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A Taste of Their Own Medicine: Guideline Adherence and Access to Expertise[†]

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We use administrative data from Sweden to study adherence to 63 medication-related guidelines. We compare the adherence of patients without personal access to medical expertise to that of patients with access, namely doctors and their close relatives. We estimate that observably similar patients with access to expertise have 3.8 percentage points lower adherence, relative to a baseline adherence rate of 54.4 percent among those without access. Our findings suggest an important role in nonadherence for factors other than those, such as ignorance, poor communication, and complexity, that would be expected to diminish with access to expertise. (*JEL* D82, D83, I11, I12, I18)

Widespread nonadherence to medical guidelines is believed to contribute to a large amount of hospitalizations, deaths, and health care spending each year (Fonarow et al. 2011; Neiman et al. 2017).[1] The causes of nonadherence are the subject of significant academic and policy interest (Lopez-Vazquez, Vazquez-Lago, and Figueiras 2012; Talkington et al. 2017; Neiman et al. 2017). Some of the prominent explanations include patient or provider ignorance, guideline complexity, and lack of trust or communication in the patient-provider relationship (Alpert 2010; Bosworth 2012; Neiman et al. 2017; Aslani, Ahmed, and da Costa 2019).[2]

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[1]For example, only a minority of patients adhere to the recommendation to take high-intensity statins following a heart attack (Colantonio et al. 2017; Neiman et al. 2017), and many physicians depart from expert guidance on antibiotic prescribing (Lopez-Vazquez, Vazquez-Lago, and Figueiras 2012; Fleming-Dutra et al. 2016).

[2]Other explanations include financial barriers (Gellad, Grenard, and McGlynn 2009; Choudhry et al. 2011; Bosworth 2012) and behavioral biases (Baicker, Mullainathan, and Schwartzstein 2015), both of which may be more important for disadvantaged populations (Mullainathan and Shafir 2013, 157, 231; Aslani, Ahmed, and da Costa 2019).

Such explanations motivate specific policy interventions, such as attempts to simplify treatment regimes or disseminate information to patients or practitioners (McDonald, Garg, and Haynes 2002; Krueger, Berger, and Felkey 2005; Brown and Bussell 2011; Irwin et al. 2014; Nieuwlaat et al. 2014; Fischer et al. 2016; van Driel et al. 2016). They also suggest the testable implication that patients with greater access to medical expertise will tend to be more adherent since they are likely to be better informed, better able to make decisions, and better able to communicate with their medical providers.

We find that the opposite holds. Specifically, we study the relationship between a patient's adherence to medication guidelines and whether the patient has personal access to medical expertise, defined as being a doctor or having one in the close family. To do so, we assemble administrative data on the entire population of Sweden from 2005 through 2016 and use them to measure adherence to 63 government-issued prescription drug guidelines. These include 6 guidelines related to antibiotics (e.g., children should start with a narrower- rather than broader-spectrum antibiotic to combat a respiratory tract infection), 20 guidelines specific to the elderly (e.g., avoid certain sleep medications), 20 guidelines related to specific diagnoses (e.g., take statins after a heart attack), and 17 guidelines on medication use during pregnancy (e.g., avoid certain antidepressants).

We use information on a person's completed education to determine if they are a doctor, and we link doctors to their relatives using a population register. In our baseline analysis, we classify a patient as having access to medical expertise if the patient, the patient's partner, or any of the patient's parents or children is a doctor. For each of the 63 guidelines, we narrow in on the set of patients who, based on their health conditions, prior prescription claiming, and demographics, are covered by the guideline; within this risk set, we examine differences in adherence between those with and without access to expertise.

Adherence to the guidelines we study requires the compliance of both the provider (to prescribe or not prescribe some medication) and the patient (to take or not take some medication). Because of Sweden's universal health insurance, financial barriers to adherence are likely minimal; patients face limited cost sharing for medical treatments or prescription drugs (Swedish Dental and Pharmaceutical Benefits Agency 2020).

We find that access to expertise is generally associated with less adherence to guidelines. Among the 63 guidelines that we study, and controlling for demographics, income, and education, the association between access to expertise and adherence is negative in 41 cases and statistically significant in 20 of those. Since the share of the population covered by any given guideline can vary by up to three orders of magnitude, we summarize these findings by averaging them across guidelines, weighting each guideline by the prevalence of its risk set in the population. We estimate that while the average patient without access to expertise adheres to guidelines 54.4 percent of the time, one with access to expertise adheres only 50.6 percent, a 3.8 percentage point lower adherence rate. The 95 percent confidence interval includes a 4.1–3.5 percentage point lower adherence rate for those with access to expertise. The education and income controls in our baseline specification strengthen the negative association between adherence and access to expertise. Relative to our baseline, the association also becomes more negative if we narrow the definition of access to include only being a doctor oneself. It becomes less negative—but remains negative and statistically significant—if we broaden the definition of access to expertise to include having a doctor in the extended rather than just close family or to include having nurses and pharmacists in the close family.

We consider several explanations for the negative association between guideline adherence and access to expertise. We first consider a potential role for unobserved socioeconomic or health differences between those with and without access to expertise but find little evidence to suggest that these differences explain the association. We next consider the possibility that access to expertise is associated with greater comfort with pharmaceutical solutions to medical problems or, relatedly, greater access to pharmaceuticals. We find some evidence consistent with this hypothesis: access to expertise is associated with greater use of prescription medications. However, we find that the negative association between adherence and access to expertise is similar for guidelines to take a particular medication and guidelines to avoid one, which is not consistent with an explanation based solely on relative comfort with, or access to, pharmaceuticals.

The last possibility we consider is that access to expertise gives patients information or confidence that prompts them to disregard guidelines that they do not perceive to be in their clinical interest. Several pieces of evidence suggest that this mechanism is at play. One is that the adherence gap between those with and without access to expertise is greater for guidelines with weaker clinical support, although it remains negative and statistically significant even for those with stronger support. Among pregnant women, access to expertise is less negatively associated with adherence for guidelines recommending against drugs classified in category D (which are contraindicated in pregnancy) than guidelines recommending against drugs in category C (which are to be used only when clearly needed). Likewise, the association between adherence and access to expertise is marginally more negative for guidelines rated by the evidence-based clinical resource UpToDate as based on weaker evidence compared to those rated as having stronger evidence, although here the difference is not statistically distinguishable. Another piece of evidence is that while the association between access to expertise and adherence is negative for each of the major categories of guidelines we consider, it is most negative for guidelines regarding the appropriate use of antibiotics, which are designed to promote public health rather than the narrow interest of the patient.

Our findings contribute to a large literature comparing the medical decisions of practitioners and their families to those of the general population. Comparisons have included preventive health behavior (Glanz et al. 1982), treatment decisions and outcomes (Bunker and Brown 1974; Ubel, Angott, and Zikmund-Fisher 2011; Chen et al. 2021), end-of-life care (Gramelspacher et al. 1997; Weissman et al. 2016; Wunsch et al. 2019), and use of cesarean sections (Chou et al. 2006; Grytten, Skau, and Sørensen 2011; Johnson and Rehavi 2016). A related literature compares the health outcomes of doctors and their families to those of the general population (Leuven, Oosterbeek, and de Wolf 2013; Artmann, Oosterbeek, and van der Klaauw 2022; Chen, Persson, and Polyakova 2022).

Most closely related to our paper, Frakes, Gruber, and Jena (2021) compare the propensity to use several types of low-value and high-value medical care (as defined by the health policy community) between military physicians and other US military personnel. They find that physicians are only slightly more likely to avoid low-value care or engage in high-value care than nonphysicians and conclude that policies aimed at improving patients' information and medical knowledge would therefore do little to affect adherence.[3] Our findings reinforce this conclusion in a different setting (and focusing on different types of guidelines) by showing that doctors and their families tend to be less adherent to guidelines, even those backed by strong evidence.

More broadly, our paper contributes to a literature comparing expert and nonexpert behavior in contexts such as consumer purchases (Bronnenberg et al. 2015), real estate (Rutherford, Springer, and Yavas 2005; Levitt and Syverson 2008), household finance (Bodnaruk and Simonov 2015), and health insurance (Handel and Kolstad 2015). Some of this literature treats the behavior of informed individuals as a normative benchmark of optimal behavior. It is unclear whether this perspective is appropriate in our context. Medication guidelines represent broad rules of thumb that may not apply in all circumstances. It is possible that the care of more informed patients is guided by clinically relevant knowledge that is not used in the care of less informed patients and that the more informed may benefit from their greater departures from guidelines. However, consistent with recent evidence that practitioners' departures from prescribing guidelines lead to worse patient outcomes (Currie and MacLeod 2020; Abaluck et al. 2021; Cuddy and Currie 2022), it is also possible that more informed patients are overconfident or otherwise mistaken in deviating from guidelines.[4]

I. Data

A. *Population and Characteristics*

The backbone of our data is an extract from the Swedish Population Register of all individuals residing in Sweden from 2000 through 2016 (Skatteverket, n.d.). For each individual, we observe information about their biological parents, which allows us to link any given individual to their grandparents, parents, siblings, children, cousins, aunts, uncles, nieces, nephews, and grandchildren. We are also able to link individuals to their spouses using marital records and to cohabiting partners using information about addresses and shared biological children. Hereafter, we refer to a person's spouse or cohabiting partner as the person's partner.

We merge these data to Statistics Sweden's longitudinal database of individuals (LISA) from 1990 through 2016, which contains information drawn from various administrative records (Statistics Sweden 1990–2016). From the education records we obtain information on each individual's highest completed degree in each calendar year. We define an individual as a doctor if their highest degree is a medical degree, taking the most recent degree in cases of multiple higher-level degrees. We define other specialized occupations analogously.

[3] Relatedly, Abaluck et al. (2021) use data from clinical notes to argue that most departures from clinical guidelines do not stem from practitioners' lack of awareness of these guidelines.

[4] Alpert (2010, 97), for example, argues that evidence-based "guideline-directed therapy for a particular condition has been shown to lead to better clinical outcomes compared with 'eminence-based,' personally derived, therapeutic strategies."

We define an individual as having access to medical expertise in a given year if the individual, the individual's partner, or any of the individual's parents or children is a doctor. We sometimes use a broader definition of access which also includes having a doctor in the extended family (i.e., among the individual's grandparents, siblings, cousins, aunts, uncles, nieces, nephews, grandchildren, or partner's parents). We define the presence of other occupations (e.g., nurses, pharmacists) in the family analogously.

We also use LISA to define control variables. From the location records, we construct a categorical variable indicating the individual's municipality (kommun) of residence as of the preceding year, using the mother's municipality for those aged 17 years and younger. From the education records, we construct a categorical variable indicating the individual's highest level of completed schooling (i.e., no college, some college, completed college) as of the preceding year, using the mother's schooling for those aged 26 years and younger. Finally, from the tax records, we define a measure of pretransfer income for each individual and year, using the average of parents' nonmissing income for individuals aged 26 years and younger and using income as of age 60 for those over 60.[5] We compute the percentile rank of each individual's income in the preceding year, among those of the same gender and birth cohort who had strictly positive income.

B. *Medical Records*

We link the data from Statistics Sweden to health records from the National Board of Health and Welfare (Socialstyrelsen 2019), which we hereafter call the Board. For each individual, we observe the universe of prescription drug purchases made in outpatient pharmacies from July 2005 through 2017. For each purchase, we observe the name of the drug and the drug's seven-digit Anatomical Therapeutic Chemical (ATC) classification code. We do not observe unfilled prescriptions, and we do not observe identifying information for the provider who wrote the prescription.

We observe the universe of inpatient hospital visits, outpatient visits (excluding those for primary care and prenatal care), and births from 2005 through 2016. For each visit, we observe the date of the visit and the diagnosis codes (ICD-10) attached to the visit. For each birth, we infer the date of conception (by subtracting 280 days from the due date) and the date the pregnancy ended (by adding the gestational age at birth to the date of conception). To form control variables for sensitivity analysis, we follow Chen, Persson, and Polyakova (2022) and define separate indicators for whether an individual had a heart attack, heart failure, lung cancer, type 2 diabetes, or asthma diagnosis in any preceding year.

C. *Prescription Drug Guidelines*

Multiple government agencies promulgate medical guidelines in Sweden. We focus on the subset of guidelines that are for prescription drugs because we are best able to measure adherence for these guidelines. We consider two types of guidelines.

[5] We adjust income for inflation using OECD (2016).

The first type are guidelines issued by the Board, a government organization that issues national guidelines for treatment of various diseases. These guidelines are written by panels of physicians appointed by the Board. The government tracks adherence to the guidelines as a mechanism for improving quality of care but does not insist that practitioners follow the guidelines. In October 2019, we identified 93 active guidelines pertaining to prescription drugs that had been issued by the Board.[6] We analyze the 46 of these for which we can measure adherence in our data.[7]

The second type are guidelines covering the use of prescription drugs in pregnancy. The potential for a drug to harm fetal development is reflected in a letter grade classification (A, B, C, or D) (Danielsson and Dencker 2019). These classifications are in turn based on text selected by the drug manufacturer from a standardized set of options provided by the European Union (Electronic Medicines Compendium 2017). Sweden's pharmaceutical database (Fass) classifies a drug as D class if the selected text says the drug is "contraindicated during pregnancy" and as C class if the text says the drug "has harmful pharmacological effects on pregnancy and/or the fetus/newborn" and "should be used during pregnancy only when clearly needed."[8] We obtained information on which drugs had C and D classifications in Sweden in May 2018 from Fass (n.d.).[9] We define one guideline for each of the ten categories of C class drugs (e.g., C class opioids) and one for each of the five categories of D class drugs (e.g., D class tetracyclines, a type of antibiotic) most frequently purchased by women in our data during the six months before conception. We also define one guideline for all other C class drugs and one for all other D class drugs, yielding a total of 17 pregnancy-related guidelines.

We group guidelines into one of four mutually exclusive and exhaustive categories: 6 guidelines covering the use of antibiotics, 20 covering medication use specifically by the elderly (defined as those aged 75 years and older), 20 covering medication use following specific diagnoses, and 17 covering medication use in pregnancy. Online Appendix Tables A1–A4 provide additional details on the guidelines in each of these four groups, as well as their classification along two additional dimensions.

First, we classify a subset of guidelines according to whether they recommend against taking a particular drug or class of drugs ("don't take" guidelines) or in favor of taking a particular drug or class of drugs ("do take" guidelines).[10] Adherence to "do take" guidelines requires the compliance of both the provider (to prescribe the medication) and the patient (to fill the prescription). Adherence to "don't take" guidelines requires the compliance of either the provider (not to prescribe the medication) or the patient (not to fill the prescription).

[6] We obtained this information from Sveriges Kommuner och Regioner (2019, sections on Indikatorer/indicators and Lakemedelsbehandling/drug treatment) and Socialstyrelsen (2017).

[7] We exclude those that rely on special drug registries unavailable to us (38 guidelines), do not have a clear direction or target value (5 guidelines), or track dosage rather than type of medication (4 guidelines).

[8] B class drugs include those whose text indicates that prescribing during pregnancy should be done "only when clearly needed." A class drugs include those whose text indicates that prescribing during pregnancy should be done "with caution" or that the drug "can be used during pregnancy." See Danielsson and Dencker (2019). Translations via Google Translate.

[9] To link these letter codes to the ATC codes we observe in our data, we use Läkemedelsverket (n.d.).

[10] We do not include antibiotics guidelines in this classification, as they advocate taking one drug over another.

Second, we classify a subset of guidelines according to the strength of the evidence underlying them. For guidelines covering medication use in pregnancy, we do this by distinguishing between C class and D class drugs. For other guidelines, we do this by determining whether UpToDate gives the guideline a 1A rating—its strongest recommendation based on the highest possible quality of evidence—or not.[11]

D. *Measuring Adherence*

To measure adherence to each prescription drug guideline, we first define the circumstance under which the guideline applies. We consider each patient-year that meets this circumstance to be in the *risk set* for the corresponding guideline. We then use the prescription drug purchase data to define a binary indicator for adherence for each case in the risk set. Online Appendix Tables A1–A4 provide additional information on the definition of the risk set and of adherence for each guideline.

For 39 of our 46 guidelines issued by the Board, we follow the Board's definition as closely as possible in defining the risk set and adherence. For example, one guideline recommends that individuals should use statins 12–18 months after a myocardial infarction (i.e., heart attack) diagnosis. We define the risk set to include each individual's first observed inpatient diagnosis for myocardial infarction, and we define adherence by whether the individual purchases a statin within 12–18 months after discharge from that inpatient episode. The remaining seven guidelines recommend against certain prescriptions or combinations of prescriptions for those 75 and older. For these guidelines, we define the risk set to be person-years who are 75 years and older and where the person purchased the given prescription or combination of prescriptions when they were 74.

For the 17 guidelines recommending against the use of certain drugs during pregnancy, we define the risk set to be the set of pregnancies in which the mother purchased the drug(s) during the 24 months prior to conception, and we define adherence as not purchasing the drug(s) during the pregnancy.

E. *Averaging across Guidelines*

We analyze results separately for each guideline but also average results across guidelines. When we average, we weight each guideline by its prevalence in the population. Specifically, for each gender and for each age from 0 through 85 years, we weight each guideline by the fraction of people in our sample, of the given gender and age, who are in the risk set in a reference year.[12] We then take an unweighted average across ages for each gender and across both males and females as our measure of prevalence. The resulting summary statistics on guideline prevalence and adherence should be interpreted as reflecting the average

[11] UpToDate is a US-based publisher of clinical decision support tools for practitioners. It uses the system of ratings developed by the Grading of Recommendations Assessment, Development and Evaluation working group; see GRADE (n.d.). For 13 guidelines we are unable to obtain a rating from UpToDate.

[12] For guidelines recommending against certain prescriptions for those aged 75 and older, the reference year is 2017, the most recent year in which we measure prescription drug purchases. Otherwise, the reference year is 2016, the most recent year in which we measure inpatient and outpatient hospital visits.

experience of a (hypothetical) person who lives each age of life, from 0 through 85 years, during our sample period.

F. *Descriptive Statistics*

Our analysis sample consists of 5,887,471 individuals aged 85 years or younger for whom we have valid information on completed education and who fall into the risk set for at least one guideline over the 2005–2017 period during which we measure prescription drug purchases.[13] Of these individuals, 149,399 have access to expertise at some point during the sample period, of whom over 95 percent have access to expertise throughout.

The share of the population in the risk set ranges from 7.6 percent for the guideline that adults should use penicillin V for their first antibiotic treatment (as opposed to starting with a broader-spectrum antibiotic) to 0.003 percent for the recommendation against using antiepileptics during pregnancy (online Appendix Figure A1, panel A).

On average, over their life cycle, an individual is exposed to 36.32 guidelines. The average woman is subject to 43.23 guidelines and the average man to 28.85 guidelines, with the difference driven primarily by the pregnancy guidelines. Guidelines are substantially more prevalent for the elderly. Online Appendix Figure A2 shows patterns of guideline prevalence in more detail.

Rates of adherence vary considerably across guidelines (Online Appendix Figure A1, panel B). Among those without access to expertise, adherence ranges from 20.4 percent for the recommendation that individuals aged 50 years and older take osteoporosis medications in the 12 months after a fracture diagnosis to 98.8 percent for the guidelines against taking D class tetracyclines (antibiotics) and progestogens (hormones) during pregnancy. On average, over their life cycle, an individual without access to expertise adheres to guidelines 54.4 percent of the time.[14]

Online Appendix Tables A1–A4 report the share of the population covered by each guideline, as well as the average adherence rate for each guideline among those without access to expertise.

II. Results

A. *Individual Guidelines*

Figure 1 presents differences in adherence between otherwise similar individuals with and without access to expertise for each of the 63 guidelines. Specifically, each row reports the coefficient and the 95 percent pointwise confidence interval from a linear regression of an indicator for adherence on an indicator for access to expertise and a set of baseline controls; the sample is the set of patient-years in the risk set for the given guideline. The baseline controls are indicators for income percentile, calendar year, month, age in years, gender, highest level of education, municipality

[13] Of those who fall into the risk set for at least one guideline, 2.4 percent are excluded from the analysis sample because of missing or invalid information on completed education.

[14] For comparison, Sabaté (2003) reports that adherence to recommended regimes for patients with chronic illnesses averages about 50 percent in developed countries.

FIGURE 1. ADHERENCE AND ACCESS TO EXPERTISE, BY GUIDELINE

Notes: For each guideline, we run an OLS regression of an indicator variable for adherence on an indicator for access to expertise, controlling for indicators for the calendar year and seasonal month at which we start measuring adherence, indicators for age in years, gender, highest level of education (or of mother's education for those aged 26 and younger), municipality of residence (or of mother's residence for those aged 17 and younger), income percentiles, and number of children previously born to the person (zero for males), all measured in the previous year. We include separate indicators for whether income is missing, zero, or negative (these represent, respectively, 4.2, 4.0, and 4.3 percent of the analysis sample) and for whether municipality of residence is missing (2.7 percent of the analysis sample). The sample for each regression is the set of patient-years in the corresponding risk set. Depicted 95 percent pointwise confidence intervals are based on standard errors which are clustered at the patient level for any guidelines for which a patient can appear in the risk set more than once and which are heteroskedasticity robust otherwise. The color code represents eight equally sized bins of guideline prevalence, with darker colors representing higher prevalence.

of residence, and number of children previously born to the person (zero for males). The confidence intervals are based on standard errors which are clustered at the patient level for any guidelines for which a patient can appear in the risk set more than once and which are heteroskedasticity robust otherwise.

Figure 1 orders guidelines by the size of the coefficient on access to expertise. Darker colors indicate guidelines that affect a larger share of the population, which is also reflected in generally smaller confidence intervals.

Out of 63 guidelines, we find a negative point estimate for 41 of them, indicating that access to expertise is associated with lower adherence; 20 of these 41 estimates are statistically significantly different from zero. For example, for the guideline that individuals aged 75 years and older should avoid a particular set of potentially risky drugs including some tranquilizers and opioids, we find that access to expertise is associated with a statistically significant 4.1 percentage point lower adherence (95 percent confidence interval 5.7 to 2.6), relative to a 49.4 percent adherence rate among those without access to expertise. Likewise, for the guideline advising that pregnant women not take C class opioids, access to expertise is associated with a statistically significant 1.9 percentage point lower adherence (95 percent confidence interval 3.4 to 0.3), relative to an 85.1 percent adherence rate among those without access to expertise.

For the remaining 22 guidelines, the point estimate is positive, with three of these estimates statistically significantly different from zero. For example, for the guideline recommending the use of statins 12–18 months after a myocardial infarction diagnosis, access to expertise is associated with a statistically insignificant 0.5 percentage point greater adherence (95 percent confidence interval -2.1 to 3.0), relative to a 53.2 percent adherence rate among those without access to expertise.

B. *Aggregate Patterns*

On average across all of these guidelines, individuals with access to expertise are 3.8 percentage points less likely to adhere to guidelines (Figure 2, top row); the 95 percent confidence interval spans 4.1 to 3.5.[15] The point estimate represents a 7.0 percent lower adherence rate among those with access to expertise. In other words, while the average patient without access to expertise adheres to guidelines 54.4 percent of the time, a demographically similar patient with access to expertise adheres only 50.6 percent of the time.

Figure 2, panel A shows that adherence is statistically significantly lower for those with access to expertise in each of the four mutually exclusive and exhaustive categories of guidelines we created. The adherence gap is most pronounced for antibiotic guidelines, where those with access to expertise are on average 5.2 percentage points (about 9.8 percent) less likely to adhere (95 percent confidence interval 5.6 to 4.9 percentage points). The adherence gap for antibiotics is statistically different from the adherence gap for each of the other three guideline categories (p-values are 0.0009, $<$ 0.0001, and $<$ 0.0001 for tests of equality with elderly, diagnosis-specific, and pregnancy guidelines, respectively). The adherence gap is least pronounced (but still statistically significantly different from zero)

[15] The 95 percent confidence intervals reported in Figure 2 are based on a patient-level bootstrap with 50 replicates.

Figure 2. Adherence and Access to Expertise, Averages

Notes: The plot shows the prevalence-weighted average coefficient on access to expertise from the regressions described in Figure 1. Spikes indicate upper and lower bounds of the 95 percent confidence interval. Row labels describe the analysis, with the number of included guidelines in parentheses if different from baseline. We bootstrap the estimation with 50 replicates drawn at the patient level and construct confidence intervals based on the bootstrap standard errors. The prevalence weights are the guideline- and age-specific empirical probabilities of being in the risk set in the reference year. Baseline includes all patients and guidelines. In panels A, D, and E, we average the coefficients for each set of guidelines. In panel B, we reestimate the regressions described in Figure 1 modifying the definition of access to expertise in three ways: first by excluding patients who are not themselves doctors (and thus excluding two guidelines that apply only to children), second by including patients with a doctor in their extended family, and third by including patients with access to a nurse or pharmacist. In the first row of panel C, we reestimate the regressions described in Figure 1 excluding the education and income controls. In the second row of panel C, we reestimate the regressions described in Figure 1 including as controls separate indicators for whether an individual had a heart attack, heart failure, lung cancer, type 2 diabetes, or asthma diagnosis in any preceding year. Panel D excludes the six antibiotic recommendations, while panel E excludes 13 guidelines for which there was no UpToDate grade available.

for the pregnancy guidelines, where those with access to expertise are on average 2.1 percentage points (about 2.4 percent) less likely to adhere (95 percent confidence interval 2.6 to 1.6 percentage points).[16] We also find that guidelines that have

[16] We also find that the adherence gap is slightly larger for men than women, consistent with a smaller gap for pregnancy guidelines, and larger for children than for nonelderly adults or elderly adults, consistent with a larger gap for antibiotic guidelines (online Appendix Figure A3).

a higher adherence rate among those without access to expertise tend to have a more pronounced adherence gap, although this relationship is not statistically significant (online Appendix Figure A4).

Panel B shows how the relationship between access to expertise and adherence changes as we narrow or broaden the definition of either "access" or "expertise." Our baseline definition of access to expertise defines doctors as experts and access based on being a doctor, partnering with one, or having one in the close family.[17] When we narrow the definition of access to expertise to include only being a doctor oneself, access to expertise is now associated with a more negative, 8.4 percentage point lower adherence rate (95 percent confidence interval 9.0 to 7.8), compared to our baseline estimate of 3.8.[18] When we broaden the definition of access to include having a physician in one's extended family, access to expertise is associated with only a 1.6 percentage point lower adherence rate (95 percent confidence interval 1.9 to 1.3). Likewise, if we leave the definition of access unchanged but broaden the definition of experts to include nurses and pharmacists, access to expertise is associated with only a 0.9 percentage point lower adherence rate (95 percent confidence interval 1.0 to 0.7).

C. *Interpretation*

Socioeconomic Status.—One explanation for the lower adherence to medication guidelines among those with access to expertise is that the negative relationship between access to expertise and adherence is driven by unobserved differences in socioeconomic status (SES) between those with and without access to expertise. Recall that we control for income percentile and education in our main analysis. Since doctors are a relatively high-SES occupation and prior evidence indicates that adherence is positively associated with SES in both the United States (Kennedy and Erb 2002; Mojtabai and Olfson 2003; Madden et al. 2008) and Sweden (Wamala et al. 2007), we expect any unmeasured differences in SES to bias against our findings, toward a more positive association between adherence and access to expertise. Consistent with this expectation, panel C of Figure 2 shows that removing income percentile and education from our set of controls produces a slightly less negative association between adherence and access to expertise.

The scatterplot in Figure 3 evaluates the role of income more directly. The y-axis variable is a measure of the association between adherence and access to each of a broad set of specialized occupations, obtained by augmenting the models underlying Figure 1 to include indicators for access to each occupation. The x-axis variable is the average income percentile of those with access to the given occupation. Not surprisingly, we find a positive association between the average income of people with access to a given occupation and their adherence rate. However, doctors are a major outlier; although those with access to doctors have very high incomes,

[17] Our baseline analysis defines access to expertise at the patient-year level. When we instead define access to expertise at the patient level, based on whether the patient ever has access to expertise during the sample period, we estimate an adherence gap of −3.5 (95 percent confidence interval −3.8 to −3.2 percentage points).

[18] When we exclude those who are doctors from the sample entirely (not shown), access to expertise is associated with a less negative 1.8 percentage point lower adherence rate (95 percent confidence interval 2.2 to 1.4).

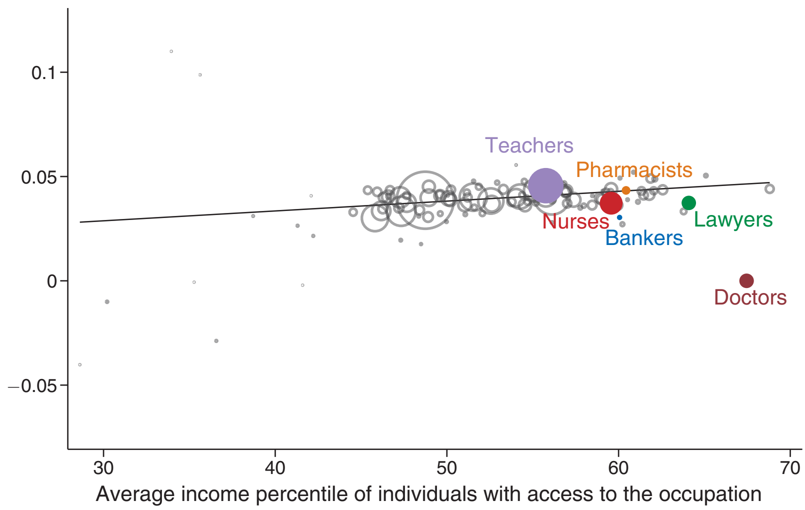

FIGURE 3. ADHERENCE BY ACCESS TO DIFFERENT OCCUPATIONS

Notes: The plot shows the prevalence-weighted average relationship between adherence and access to a given occupation, plotted against the average income percentile of those with access to the occupation. To construct the *y*-axis variable, we augment the models underlying Figure 1 to include indicators for access to each occupation; the regressions include all of our baseline controls (including own income percentile), and a given case in the risk set may have access to multiple occupations. We then average the coefficient on the access indicator using the method underlying Figure 2. We exclude occupations with fewer than 150 individuals. We normalize the average coefficient for each occupation by subtracting the average coefficient for access to a doctor. To construct the *x*-axis variable, we calculate the average income percentile of those with access to the given occupation in 2016. We plot the line of best fit excluding doctors, nurses, and pharmacists, weighted by the number of individuals in the occupation, which is proportional to circle areas.

access to doctors is associated with markedly lower adherence.[19] Figure 3 thus suggests that access to doctors is associated with lower adherence despite, rather than because of, the high SES of those with access to doctors.

Health.—Our finding could also be driven by health differences between those with and without access to expertise. Existing evidence, including prior work in our setting, indicates that doctors and their families tend to have better health and health behaviors (Leuven, Oosterbeek, and de Wolf 2013; Artmann, Oosterbeek, and van der Klaauw 2022; Chen, Persson, and Polyakova 2022).[20]

Each of our analyses of the adherence gap is restricted to those who fall within the risk set for the given guideline. We expect that this reduces the scope for differences in health between those with and without access to expertise. But it is likely that some unmeasured variation in health remains among those in the risk set, both because the construction of the risk set considers only a limited number of health factors and because selection into the risk set may depend on nonhealth factors such as willingness to seek out diagnosis or treatment.

[19] Consistent with panel B of Figure 2, those with access to nurses and pharmacists are close to the line of best fit in Figure 3.

[20] Consistent with this evidence, panel A of online Appendix Figure A5 shows that those with access to expertise are less likely to be in the risk set for some guidelines where the risk set is based on a diagnosis.

Whether people who are in better health are more or less likely to follow guidelines is a priori unclear. In cases where adherence to the guideline trades off the health of the patient against other considerations—such as antibiotic guidelines that recommend starting with a less aggressive treatment for public health reasons or recommendations against medication in pregnancy that trade off the health of the mother against potential risks to the fetus—we might expect patients in poorer health to be less likely to follow the guideline. If those in the risk set with access to expertise are in better health, this would bias the estimates against our findings, toward a positive association between adherence and access to expertise. In practice, adding controls for the five health conditions described in Section IB makes little difference to the estimated relationship between adherence and access to expertise (Figure 2, panel C).

Comfort with or Access to Pharmaceuticals.—Another possible explanation for the adherence gap is that access to expertise is associated with greater familiarity and comfort with pharmaceutical solutions to medical problems, or greater ease of filling prescriptions, and thus a greater propensity to take medications even in contradiction of guidelines. Consistent with this explanation, for guidelines whose risk set is based on taking a particular medication, those with access to expertise are on average more likely to be in the risk set (online Appendix Figure A5, panel B; see also Anderson et al. 2021). As noted above, differential selection into the risk set could also affect the association between access to expertise and unmeasured factors, such as health, among those in the risk set.[21]

However, panel D of Figure 2 shows that the relationship between adherence and access to expertise is similar between guidelines that recommend against taking a specific drug or class of drugs ("don't take" guidelines) and those that recommend in favor of doing so ("do take" guidelines). For the 30 "don't take" guidelines, we estimate that access to expertise is associated with a 3.4 percentage point (95 percent confidence interval 4.2 to 2.6) lower probability of adherence. This is similar to the 2.9 percentage point lower adherence (95 percent confidence interval 3.3 to 2.6) for the 27 "do take" recommendations. The adherence gaps are not statistically distinguishable between these two groups (p-value $= 0.1950$). This suggests that comfort with or access to pharmaceuticals does not account for the negative association between adherence and access to expertise.

Superior Information about Guidelines.—The final explanation we consider is that access to expertise brings with it access to information that contradicts the guidelines in some situations, the confidence (or ability) to act on this information, and/or access to providers who have such information. One testable implication of this hypothesis is that access to expertise will be more negatively associated with adherence to guidelines that are based on weaker clinical evidence. Consistent with this implication, panel E of Figure 2 shows a larger adherence gap where

[21] The adherence gap persists in the subset of guidelines for which the strength of the association between being in the risk set and access to expertise is below the median, as measured by the absolute value of the coefficient from online Appendix Figure A5 divided by the share in the risk set from online Appendix Tables A1–A4. For this subset, we estimate an adherence gap of -3.8 (95 percent confidence interval -4.2 to -3.4).

the evidence is weaker. For guidelines related to medication use in pregnancy, the recommendation against C class drugs is weaker than that against D class drugs (see Section IC); correspondingly, the adherence gap is -2.3 on average for C class drugs and -1.2 on average for D class drugs, and these two values are statistically distinguishable (p-value $= 0.0044$). For guidelines related to specific diagnoses and to medication use among the elderly, among those for which we are able to find a rating on UpToDate (again see Section IC for details), we find an adherence gap of -3.7 among those with weaker evidence and a gap of -3.4 among those with stronger evidence, though the difference between the two groups is not statistically distinguishable (p-value $= 0.1960$).[22]

Another testable implication is that access to expertise will be most negatively associated with adherence to guidelines whose recommendations are intended to serve goals other than the narrow interest of the patient. The antibiotic guidelines to use narrower- rather than broader-spectrum antibiotics are an example of recommendations motivated by public (rather than private) health considerations (Pichichero 2002; Talkington et al. 2017; Sirota et al. 2017). As reported in Section IIB, the adherence gap is largest—by a considerable and statistically significant margin—for the antibiotic guidelines among the four groups of guidelines that we consider.

III. Conclusion

As of mid-2018, the US National Guideline Clearinghouse described over 1,400 currently active medical guidelines (Timmermans and Berg 2003; Agency for Healthcare Research and Quality 2018a, 2018b). Guidelines can help move average practice toward evidence-based standards but can also discourage customizing care to relevant medical circumstances (Basu 2011; Lugtenberg et al. 2011; Boudoulas et al. 2015).[23]

We find that patients with access to medical expertise are, on average, less adherent to medication guidelines. This suggests an important role in nonadherence for factors other than those emphasized in much of the literature—such as ignorance, complexity, or failures of patient-provider communication—which would be expected to diminish with access to expertise.

The normative implications of our findings are not clear. It is possible that lower guideline adherence among those with access to expertise may partly reflect these patients' superior understanding of guidelines. Our finding that the negative relationship between access to expertise and guideline adherence is more pronounced for guidelines based on weaker clinical evidence, and for guidelines intended to serve interests beyond those of the patient, is consistent with this interpretation, as is other evidence from our setting that those with a health professional in their family are healthier overall (Chen, Persson, and Polyakova 2022). However, there is also evidence that practitioners' departures from prescribing guidelines lead to

[22] For the 13 guidelines in these categories for which we were not able to find a rating on UpToDate, we find an adherence gap of -4.3 percentage points (95 percent confidence interval -5.0 to -3.6).

[23] Gerber et al. (2010) report that more than 80 percent of the US public is somewhat or very convinced by the argument that treatment guidelines prevent customizing care; see also Patashnik, Gerber, and Dowling (2017).

worse patient outcomes (Currie and MacLeod 2020; Abaluck et al. 2021; Cuddy and Currie 2022). An important avenue for further research is to identify whether and when nonadherence is in the patient's best interest.

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