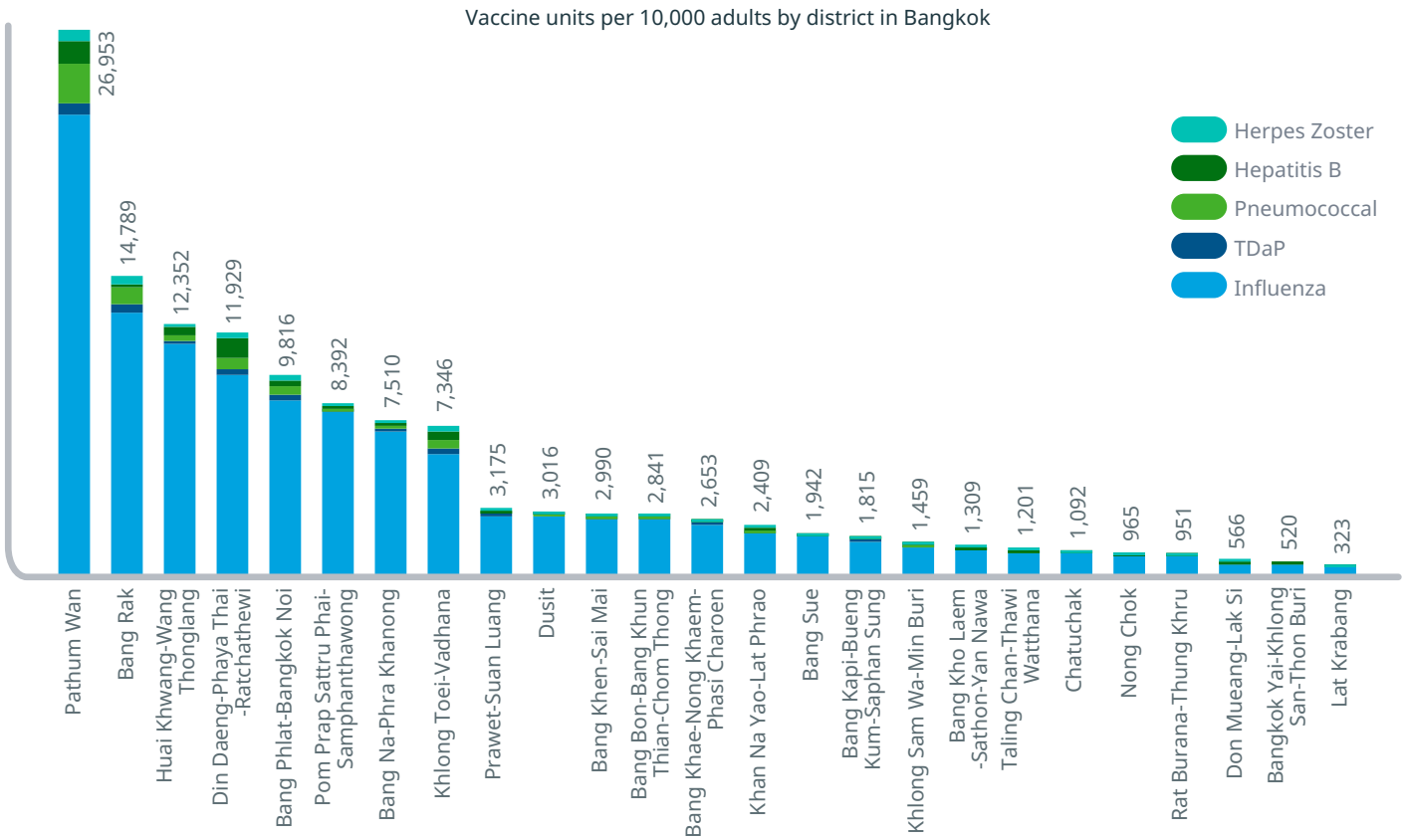
Access to sites for vaccination and accounting for differences in an individual's financial capability and overall economic development of an area will be crucial for equitable adult vaccine use

- Vaccine use is highly driven by the presence of hospitals and clinics
- The birth and death rates, indicative of the relative sizes of children and elderly populations in the districts, are both positively correlated with the percentage of population that are immunized.

These populations tend to be a higher priority for free vaccination under NIP, which suggests that programmatic focus on specific vaccines and overcoming financial barriers may be an important driver of adult vaccination.

- A high correlation is also observed between vaccine access and commercial sector parameters, such as capital of new retail and wholesale entities, which is likely driven by free vaccination provided by Thai corporate companies as part of employee benefits. Many corporate companies partner with private insurance companies and provide benefits, such as group insurance for employees and free vaccinations. his dynamic will be important to account for to address health inequities as certain populations will not have access to these type of vaccinations.

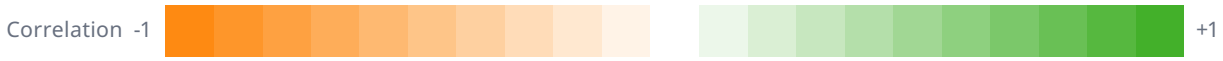
Exhibit 6: Vaccine use in each Bangkok city district by type



Source: IQVIA Xponent selling out data, Moving Annual Total Q2 2023.
Notes: Phra Nakhon was excluded form this figure due to low volume captured in dataset. Some districts have vaccine use greater than 10,000 as many adults travel from one district to another to get their vaccine
Abbreviations: TDaP, diphtheria, tetanus and pertussis. Very low volumes were captured for Phra Nakhon potentially due to a limited number of vaccination sites.

Exhibit 7: Correlations of vaccine use and socioeconomic and sociodemographic variables in Bangkok

		DTAP	INFLUENZA	HERPES ZOSTER	PNEUMOCOCCAL	HEP B
	Nbr newborn (per 10,000)	***1.0***	0.9	***0.9***	1.0	***0.8***
	Nbr deaths (per 10,000)	***0.9***	0.9	***0.9***	0.9	***0.7***
	Nbr marriages (per 10,000)	***0.4***	0.4	***0.5***	0.4	0.1
	Household size	***-0.5***	-0.6	***-0.5***	-0.5	***-0.5***
	Nbr of outward migrations (per 10,000)	***0.8***	0.8	***0.8***	0.9	***0.7***
	Land and housing tax per household	***0.4***	0.4	***0.5***	0.3	0.1
	Land and housing tax (per 10,000)	***0.4***	0.4	***0.5***	0.4	0.1
	Signage tax (per 10,000)	***0.8***	***0.7***	***0.8***	***0.8***	***0.7***
	Land and building tax (per 10,000)	***0.9***	***0.8***	***0.9***	***0.9***	***0.7***
	No of new retail entity (per 10,000)	***0.7***	***0.6***	***0.7***	***0.7***	***0.4***
	Capital of new retail entity (per 10,000)	***0.9***	***0.8***	***0.9***	***1.0***	***0.7***
	No of new wholesale entity (per 10,000)	***0.7***	***0.6***	***0.7***	***0.6***	0.3
	Capital of new wholesale entity (per 10,000)	***0.8***	***0.9***	***0.8***	***0.8***	***0.6***
	Nbr vaccination points (per 10,000)	***0.9***	***0.9***	***0.9***	***0.9***	***0.8***



Source: IQVIA Drug Distribution Data, Moving Annual Total Q2 2023.
Notes: Only variables showing statistically significant correlations (P value of ≤0.1) are displayed. Only values with P value ≤0.1 are in color. Correlations strength and direction is indicated by colour as shown in the scale for those with P value ≤0.1. Correlations with P-value of ≤0.05 are displayed in bold, italic type. White cells show correlations that are not statistically significant.
Abbreviations: Hep B, Hepatitis B; DTaP, diphtheria, tetanus and pertussis; Nbr, number.

Case Studies — United States of America/Chicago and New York

VACCINATION PROGRAM

Vaccine recommendations are developed by the Advisory Committee on Immunization Practices (ACIP) and most recommended vaccines are covered by insurers

In the U.S., the ACIP is a group of medical and public health experts that develops recommendations on how to use vaccines to control diseases in the United States. Vaccines are covered through public (Medicare and Medicaid) and private insurance based on ACIP recommendations. Adult vaccines can generally be administered at the physician office or at a pharmacy in most states. Some states require a prescription. Gaps in coverage remain for travel vaccines which require out-of-pocket expenses.[38]

Adult vaccines are generally reimbursed by public and private insurers in the U.S. for the recommended population. As of 2023, new policy changes in the Inflation Reduction Act closed the out-of-pocket costs in Medicare Part D (prescription drug coverage) and for traditional Medicaid.[39] Now, nine out of ten Americans have access to ACIP recommended vaccines with no out of pocket costs, the uninsured still lack coverage.[40]

Adult vaccines coverage, particularly for herpes zoster, lag behind childhood vaccination coverage and highlight room for substantial improvement

A 2022 CDC study estimated the coverage of adult vaccines in the U.S.

- Pneumococcal vaccination coverage overall (≥1 dose of PPSV23 or PCV13) among adults aged ≥65 years was 67.5% in 2020.
- Herpes zoster vaccination coverage among adults aged ≥50 and ≥60 years in 2020 was 29.4% and 39.1%, respectively
- In 2019, the proportion of adults aged ≥19 years reporting having received any tetanus toxoid–containing vaccination during the past 10 years was 62.9%

In comparison to adult vaccination, child vaccine coverage is generally higher, ranging from 80 to 90%.

DATA SOURCE AND STUDY METHODOLOGY

In the U.S., Chicago and New York were studied. New York has a population of around 8.5 million. Chicago has a population of 2.7 million. This research was conducted with data from a 12-month period from October 2022 to September 2023. The total vaccinated population at zip code level were calculated using IQVIA Xponent and Drug Distribution Data (DDD). The relevant population as well as other key variables (age, gender, education etc.) for a zip code was calculated from publicly available data sources (United States Census Bureau). Some findings are shown at a county/borough level for ease of summary. In some cases, vaccine units were not disaggregated between adults and children in some cases (e.g. Influenza, Hepatitis B). Hence the vaccine units used for this analysis may include some that were used for children as well.

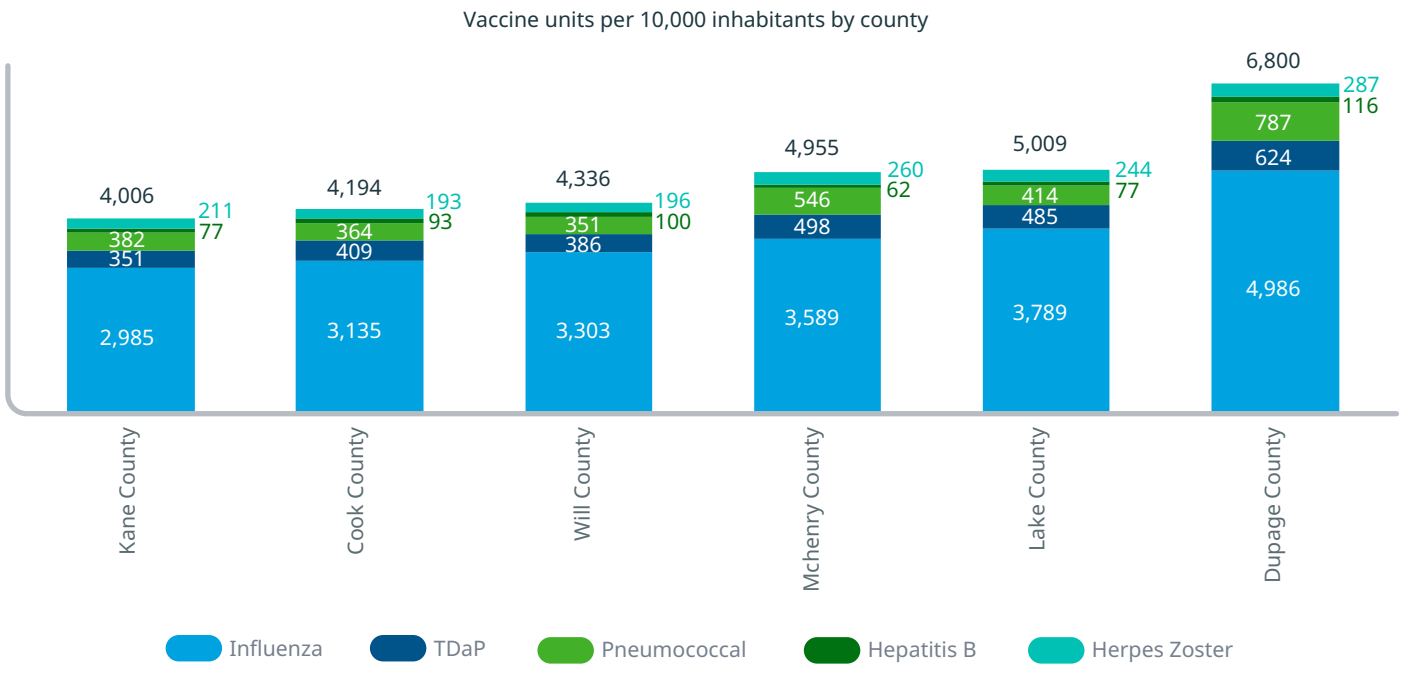
FINDINGS — CHICAGO

Adult vaccine use per 10,000 inhabitants varies across counties in Chicago, with the highest county (Dupage) seeing nearly 70% more vaccine use per 10,000 inhabitants compared to the lowest vaccine using county (Kane) — Exhibit 8

Household income, education, lack of insurance, and median house value are highly correlated with vaccination rates across all vaccines studied; race and ethnicity also show correlations with vaccination rates in some cases

Social determinants play a key role in vaccine rates in Chicago. Higher income and education levels are correlated with greater vaccine use while lack of insurance is correlated with lower vaccine use in some cases — Exhibit 9. Race and ethnicity appears to be moderately correlated with vaccine rates. These dynamics need to be understood further to ensure that historic social inequities are not exacerbated due to differences in adult vaccine use.

Exhibit 8: Vaccine use in each Chicago county by type



Source: IQVIA Xponent and Drug Distribution Data, September 2022 to October 2023, US Census.
Notes: Vaccine units per 10,000 adults by county. In some cases, vaccine units may not be disaggregated between adults and children in some cases (e.g. Influenza, Hepatitis B). Hence the vaccine units used for this analysis may include some that were used for children as well.

Exhibit 9: Correlations of vaccine use and socioeconomic and sociodemographic variables in Chicago

	MEASURE	TDAP	INFLUENZA	HERPES ZOSTER	PNEUMOCOCCAL	HEP B
	Household income	***0.4***	***0.5***	***0.3***	***0.2***	***0.2***
	Median home value	***0.3***	***0.5***	***0.3***	***0.2***	***0.2***
	% with higher education	***0.4***	***0.6***	***0.3***	***0.3***	***0.3***
	% w/o healthcare coverage	***-0.3***	***-0.3***	***-0.3***	***-0.2***	***-0.2***
	Average age	0.1	***0.2***	***0.3***	***0.2***	0.0
	% Caucasian	***0.2***	***0.4***	***0.2***	***0.2***	0.0
	% Asian	***0.3***	***0.4***	***0.2***	0.1	***0.2***
	% African American	***-0.2***	***-0.4***	***-0.2***	-0.1	0.0
	% Hispanic	***-0.2***	***-0.3***	***-0.2***	***-0.2***	***-0.1***
	% Other/ Unspecified	***-0.2***	***-0.2***	***-0.2***	***-0.1***	-0.1

Source: IQVIA Xponent and Drug Distribution Data, October 2022 to September 2023.
Notes: Only variables showing statistically significant correlations (P value of ≤0.1) are displayed. Correlations strength and direction is indicated by colour as shown in the scale. Correlations with P-value of ≤0.05 are displayed in bold, italic type. White cells show correlations that are not statistically significant. Analysis was done at Zip level.
Abbreviations: DTaP, diphtheria, tetanus and pertussis; w/o, without

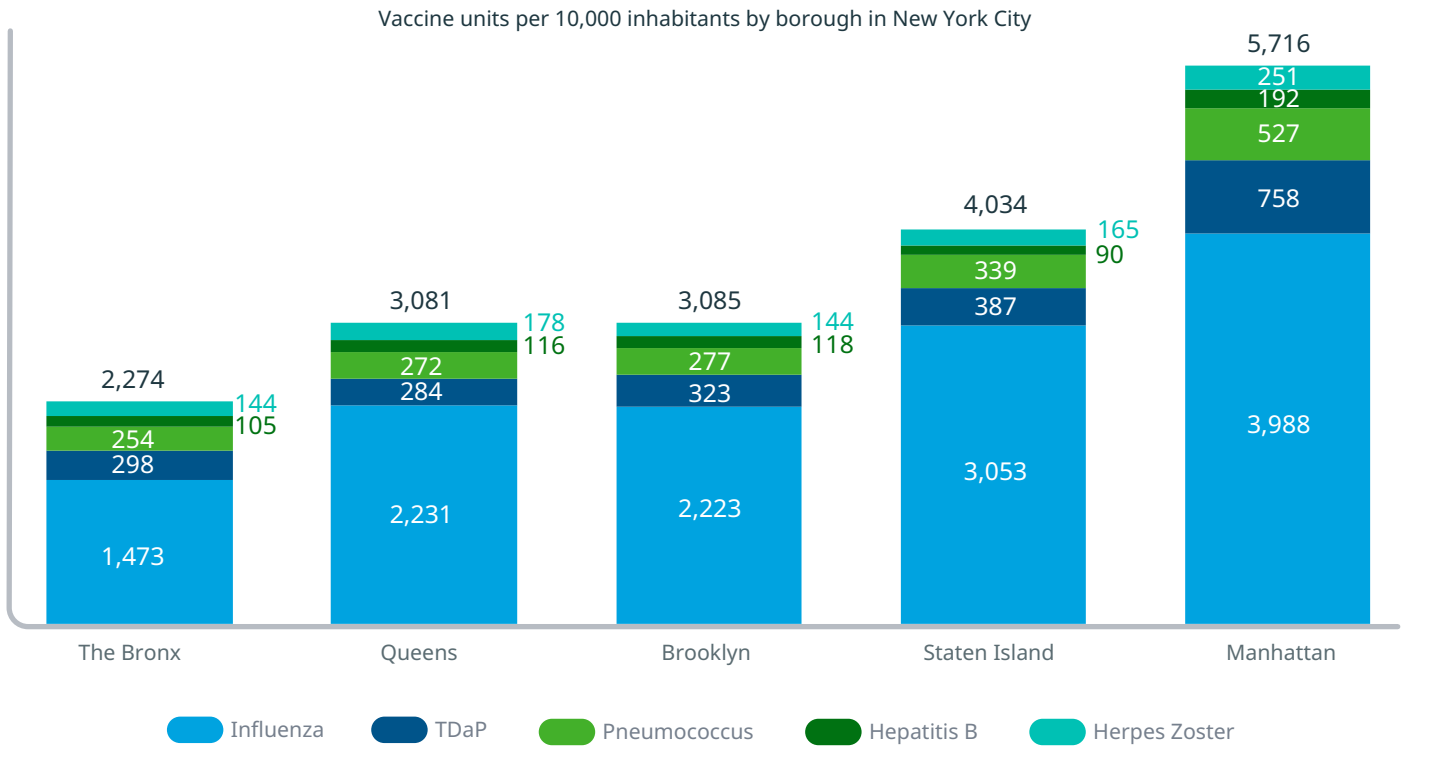
FINDINGS — NEW YORK

Adult vaccine use per 10,000 inhabitants varies across boroughs in New York, with the highest borough (Manhattan) seeing over 1.5 times the vaccine use per 10,000 inhabitants compared to the lowest vaccine using borough (Bronx) – Exhibit 10

Household income, education and median house value are highly correlated with vaccination rates across all vaccines studied; Race and ethnicity also show correlations with vaccination rates in some cases

Social determinants play a key role in vaccine rates in New York. Higher income and education levels are correlated with greater vaccine use while lack of insurance is correlated with lower vaccine use in some cases (Exhibit 11). Race and ethnicity appears to be moderately correlated with vaccine rates. These dynamics need to be understood further to ensure that historic social inequities are not exacerbated due to differences in adult vaccine use.

Exhibit 10: Vaccine use in each New York City borough by type



Source: IQVIA Xponent and Drug Distribution Data, October 2022 to September 2023. US Census.
Notes: In some cases, vaccine units may not be disaggregated between adults and children in some cases (e.g. Influenza, Hepatitis B). Hence the vaccine units used for this analysis may include some that were used for children as well.

Exhibit 11: Correlations of vaccination rates and socioeconomic and sociodemographic variables in New York City

	MEASURE	TDAP	INFLUENZA	HERPES ZOSTER	PNEUMOCOCCAL	HEP B
	Household income	***0.5***	***0.5***	***0.2***	***0.4***	***0.3***
	Median home value	***0.4***	***0.4***	***0.2***	***0.3***	***0.3***
	% with higher education	***0.5***	***0.5***	***0.2***	***0.3***	***0.3***
	% w/o healthcare coverage	***-0.3***	***-0.3***	0.0	***-0.2***	-0.1
	% Caucasian	***0.4***	***0.4***	0.2	***0.3***	***0.2***
	% Asian	0.1	***0.3***	***0.3***	0.1	***0.2***
	% African American	***-0.3***	***-0.3***	***-0.2***	***-0.2***	***-0.2***
	% Hispanic	***-0.2***	***-0.3***	-0.1	-0.1	-0.1
	% Other/ Unspecified	***-0.3***	***-0.4***	***-0.2***	***-0.2***	-0.1

Source: IQVIA Xponent and Drug Distribution Data, October 2022 to September 2023.
Notes: Only variables showing statistically significant correlations (P value of ≤0.1) are displayed. Correlations strength and direction is indicated by colour as shown in the scale. Correlations with P-value of ≤0.05 are displayed in bold, italic type. White cells show correlations that are not statistically significant. Analysis was done at Zip level.
Abbreviations: DTaP, diphtheria, tetanus and pertussis; w/o, without

DATA-BASED IMPLICATIONS FOR LOCAL POLICY INTERVENTIONS

Policies for enhancing vaccination rates will need to consider dynamics within communities and account for income and education driven barriers

- For both New York and Chicago, vaccination rates vary substantially across areas and communities. The causes of differences in vaccine uptake are complex; however, income and education can act as barriers. Urban policies need to take this into account and reach out to adults accordingly to enhance adult vaccination rates to ensure equity of vaccine use.
- In Chicago, the percentage of insured population is negatively correlated with vaccine use which highlights the potential barriers lack of reimbursement can play in this population. Similar to the income and education discussion above, urban policies need to ensure that populations which do not have insurance are not left behind with respect to crucial adult vaccination.
- Race and ethnicity also plays an important role in both cities, with caucasian populations more likely to be vaccinated. Such dynamics can exacerbate existing inequities and need to be explored further.

Conclusions and policy implications

GLOBAL COLLABORATIONS THAT LEVERAGE THE LEARNINGS FROM COVID-19, SUCH AS THE UN DECADE OF HEALTHY AGEING, PRESENT CRUCIAL OPPORTUNITIES TO INCREASE THE PRIORITY OF AND OPTIMIZE THE USE OF ADULT VACCINES

Vaccination against VPDs has been shown to present a whole host of clinical and economic benefits. We are in the early stages of the United Nations Decade of Healthy Ageing, which extends from 2021–2030 and is intended to be an opportunity to bring together governments, civil society, international agencies professionals, academia, the media, and the private sector for concerted action to improve the lives of older people.[9] The focus on healthy ageing need to be utilized to the priority of and optimize the use of adult vaccines and Life Course Immunziation. Additionally, as vaccination rates increase, the market incentives for innovation will also increase both for improved vaccination types for existing ones and also for new and different needs.

SUB-CITY LEVEL RESEARCH SHOWCASES THE IMPORTANCE OF URBAN POLICIES, SUCH AS ACCESS TO A PHARMACY, IN ENSURING EQUITABLE ACCESS TO ADULT VACCINES

The WHO age-friendly city framework helps guide cities to encourage active ageing and enhance quality of life as people age. Among the core features of an age-friendly city are social inclusion, information access, community support, and access to health services.[10] Access to and abundance of local pharmacies or vaccination points showed a clear association with vaccination consumption in this study, and the valued role of pharmacists as vaccine administrators and educators has been demonstrated to reduce health inequities across multiple countries by removing obstacles to access.[43,44] Pharmacy immunization services are also reported to deliver economic benefits by reducing direct healthcare costs and productivity loss.[45,46]

In many countries, pharmacists are permitted to prescribe and administer vaccines, but this is often limited to influenza vaccine and COVID-19 vaccines. Vaccination in pharmacies enables higher coverage rates, and pharmacists can also have an important role in identifying and prompting vulnerable people visiting a pharmacy to get vaccinated.[18,19] The U.S. also offers a range of pharmacist point of care vaccinations, and such strategies have been implemented in low- and middle income countries too.[47] Also, U.S. publications state that pharmacist involvement as immunizer, advocator, or both has favorable effects on immunization uptake, especially with influenza vaccines.[18,19]

DEMOGRAPHIC FACTORS CAN ALSO IMPACT VACCINATION COVERAGE AND ACCOUNTING FOR THESE FACTORS WILL BE IMPORTANT FOR ACHIEVING EQUITY OF VACCINE USE

These case studies also identified demographic factors associated with differences in vaccination coverage – these included marital status, household size and family composition, which may result from a mix of behavioral drivers and structural barriers, as has been reported elsewhere.[48] These imply that consideration of differences in households necessary to mitigate inequalities, including joint appointing for cohabitees, and pharmacy or clinic opening times that can accommodate patients with care duties will be important.

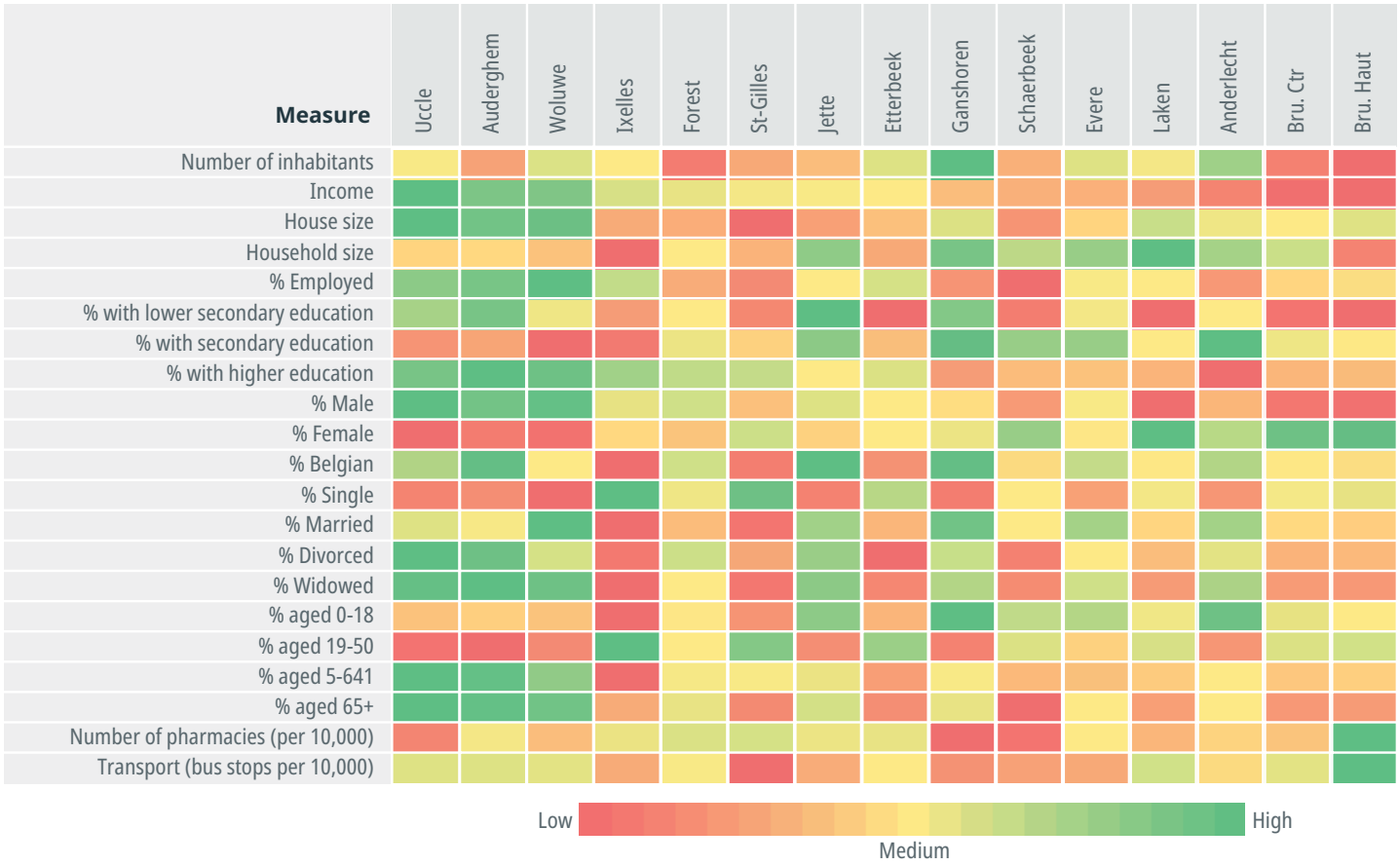
Understanding and acknowledging these factors that drive the underlying differences in vaccination coverage serves as a starting point to help address them. The research conducted here serves as a pilot for understanding the adult vaccination dynamics at a sub-city level. The outcomes of this study point to a few approaches that can support the optimal use of adult vaccines:

- **Track adult vaccination data regularly at national and sub-national levels**: Regular tracking of data at various levels allows for measurement of the impact of policies and helps highlights areas of focus for ensuring improvements in vaccine use and equity across regions. Systems will need to be put in place to collect and monitor this data regularly. Learnings from monitoring the COVID-19 vaccine uptake and systems developed during this period will provide an important starting point.
- **Ensure financial considerations do not impact vaccine uptake**: Income can act as a barrier to vaccine use. Reimbursement of adult vaccines can help overcome financial burdens and ensure that vaccine equity is achieved. Ensuring adequate funding to implement equitable and accessible vaccination programs with a greater emphasis on prevention is important.
- **Increase the number of vaccinators**: Given the crucial role of pharmacists identified by this research, expanding the pharmacists' role to prescribe and administer vaccines and ensuring sufficient access points are available will be key.
- **Ensure that urban policymaking for sub-city level differences in and social determinants of vaccine use**: Demographics and city level infrastructure (such as availability of public transport) can play a role in vaccine use. Policies related to adult immunization will have to take these aspects into consideration and resources will need to be allocated accordingly; for example, accounting for differences in education levels or economic development while allocating resources will help with vaccine equity.
- **Provide the basis for a growing and robust market that has incentives for ongoing innovation**: Improved vaccinations for ones already existing and new and different applications will only be possible if the current market is well understood and a growing older adult population is accounted for through regular and optimal vaccination.

The research conducted in this brief serves as a starting point for a discussion on enhancing adult immunization. To continue improving our understanding of adult vaccination, further studies to delve into the inequalities identified in the case studies, both to identify their importance in other cities and to search for causal mechanisms behind, will be needed. Addition of more cities to such an undertaking, and a different approach to data collection, including qualitative research, would help further the understanding of adult vaccine use.

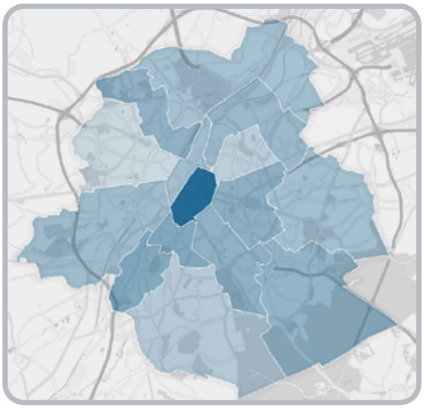
Appendix

Appendix exhibit 1 – Socioeconomic and sociodemographic variables by Brussels city district

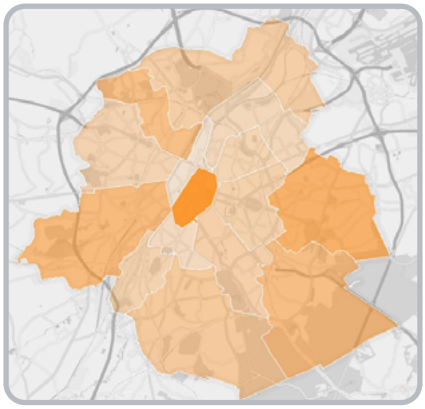


Source: StatBel, Dividuals, IQVIA OneKey, Opendata Brussels.
Notes: Sociodemographic and sociodemographic variables used for the Brussels study. Values are relative with green being higher and red being lower values relative to the other districts. Districts are listed on order of relative average income level. Abbreviations: Bru., Brussels.

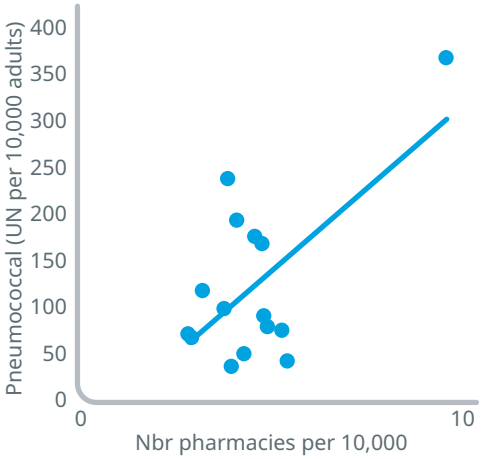
Appendix exhibit 2: Heatmap and correlations of Pneumococcal vaccine use per 10,000 adults and number of pharmacies per 10,000 inhabitants in Brussels



Number of pharmacies per 10,000 inhabitants



Pneumococcal units per 10,000 adults



Source: IQVIA Xponent selling out data, September 2022 to August 2023.

Appendix exhibit 3 : Correlations of vaccine use among patients with co-morbidities and socioeconomic and sociodemographic variables in Brussels

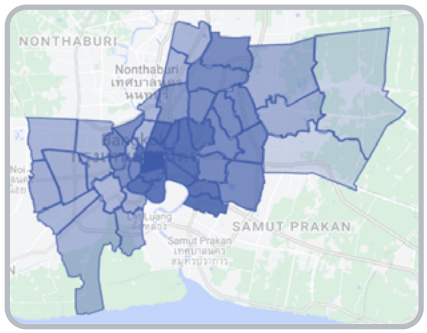
		TDAP		INFLUENZA				PNEUMOCOCCAL				HEP B
		DIABETES	RESPIRA-TORY	ANY CO-MED-ICATION	DIABETES	HEART DISEASE	IMMU-NOLOGY	ANY CO-MED-ICATION	DIABETES	HEART DISEASE	RESPIRA-TORY	HEART DISEASE
	Income	0.4	0.5	0.0	0.0	0.0	-0.2	0.4	0.4	0.5	0.4	0.1
	Size of house	0.0	0.1	-0.3	-0.4	-0.3	-0.5	0.1	0.0	0.2	0.3	0.2
	Household size	-0.4	- 0.5	0.0	0.0	0.1	0.2	-0.3	-0.5	-0.4	-0.3	0.2
	% with Higher education	0.5	***0.6***	0.0	0.0	0.0	-0.2	0.4	0.5	0.5	0.4	- 0.0
	% Male	0.5	***0.5***	0.1	0.1	0.1	-0.1	0.5	0.4	***0.5***	***0.5***	0.3
	% Single	0.2	0.2	0.1	0.2	0.1	0.2	0.0	0.3	0.0	-0.3	-0.5
	% Married	-0.3	-0.3	-0.2	-0.2	- 0.1	-0.2	- 0.1	-0.4	-0.1	0.1	0.5
	% Divorced	0.1	0.1	0.0	-0.1	0.0	-0.2	0.3	0.1	0.3	0.5	0.2
	% Widowed	0.0	0.0	-0.1	-0.2	- 0.1	-0.3	0.2	0.1	0.3	0.5	0.4
	Nbr pharmacies per 1000	-0.4	- 0.2	-0.4	-0.5	- 0.5	***-0.6***	-0.1	-0.3	-0.1	0.1	0.0

Source: IQVIA LRx data, September 2022 to August 2023.
Notes: Summary of Summary of correlations between patients receiving vaccines and treated for the listed therapy areas, against and district socio demographic and socio economic variables. Any co-medication includes diabetes (ATC class A10), heart disease (C3A, C7, C8, C9), immunological weaknesses (A7E9, D5B, D5X, L1A,L1B,L1X9, L4B, L4C, L4X, M1C, N7A, V3X), kidney disease (V03G, V3G2), liver damage (J5D2, J5D3), Neurological conditions (M3A, M3B, N3A, N4A, N7D, N7X) and respiratory problems (R3).
Abbreviations: Hep B, Hepatitis B; DTaP, diphtheria, tetanus and pertussis; Nbr, number.

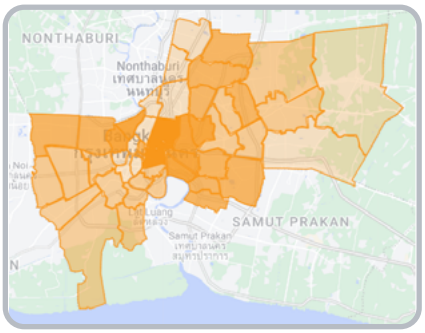
Appendix exhibit 4 – Socioeconomic and sociodemographic variables by Bangkok city district

Source: IQVIA drug distribution data, Bangkok Metropolitan Administration Statistics 2022.
Notes: Sociodemographic and sociodemographic variables used for the Bangkok study. Values are relative with green being higher and red being lower values relative to the other districts. Abbreviations: Nbr, number.

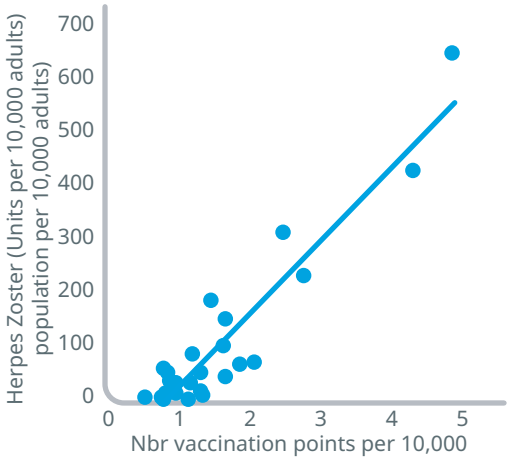
Appendix exhibit 5: Heatmap and correlations of Herpes Zoster vaccine use per 10,000 adults and number of vaccination points per 10,000 inhabitants in Bangkok



Number of vaccination points per 10,000 inhabitants

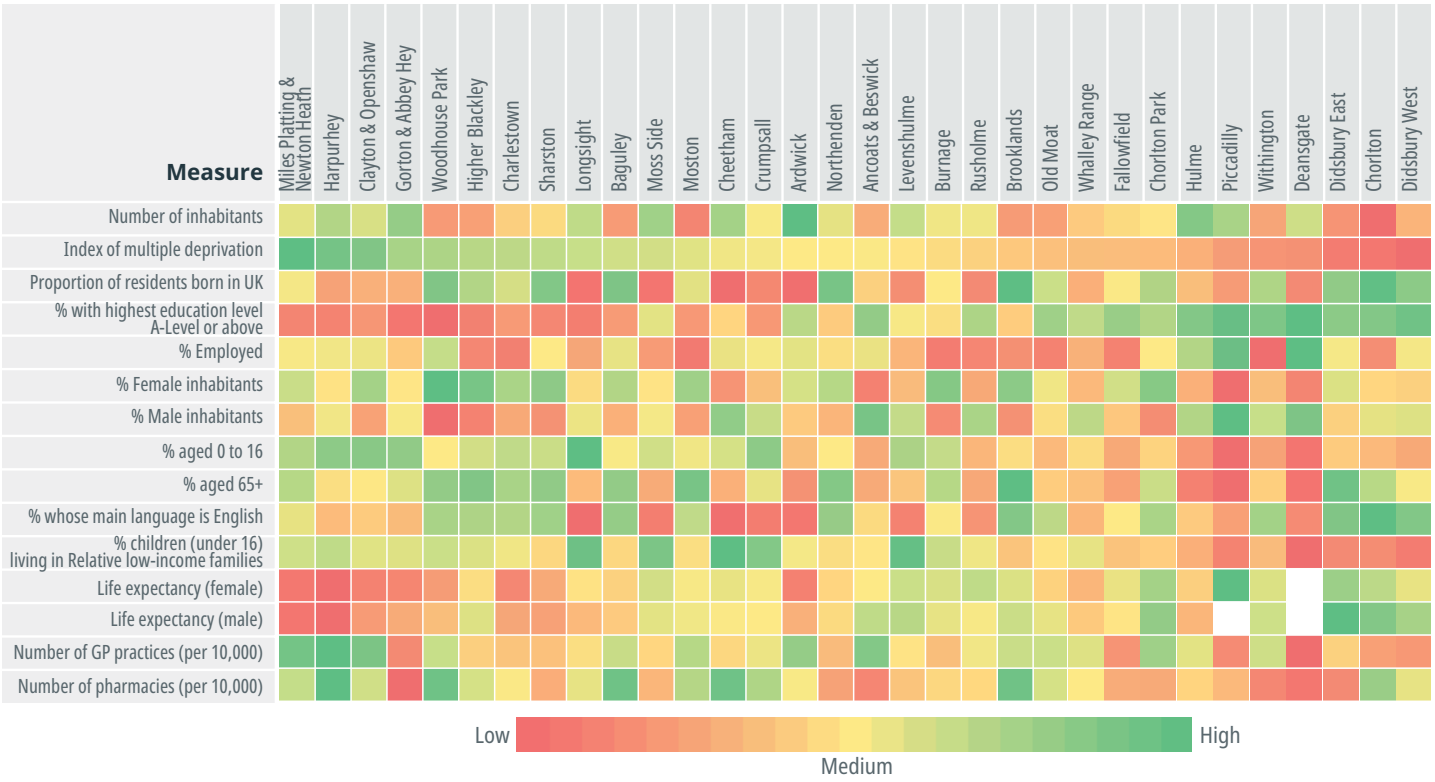


Herpes Zoster units used per 10,000 adults



Source: IQVIA Drug Distribution Data, Moving Annual Total Q2 2023

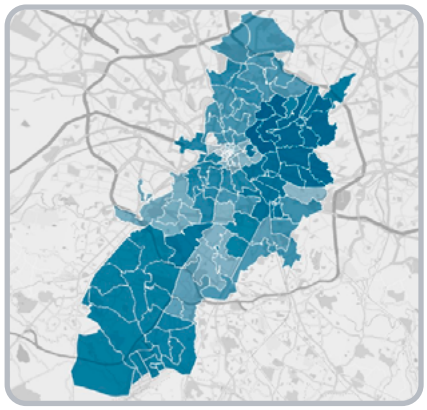
Appendix exhibit 6 – Socioeconomic and sociodemographic variables by Manchester city district



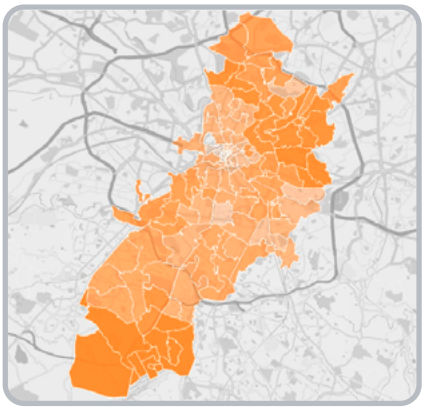
Source: Manchester City Council and Manchester City Council census 2021 data

Notes: Sociodemographic and sociodemographic variables used for the Manchester study. Values are relative with green being higher and red being lower values relative to the other districts. Note, no data are reported for Deansgate (male and female life expectancy) and Piccadilly (male life expectancy).

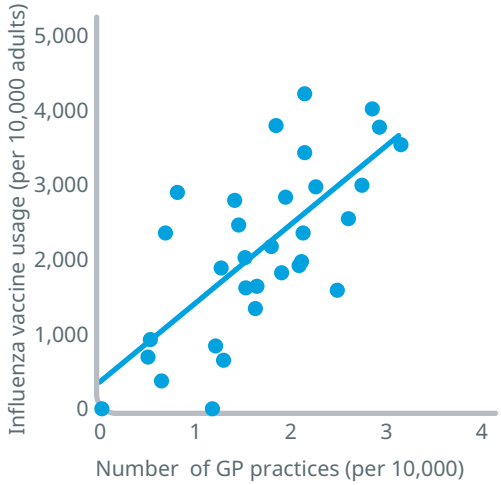
Appendix exhibit 7: Heatmap and correlations of influenza vaccine use per 10,000 adults and number of GP practices per 10,000 inhabitants in Manchester



Number of GP practices per 10,000 inhabitants

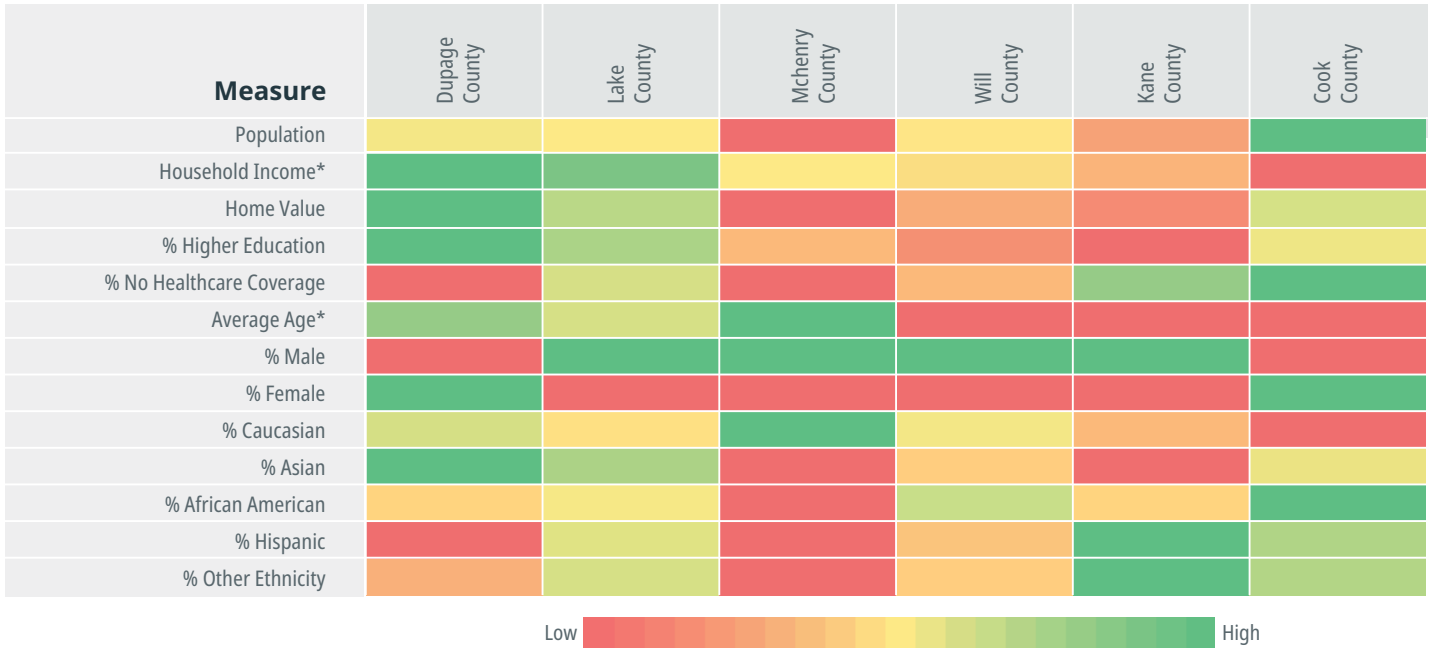


Influenza vaccine use per 10,000 adults



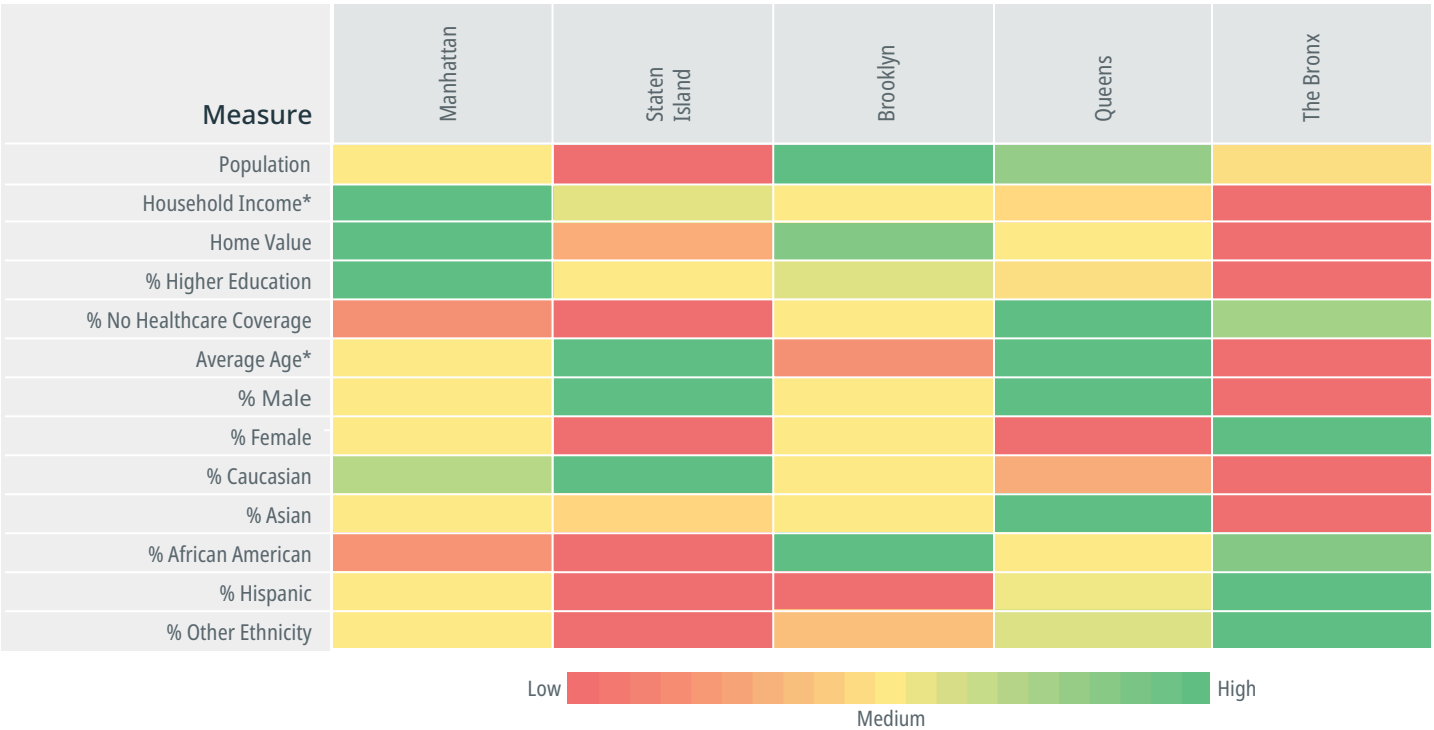
Source: NHS Digital – GP Contract Services April 2022 to March 2023 and IQVIA Supply Chain Manager for August 2022 to August 2023.

Appendix exhibit 8 – Socioeconomic and sociodemographic variables by Chicago counties



Source: United States Census Bureau.
Notes: Sociodemographic and sociodemographic variables used for the Chicago and New York City studies. Values are relative with green being higher and red being lower values relative to the other districts.
*Values represent the weighted averages of the zip level average age, income, and median home value.

Appendix exhibit 9 – Socioeconomic and sociodemographic variables by New York City boroughs



Source: United States Census Bureau.
Notes: Sociodemographic and sociodemographic variables used for the Chicago and New York City studies. Values are relative with green being higher and red being lower values relative to the other districts.
*Values represent the weighted averages of the zip level average age, income, and median home value.

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About the Institute

The IQVIA Institute for Human Data Science contributes to the advancement of human health globally through timely research, insightful analysis and scientific expertise applied to granular non-identified patient-level data.

Fulfilling an essential need within healthcare, the Institute delivers objective, relevant insights and research that accelerate understanding and innovation critical to sound decision making and improved human outcomes. With access to IQVIA's institutional knowledge, advanced analytics, technology and unparalleled data the Institute works in tandem with a broad set of healthcare stakeholders to drive a research agenda focused on Human Data Science including government agencies, academic institutions, the life sciences industry, and payers.

Research agenda

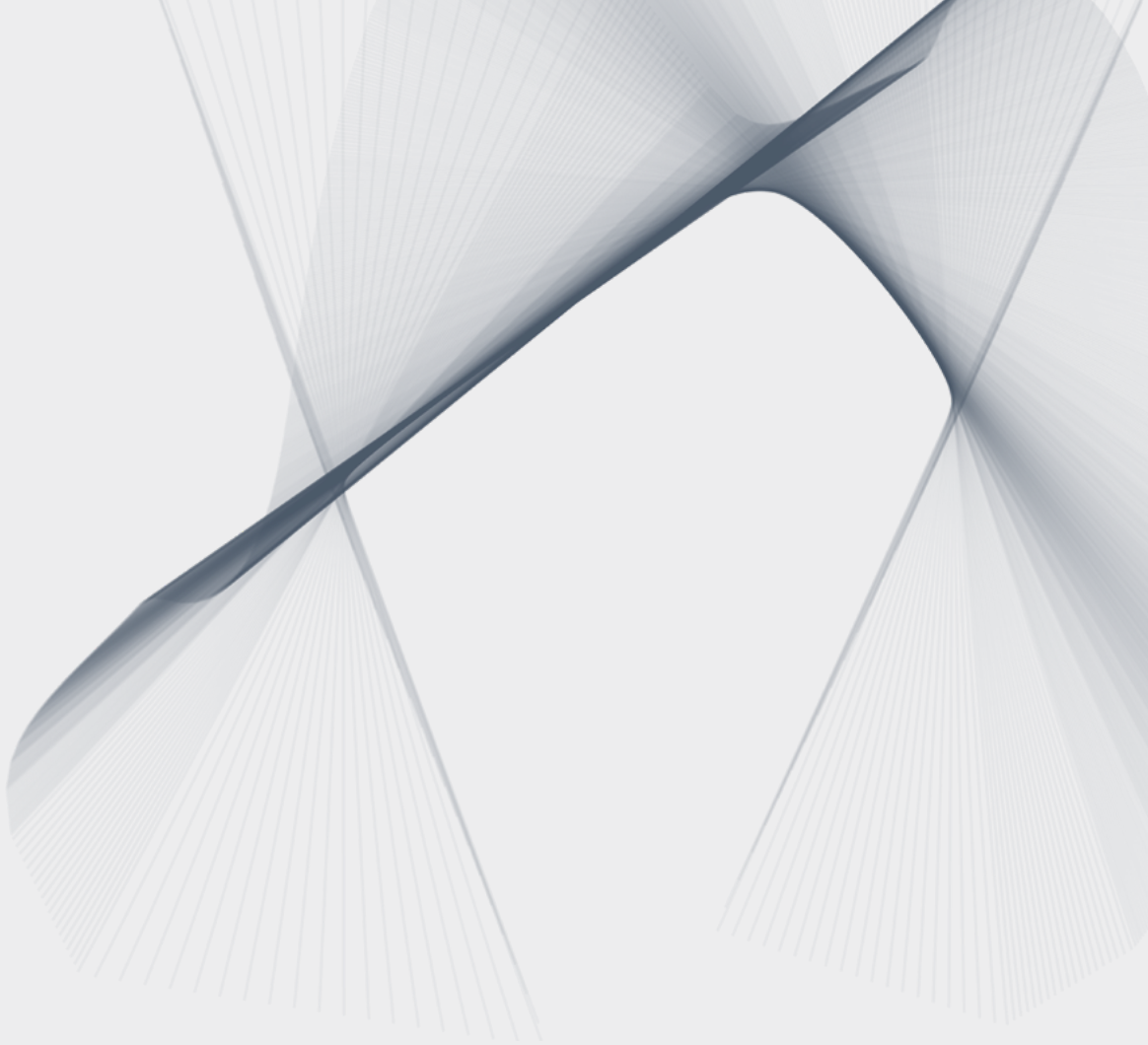
The research agenda for the Institute centers on five areas considered vital to contributing to the advancement of human health globally:

- Improving decision-making across health systems through the effective use of advanced analytics and methodologies applied to timely, relevant data.
- Addressing opportunities to improve clinical development productivity focused on innovative treatments that advance healthcare globally.
- Optimizing the performance of health systems by focusing on patient centricity, precision medicine and better understanding disease causes, treatment consequences and measures to improve quality and cost of healthcare delivered to patients.
- Understanding the future role for biopharmaceuticals in human health, market dynamics, and implications for manufacturers, public and private payers, providers, patients, pharmacists and distributors.
- Researching the role of technology in health system products, processes and delivery systems and the business and policy systems that drive innovation.

Guiding principles

The Institute operates from a set of guiding principles:

- Healthcare solutions of the future require fact based scientific evidence, expert analysis of information, technology, ingenuity and a focus on individuals.
- Rigorous analysis must be applied to vast amounts of timely, high quality and relevant data to provide value and move healthcare forward.
- Collaboration across all stakeholders in the public and private sectors is critical to advancing healthcare solutions.
- Insights gained from information and analysis should be made widely available to healthcare stakeholders.
- Protecting individual privacy is essential, so research will be based on the use of non-identified patient information and provider information will be aggregated.
- Information will be used responsibly to advance research, inform discourse, achieve better healthcare and improve the health of all people.



The IQVIA Institute for Human Data Science is committed to using human data science to provide timely, fact-based perspectives on the dynamics of health systems and human health around the world. The cover artwork is a visual representation of this mission. Using algorithms and data from the report itself, the final image presents a new perspective on the complexity, beauty and mathematics of human data science and the insights within the pages.

This algorithmic art is based on the vaccine use per 10,000 adults across the cities in this research brief.

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