Imprinting variation:
The diagnosis of autism spectrum disorder at two specialty clinics

Phech Colatat¹
Maria Massolo²
Yinge Qian²
Lisa Croen²

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Abstract:

Field-level changes create pressures for organizational change and isomorphism of the organizational field, yet stable practice heterogeneity sometimes results. We study how this is possible by examining a large health maintenance organization, Allied Health, which recently reformed its practices for diagnosing Autism Spectrum Disorder (ASD). Despite homogenizing pressures, substantial variation emerged across Allied’s three specialized ASD clinics. In tracing the difference using qualitative and quantitative data, we find that prior imprints on key individuals led to different diagnostic practices at each clinic, which came to be rendered stable, i.e., imprinted, at the clinic level. Theoretically, we demonstrate that (1) inertial mechanisms of imprinting may unintentionally shape the way that adaptation is enacted in an organization in response to field-level change, and (2) the act of organizational adaptation can lead to new imprints sustained by the microstructures of work. We call this imprinting variation.

¹ PhD Candidate. MIT Sloan School of Management. 100 Main Street, E62-359. Cambridge, MA 02142. This work was funded by the Simons Center for the Social Brain and supported by Ezra Zuckerman, Susan Silbey, Ray Reagans, and Autism Research Program staff at Kaiser Permanente. Tristan Botelho, Sarah Kaplan and numerous others at MIT provided excellent comments in discussion. Kate Kellogg provided outstanding comments on an earlier draft. Comments from seminar participants at MIT, NYU Stern, Washington University, Johns Hopkins University, and Yale University were insightful and helpful. Please address correspondence to: pcolatat@mit.edu.
1 Introduction

How do organizations respond when a new practice becomes popular in the organizational field? Several strands of literature suggest that organizations generally respond by adapting to field-level changes. Whether motivated by legitimacy (DiMaggio and Powell 1983; Meyer and Rowan 1977) or by efficiency (Strang and Macy 2001; Tolbert and Zucker 1983), organizations have been found to replicate what is prevalent in the field, and often come to be isomorphic with other organizations. On the other hand, several strands of literature emphasize organizational inertia and the inability or unwillingness of organizations to adapt to environmental pressures. Existing organizational practices may become infused with value (Selznick 1949), accepted as social fact (Zucker 1977), too complex to be changed (Levinthal 1997), defended by powerful organizational actors (Westphal and Zajac 2001), or the outcome of a selection (Hannan and Freeman 1984) or imprinting process (Baron, Hannan and Burton 1999). These two sets of literature offer contradictory predictions yet have largely spoken past each other. Presumably, processes for adaptation and inertia work towards opposite ends: when inertial forces are relatively weak, organizations adapt and, when inertial forces are relatively strong, they do not adapt.

In this paper, we examine a case that demonstrates that pressures for adaptation and pressures for inertia are not necessarily competing and can in fact be complementary. We describe what happens when a large staff-model health maintenance organization (HMO), Allied Health,3

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3 Allied Health is a pseudonym.
adapts to field-level changes in the diagnosis of Autism Spectrum Disorder (ASD). In 2001, in response to a legal change governing HMOs and a changing professional sensibility about appropriate ASD diagnosis, Allied Health initiated organization-wide changes to its process for diagnosing ASD. The number of ASD diagnoses at Allied increased, consistent with regional diagnostic trends. The actions of and outcomes at Allied are consistent with theories predicting organizational adaptation and isomorphism.

However, a closer look at diagnostic outcomes within Allied reveals a puzzling pattern that cannot be reconciled with existing theory. Across the three specialized ASD clinics in Allied Health, we find remarkable variation in ASD diagnosis rates. In Alpha clinic, patients referred for evaluation have a 66% probability of ASD diagnosis, while at Bravo clinic and Charlie clinic, the rates of diagnosis are 39% and 35%, respectively.\(^4\) This variation does not appear to be explained by differences in patient characteristics or physician characteristics.

Prior research posits two primary reasons for variation in practices prompted by field-wide change: resistance (Fiss and Zajac 2004; Meyer and Rowan 1977; Westphal and Zajac 2001) and customization (Ansari, Fiss and Zajac 2010; Tolbert and Zucker 1983; Westney 1987; Westphal, Gulati and Shortell 1997). Neither applies in this case. Evidence indicates that Allied earnestly sought to adapt and establish uniform practices across the organization by designing new processes and allocating resources to improve ASD diagnosis. Senior managers at Allied did not

\(^4\) Alpha, Bravo and Charlie are pseudonyms.
deliberately attempt to resist or alter the field-level practices, yet variation across clinics emerged nonetheless.

In this study, we trace the origin of intra-organizational variation to the influence of imprinting processes at each clinic. According to imprinting, behavior is shaped by environmental factors during a relatively brief sensitive time period and this behavior persists over time (Johnson 2007; Marquis and Tilesik 2013; Stinchcombe 1965). We explain how clinic-level differences in diagnosis were shaped early on in each clinic’s history by key individuals and have persisted over time even as these individuals have left or took reduced diagnostic roles. Diagnostic differences appear to remain stable because of the team-based structure of evaluations, in which clinicians are continually negotiating the tacit rules for diagnosis with colleagues in their clinic. The key insights of this theory-building paper are (1) field-level changes typically expected to lead to adaptation and isomorphism can be unintentionally moderated by prior imprints which create unexpected practice variation as organizational actors enact change and (2) the stability of new practices post-adaptation can come from a new set of imprints, the exact form of which is determined by seemingly minor organizational decisions during adaptation. We call this imprinting variation. The role of inertial forces, particularly imprinting, in adaptation has been overlooked by previous research, which has instead tended to focus on either adaptation or inertia, not both.

This paper also lends additional insight into the sociological forces partially responsible for the recent “autism epidemic” (Grinker 2008; Liu, King and Bearman 2010). Given the central role of the health care provider in the diagnosis of ASD, it is surprising that medical and
organizational sociologists have not yet studied the pediatricians, psychologists and psychiatrists responsible for diagnosing ASD. The empirical findings at Allied Health illustrate organizational processes that are likely common (if not more powerful) at other ASD clinics throughout the country, and suggest a new explanation for the increase in and geographic clustering of ASD diagnoses.

The remainder of the paper is organized as follows. After a brief review of the relevant theories predicting adaptation and inertia, we introduce our research setting: ASD diagnosis in Allied Health. We then show how, as we would expect given current theories of adaptation, field-level changes impacted the diagnostic practices and outcomes at the organizational level. Next, we present evidence of diagnostic variation within Allied, and rule out alternative explanations for this variation including differences in patient characteristics across clinics. An examination of qualitative evidence indicates that each clinic has a distinct orientation towards diagnosis that was seeded by diagnostic approaches of key individuals years earlier but were rendered stable over time. We then describe how this process can be understood as *imprinting variation*, drawing on the concept of imprinting in a way that develops the theoretical relationship between imprinting and organizational adaptation. Finally, we conclude by discussing the importance of these findings for organizational scholars and policy-makers.

2 Theoretical foundations

2.1 Organizational adaptation induced by institutional change

Organizational adaptation in response to field-wide institutional change is expected – with few exceptions – to lead to homogeneity and isomorphism at the field level. Accounts of
isomorphism are organized along two general lines (Colyvas and Jonsson 2011). According to neoinstitutional theory, organizations may adopt the structures and practices of similar organizations in the pursuit of legitimacy and organizational survival (Meyer and Rowan 1977). Increasing rationalization encouraged by the state, professions and competition lead to widespread use of the organizational practice (DiMaggio and Powell 1983). Institutional accounts of new practice adoption point to a legitimacy benefit independent of technical rationality (Baron, Dobbin and Jennings 1986; Guler, Guillen and Macpherson 2002; Staw and Epstein 2000; Tolbert and Zucker 1983; Westphal, Gulati and Shortell 1997). Organizations adopt practices widely considered appropriate and worthy (Deephouse 1996; Guler, Guillen and Macpherson 2002; Ruef and Scott 1998; Westphal, Gulati and Shortell 1997), which leads organizations to look increasingly similar.

According to theories of social contagion, adaptation occurs because of the diffusion of information throughout networks (Burt 1987; Centola and Macy 2007; Coleman, Katz and Menzel 1957; Davis 1991). Accounts vary in terms of the theorized mindfulness of the actors (Argote and Todorova 2007; March 1994), with some treating adoption as relatively automatic and mechanical (Centola 2010) and others treating adoption as a fairly calculated (Still and Strang 2009; Strang and Macy 2001), but the end result of homogeneity is the same. Common to both neoinstitutional theory and theories of social contagion is the prediction that an organization observes changes in the organizational field and initiates change, often adopting newly popular practices and coming to resemble other organizations in the field.
Exceptions to predictions of isomorphism outline conditions in which field-induced change may lead to organizational heterogeneity, and emphasize either a conflict or customization perspective. Conflict may arise when external actors impose objectionable expectations on organizations. Organizations are biased towards inertia for many reasons (Hannan and Freeman 1984; Levinthal 1997; Selznick 1957; Zucker 1977) and may employ strategies to resist external expectations (DiMaggio and Powell 1983). Conflict can also arise among parties within organizations, leading to an unpredictable or ambivalent organizational response (Kellogg 2009; Zbaracki 1998). In conflict-based accounts, the organizational outcome may be largely a function of the power and effectiveness of the resisting party (Henisz, Zelner and Guillerón 2005; Westphal and Zajac 2001).

Customization accounts highlight the interpretive role of actors inside organizations. Individuals perceive field-level changes and formulate a corresponding organizational response *ex ante* (Ansari, Fiss and Zajac 2010; Still and Strang 2009; Westney 1987; Westphal, Gulati and Shortell 1997) or in response to varying institutional demands (Fligstein 1990; Lounsbury 2007; Thornton and Ocasio 1999). Actors may also vary in their ability to respond “rationally” to field-level changes (Edelman 1990; Tolbert and Zucker 1983).

We will demonstrate that neither conflict nor customization accounts adequately explain the variation we observed at Allied Health. Instead, we find the best explanation draws on the concept of imprinting.
2.2 Imprinting in organizational adaptation

Organizational sociologists have used the concept of imprinting to explain the persistence of organizational features. Stinchcombe (1965) observes that differences among organizations in the same industry are related to the timing of organizations’ foundings. He speculates that, because organizations experience different environmental conditions at birth, different organizational features would be developed and persist into the present day. The central predictions of imprinting are that (1) actors are shaped by the environment during a short sensitive time period and (2) actors’ behavior persists over time (Johnson 2007; Marquis and Tilesik 2013). In most empirical work, scholars emphasize the outcome of imprinting, for example, the persistence of organizational structure, practices, or relationships, rather than the process of imprinting itself. As such, imprinting is commonly associated with organizational inertia.

Conceptually, however, imprinting is not necessarily incompatible with organizational adaptation and change. First of all, imprinting may not occur exclusively at the founding period of the organization. Organizational practices can be rendered stable even if those practices are introduced after birth. Organizations often experience dramatic episodes of change interspersed within long periods of stability (Tushman and Romanelli 1985). During major periods of transition, actors are re-establishing how they will carry out work and are effectively selecting the historically specific features that will adhere through time (Carroll and Hannan 2004). New rationales for current practices can be constructed by members of the organization at times besides founding (Selznick 1957; Zilber 2002).
Second, the form in which organizational change occurs may be subtly affected by pre-existing practices. Organizations do not develop from scratch, but rather from the materials that are available to them. Describing adaptation, Meyer and Rowan (1977) write that “the building blocks for organizations come to be littered around the societal landscape; it takes only a little entrepreneurial energy to assemble them into a structure” (p345). Similarly, Stinchcombe (1965) explains “the organizational inventions that can be made at a particular time in history depend on the social technology available at the time” (p153). Existing structures and practices in the organization may similarly serve as building blocks for new practices as the organization adapts. Moreover, actors working with locally-available building blocks may not be fully aware of or may discount alternatives when formulating new practices. If existing practices are locally institutionalized (Berger and Luckmann 1967; Zucker 1977), actors may incorporate existing practices into future practices unintentionally.

In this paper, we examine the role of imprinting in organizational adaptation and propose a new explanation for practice variation in face of otherwise homogenizing field-wide trends. We call this *imprinting variation*.

3 Research setting and data

Medical diagnosis is an excellent setting for studying organizational adaptation to field-wide change because, in medicine, knowledge is both abundant yet ambiguous. Individuals and organizations know enough knowledge to theorize advantages and disadvantages of certain practices, but the *optimal* set of practices is difficult to assess, particularly as medical science and technology advances continuously. Indirect signs of effectiveness therefore carry substantial
weight. Medical practice variation is tolerated in general (Wennberg and Cooper 1998), but may be even more pronounced in the case in the diagnosis of Autism Spectrum Disorder (ASD). Lacking a biologically-based test, diagnosis is often based on clinical impression or, at best, psychological instruments requiring professional interpretation and judgment. Despite the considerable level of ambiguity around ASD diagnosis, immense public and scholarly attention on ASD places substantial pressure on health care organizations to respond in a way deemed appropriate.

3.1 Autistic Spectrum Disorder

ASD is a highly variable disorder that impairs the normal development of social and communication skills in young children. Children with autism have difficulty socializing with peers, caring for themselves, and integrating into social institutions such as play groups and schools. As adults, individuals with autism often have trouble leading independent and economically self-sufficient lives. There is no cure for autism but individuals with autism can be taught necessary life skills through years of continual therapy. The impact on families can be substantial (Cidav, Marcus and Mandell 2012; Herring et al. 2006); in addition to the emotional burden, families must endure stigma and structure their daily lives around care for their child (Marcus, Kunce and Schopler 1997). Economically, the total direct costs of caring for a child aged 3 to 7 with autism, over and above the care costs for a child without autism is estimated at $46,220 per year (Ganz 2006).
ASD is controversial primarily because of the way it is diagnosed (Grinker 2008). Like many other disorders presenting as mental or behavioral rather than immediately physiologic, there is no known biomarker for ASD; diagnosis is made on the basis of interpretation against a set of qualitative behavioral criteria in the Diagnostic and Statistical Manual of Mental Disorders (DSM). The challenge is that a symptom, such as lack of eye contact, may be indicative of ASD as well as other psychiatric disorders. Health care providers must make a logical inference based on empirical evidence of patient behavior using professional judgment. Because the process of inference is opaque, it is unclear whether too few, too many, or simply the wrong people are being diagnosed.

These concerns are amplified by unsettling trends in the estimated prevalence of ASD, which has increased steadily over the past two decades. Between 1993 and 2011, the number of new autism cases recorded in the California Department of Developmental Services increased by 688%. Substantial scholarly effort attempts to explain this increase, focusing attention on environmental toxins (Larsson et al. 2005; Lathe 2006; Newschaffer et al. 2007) and genetic factors (Baron-Cohen 2006; Neale et al. 2012; Sebat et al. 2007). A single satisfactory explanation has yet to be found. One emerging line of thought advanced by social scientists draws a distinction between the true-but-unobserved prevalence of ASD and the social factors that affect the

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5 It is also controversial for pathologizing what is arguably unusual but normal behavior. The effect of the autism “label” can cause harm in and of itself (Link et al. 1989; Scheff 1966). This aspect of the autism controversy is interesting and important and raises questions of the social construction of autism historically. However, for the purposes of this paper, we treat ASD as “real” in the sense that ASD exists in the abstract but the distribution of autism in the population is determined (in part) by social forces.
diagnostic process itself (Grinker 2008; King and Bearman 2009), though no prior research has
examined how organizational context affects autism diagnosis rates.

3.2 Allied Health

The data for this study come from Allied Health, a well-known staff-model health
maintenance organization. An HMO is an advantageous research setting because per capita
reimbursement encourages the organization to operate efficiently. Allied has incentives to
continually seek out the best set of medical practices and implement them uniformly throughout
the organization. (Scott et al. 2000) and, consequently, we should expect diagnostic practice
variation to be minimal. A second benefit of studying a staff-model HMO is the
comprehensiveness of the data. People insured through Allied only see health care providers from
Allied and Allied health care providers see only people insured by Allied. Medical records
therefore provide a fairly complete medical history of each patient. Lastly, Allied is a good setting
because of its size. Allied serves one in four individuals with health insurance in the local
metropolitan area. Even leaving questions of generalizability aside, research findings based on
Allied are ipso facto significant for many health care administrators and patients.

The Allied data consist primarily of highly-detailed, confidential electronic medical records

7 Exceptions are possible—say if patients pay out of pocket or if Allied does not offer a particular service. But
the general rule at Allied sharply distinguishes it from other types of HMOs and types of health
insurance.
patients, 3,181 (1.15%) children have been identified with ASD. At the patient level, these data include date of birth, race, sex, parent education, and place of residence among other fields. At the level of the health care provider, these data include occupation, specialty, and office address. At the medical encounter level, they include fields for patient, health care provider, and medical diagnosis. These fields are used to precisely characterize the differences across clinics and rule out alternative accounts for the diagnostic difference.

In addition, we have collected qualitative data to better understand the organizational and historical context of diagnosis at Allied. Quantitative and qualitative data were combined in an iterative manner (Genn 2009; Miles and Huberman 1994). Qualitative findings motivated precise quantitative analyses and, to understand and interpret the results of these analyses, we conducted further qualitative inquiry. Based on a theoretical sampling logic (Yin 1994), qualitative data collection and analysis focused on two clinics – Alpha and Charlie – which represented the extremes in diagnostic outcomes and which we believed a priori would best illustrate the underlying processes at work.

These data include 28 interviews with a cross section of Allied health care providers with direct experience of ASD: pediatricians, psychologists, psychiatrists, social workers, speech therapists, and occupational therapists. We have also conducted 60 hours of observation of clinicians at Allied’s three specialized ASD clinics where we shadowed psychologists and psychiatrists conducting full day ASD assessments with patients and their families. For these observations, we were seated either directly in the room or behind a one way mirror. Using internal documents – emails, memos, presentations, spreadsheets - we are able to triangulate and
add detail to interview and observation data. These documents were essential for establishing the historical timeline of ASD diagnosis at Allied. Finally, we had open access to staff at Allied Health’s headquarters, allowing us to continually discuss our emergent findings with key informants who could provide contextual information and point us to supplemental data sources.

4 Environmental pressures for change at Allied

4.1 Field-level changes in the diagnosis of ASD

Although autism had been identified as far back as 1943 (Kanner 1943) and listed in the DSM starting in 1980 (Grinker 2008), autism did not emerge as an “epidemic” until the turn of the 21st century. Andrew Wakefield and colleagues brought the spotlight on autism in a 1998 paper that claimed to linked autism to the measles-mumps-rubella (MMR) vaccine (Wakefield et al. 1998). Shortly after, a report using California Department of Developmental Services (DDS) data deepened and broadened the mystery. The DDS is mandated by state law to provide assistance to individuals with mental retardation, cerebral palsy, epilepsy and autism; the state’s administrative data is possibly the largest single dataset of individuals with autism. The 1999 report documented a drastic increase in DDS enrollment of individuals with autism between 1988 and 1998 (California Department of Developmental Services 1999). ASD, it seemed, was a bigger

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8 In 2009, he was accused of manipulating the study data. By 2010, the Lancet formally retracted the Wakefield’s article and, in 2011, it was revealed that Wakefield had engaged in deliberate fraud. (Deer 2011a; Deer 2011b; Deer 2011c)
problem than had been recognized previously, and medical researchers seemed to know little about ASD etiology.

This prompted high-profile questions about causes of the increase and the link between enrollment and the underlying number of autism cases. The US Congress held hearings about autism, its prevalence and potential link to the MMR vaccine (US House of Representatives 2001). The California legislature commissioned a study to investigate possible explanations for the upward trend in enrollment. Media references to autism increased precipitously around this time (Blakeslee 2002), as did scientific articles related to autism.9

The medical community increasingly sought to improve the quality of autism diagnosis around this time. Consistent, high-quality diagnosis was seen as a fundamental first step to understanding autism and ensuring children who met criteria for ASD would receive the appropriate treatment (Filipek et al. 1999). The National Research Council conducted a review of research literature to establish guidelines for educating children with autism (National Research Council 2001). In California, motivated by the 1999 DDS report and ensuing public discussion, the state legislature called for the development of tools and methods to “ensure consistency and accuracy of diagnosis of autism disorder [sic]” (California Department of Developmental Services 2002: p VIII) and assembled a series of advisory panels to develop best practice guidelines

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9 A search of the New York Times in Lexis Nexis shows the number of autism-related articles per year increased by a factor of 4.5 between 1995 and 2005. A keyword search of academic articles in Pubmed over the same 1995 to 2005 time period shows the number of annual autism-related publications increased by a factor of 9.
(California Department of Developmental Services 2002). The Autism Diagnostic Observation Schedule (ADOS), broadly considered the “gold standard” diagnostic instrument used by scientists research settings, was made commercially available\(^{10}\) for use in clinical settings (Lord et al. 1999). A common conception of proper diagnosis began to emerge.

Improved ASD diagnosis was understood as more sensitive diagnosis, i.e., more likely to identify true cases of ASD.\(^{11}\) While improvement is not necessarily tantamount to sensitivity, it was the case for ASD, as it is for many medical conditions for which diagnostic technology improves the ability to detect subtle signs and symptoms (Grob and Horwitz 2009). The upward trend evident in the DDS data, special education data (US Government Accountability Office 2005) and epidemiological studies of autism (Fombonne 1999; Fombonne 2003; Wing and Potter 2002) raised questions about the widely-held understanding of ASD. Autism was once understood as a relatively severe and relatively rare disorder (Weintraub 2011; Wing and Gould 1979), but its true prevalence (while still unknown) was almost certainly higher than earlier estimates. For clinicians, this suggested that past procedures for screening and diagnosis overlooked individuals who would meet the current criteria for ASD if examined using new diagnostic technology (Grinker 2008). This possibility was particularly unsettling to clinicians because overlooking a

\(^{10}\) Clinicians outside the research setting could purchase an ADOS “kit,” which included booklets and equipment, and enroll in training courses to develop the latest skills in autism diagnosis.

\(^{11}\) Epidemiologists consider sensitivity as the ability of a diagnostic test to identify positive results. Sensitivity is calculated as the number of “true” positives identified by the test divided by the total number of “true” positives in the sample.
diagnosis was known to lead to delayed intervention and inferior development outcomes (Baird et al. 2000; Cox et al. 1999; Dawson and Osterling 1997; Lovaas 1987).

4.2 Organizational adaptation to field-level change at Allied

The changing scientific and professional understanding of ASD carried immense weight with health care organizations. Medicine is an applied practice that maintains a close though independent relationship with basic science (Freidson 1970; Rosenberg 1995; Starr 1982). Science imbues medicine with legitimacy, certifying medical practices and separating doctors from competing occupations. Clinical practice often aspires to be evidence-based and on the cutting edge of findings in the scholarly research community (Sackett et al. 1996). Developments in the scientific understanding of ASD altered the normative image of a well-run organization to include a more sophisticated system for diagnosis.

At Allied, these changes were precipitated by the passage of a state Mental Health Parity Law in the late 1990s. Prior to the law, health insurers often limited benefits for mental health patients, e.g., a cap on outpatient visits, high deductibles and copayments. Under the new law, insurers had to offer benefits comparable to benefits for physical health ailments, which meant that insurers had to provide all services that were “medically necessary,” and to make available services to mental health patients if those same services were available to other insured patients.

Despite the law change, the necessary organizational changes were not clear to senior managers at Allied. As is often the case with new regulation (Dobbin et al. 1993; Edelman 1992), Allied needed to translate the legal mandate into a new set of mental health practices. It was in
this translation that managers were guided by the emerging field-wide understanding of autism.

A task force dedicated to ASD was assembled in 2001 to identify what services Allied would offer and how Allied would deliver them. This initiated more than a decade of efforts to develop and implement a new system of diagnostic practices.

Central to the new diagnostic approach was the establishment of three specialized ASD centers exclusively dedicated to conducting ASD evaluations. The task force examined well-known specialty clinics in the nearby metropolitan area. Consistent with best practices promulgated in the scientific literature, the clinics would perform a team-based ASD assessment and coordinate care for children across and outside Allied. In a team-based assessment, several healthcare providers see the patient in a single visit (rather than a sequence of separate visits) and then work jointly to formulate an accurate diagnosis and comprehensive treatment plan. This degree of specialization is not common in clinical settings (Skellern, McDowell and Schluter 2005). Furthermore, health care providers would use the ADOS diagnostic instrument (Lord et al. 2000), which is widely considered the gold standard instrument for ASD but is used infrequently outside of research settings because of high training requirements.

The plan to develop the clinics was approved in 2002 and funds were allocated to open the three clinics in sequence. Alpha clinic opened in 2004, Bravo clinic in 2006 and Charlie clinic in 2008. According to the Allied director who oversaw the clinics, “The plan was to have the three ASD centers perform the same evaluations with the same tools and have consistent trainings.” The choice to create three centers represented a balance between gains from specialization and accessibility to families spread across a wide geographic area. In addition to the three centers, a
permanent organizational-level ASD office and a council of ASD “champions” were established to
govern the clinics and coordinate with the rest of the Allied Health organization.

These changes appear to have had an effect on diagnostic outcomes. The number of new
ASD diagnoses increased, largely tracking the regional field-wide trend of a factor of six increase
between 1993 and 2011 (Figure 1). The percentage of each birth cohort diagnosed with ASD by
the age of 5 increases as does the proportion of ASD diagnoses relative to all child psychiatric
disorders (Figure 2).

While costly, clinician managers at Allied believed these diagnostic changes to be
worthwhile. From a legitimacy standpoint, these changes satisfied the regulatory mandate in a
way that incorporated contemporary insights about autism. Organizations that consider
themselves industry leaders, like Allied, may also experience strong positive pressure to live up to
their reputations and be among the first to adopt new practices (Burt 1987; Staw and Epstein
2000). Clinicians at Allied were proud of the ASD centers for making high quality ASD

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12 There are other proposed explanations for the field-wide increase in autism diagnosis – the changing
definition of autism (King and Bearman 2009), increasing parental age (Liu, Zerubavel and Bearman 2010),
and social influence among parents (Liu, King and Bearman 2010). Even if we take this at face value, there
is ample room for changes in health care organizations to also account for part of the field-wide autism
increase. The authors of previous sociology-based studies of ASD argue that these explanations account for
up to 50% of the autism increase. Given the drastic changes at Allied, the concomitant rise in diagnoses is
suggestive of the influence of organizational factors. This paper provides evidence of this.
evaluations available to a large patient population. Even university-based ASD clinics, on the forefront of autism research, could not offer the same level of integration with other health services.

From an efficiency standpoint, improving ASD diagnostic practices offered a way – using language from internal Allied presentations - to improve “quality of care” and “increase member satisfaction.” There was also a cost minimization rationale; Allied would provide some degree of care anyway to children with developmental delays regardless of ASD diagnosis, and a correct and timely diagnosis would save resources spent on prolonged diagnosis and inappropriate treatment.

5 Differences in diagnostic outcomes

5.1 Intra-organizational variation

Despite these organizational changes, we found a surprising degree of heterogeneity across the three ASD centers at Allied. Figure 3 shows the observed percentage of children diagnosed with ASD at each of the three clinics. Alpha clinic diagnoses at 66%, while Bravo clinic diagnoses at 39% and Charlie clinic diagnoses at 35%. While Bravo and Charlie diagnose at roughly the same rates, their 27 to 31 percentage point difference from Alpha is both striking and statistically significant.13

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13 Alpha vs Bravo: 26.5% difference, t-statistic = 15.68, p-value < 0.001; Alpha vs Charlie: 30.5% difference, t-statistic = 13.29, p-value < 0.001; Bravo vs Charlie: 4.1% difference, t-statistic = 1.41, p-value (two-tailed) < 0.157
In addition to the large differences in the diagnosis rate between clinics, there is also remarkable consistency in diagnosis rate among individual clinicians within each clinic. Figure 4 shows the distribution of diagnostic rates among clinicians; the vertical axis is the percentage of cases in which ASD was diagnosed, while the horizontal axis is a randomly-assigned index variable. There is little overlap in the diagnostic rates of individuals across clinics. The clinicians at Charlie generally diagnose ASD in 30% to 40% of their cases, the clinicians at Bravo diagnose ASD in 35% to 55% of their cases, and the clinicians at Alpha diagnose ASD in 50% to 90% of their cases. The average differences across clinics, along with the consistency within clinics, suggests the diagnostic heterogeneity at Allied is a clinic-level phenomenon.

[Insert Figure 3 here]

[Insert Figure 4 here]

To scholars of organizations, these patterns are surprising because the three clinics were opened by and report to the same ASD director at Allied, all have a team-based diagnostic approach, and use the same set of psychological instruments including the ADOS.\textsuperscript{14} It was an organization-level, not a clinic-level, decision to implement organizational change, so why are there differences at the clinic level?

\textsuperscript{14} It is even possible to claim that we should expect to see the \textit{opposite} of what was observed, i.e., that Charlie ought to have the highest rate and Alpha the lowest. The scientific-consensus in the field continued to see ASD as even more common. Because the clinics were opened at different times, they were exposed to slightly different institutional conditions.
To scholars of ASD, these patterns are familiar and provocative. The increased number of diagnoses resembles broader trends throughout the country (Boyle et al. 2011) as does clustering of autism cases (Van Meter et al. 2010). Many attempts have been made to explain these patterns, but no study has drawn a connection to organizational processes among health care providers. What is the organization’s role in the current case?

5.2 Regression analysis

Before attempting to answer these questions, it is critical to rule out a number of alternative explanations for the observed diagnostic pattern. In establishing evidence of a difference between clinics using only observational data, the major challenge to overcome is confounding by unobserved patient characteristics that may be unevenly distributed geographically and correlated to the underlying risk of ASD. The three ASD clinics are located in different geographical areas and patients are assigned to clinics based on the location of their primary care provider. Given the potential spatial correlation between patient characteristics and risk of ASD, unobserved patient characteristics may be responsible for the observed diagnostic differences between clinics. Put simply, clinics may be seeing different types of patients.

Prior research has established geographic clustering of ASD cases (Van Meter et al. 2010) and enumerated three general explanations: localized environmental toxins, clustered demographic characteristics of patients (Mandell, Novak and Zubritsky 2005; Mandell et al. 2009), and social influence from children already diagnosed with autism (Liu, King and Bearman 2010). Clustering could also be related to “schools of thought” among local physicians that can lead to locally
homogenous medical practices (Epstein and Nicholson 2009; Grytten and Sørensen 2003). Ruling out these possibilities would require patients to be drawn from a common geographic area.

A second related-but-distinct problem stems from variation in the referral patterns of primary care providers. Because patients need a referral to be seen at an ASD clinic, local referral practices affect the composition of patients seen at each clinic. Systematic differences in the referral decisions of primary care providers across geographic areas can alter the risk set at each clinic; primary care providers who are more conservative will lead to a risk set with a greater proportion of positive diagnoses, while less conservative primary care providers will lead to a risk set with a lower proportion of positive diagnoses. Ruling out this possibility would require patients to be drawn from a common referral area.

We address these concerns using regression analysis, controlling for patient demographic factors and exploiting externally-imposed changes in clinic catchment areas. We model the probability that a patient receives an ASD diagnosis when visiting an ASD center. First, we include controls for age, sex, race, parent education, parent age. Second, we include the visit number as a control variable. Most patients are seen at an ASD clinic only once, but occasionally are seen a second time (26.3% of visits) at the same or a different clinic (1.7% of visits).15 Typically, this happens because the family wants a second opinion or new symptoms emerged.

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15 This raises the possibility of selection bias driven by patients. However, I believe this is a minor problem because it only accounts for 1.7% of total visits and relies on a very strong set of assumptions which I discuss in the Appendix.
Third and most importantly, the key to addressing differences in patient composition across clinic is the inclusion of fixed effects for the medical office of each patient’s primary care provider and for the zip code of the patient. Fixed effects exploit changes in clinic catchment areas that are unrelated to the diagnostic practices at each clinic. Allied generally assigns patients to pediatricians and pediatricians to ASD clinics, typically based on geographic proximity. However, the assignment between pediatricians and ASD clinics changes over time as the Bravo and Charlie clinics were opened and as the clinics continually adjust to changes in patient demand and clinician availability (e.g., maternity leave). Models with medical office fixed effects exploit within-office variation in clinic use, and directly address differences in referral patterns. Models with patient zip code dummies are used to rule out explanations directly correlated geographically.

We estimate the following linear probability model:

\[ Y_i = \alpha_1 1[\text{Alpha clinic}] + \alpha_2 1[\text{Bravo clinic}] + Z_i \gamma + X_i \beta + \epsilon_i \]

The unit of analysis, \( i \), is patient visit.\(^{16} \) \( Y_i \) is the probability that the patient is diagnosed with ASD at the clinic visit. \( 1[\text{Alpha clinic}] \) and \( 1[\text{Bravo clinic}] \) are indicator variables for each clinic. \( Z_i \) is a vector of indicator variables specifying the medical office of the primary care provider, or patient zip code. \( X_i \) is a vector of control variables that includes indicators for sex and race, patient age, maternal and paternal education, maternal and paternal age, and visit number.

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\(^{16}\) Because an ASD evaluation may involve encounters with multiple health care providers over several days, I define a visit as the entire set of patient interactions at a particular clinic within a seven day period. At the end of the visit, health care providers typically come to a decision over the diagnosis of the patient.
Table 1 lists descriptive statistics for patients. Patients in the data are overwhelmingly male but include a wide distribution by race. Whites account for 55%, Asians 21%, Blacks 6%, and Hispanics 14%. The average age of parents at birth is 31.6 years for mothers and 34.5 years for fathers. The average parent has completed some college.\textsuperscript{17} There have been 3,957 outpatient visits to the three centers, out of which a diagnosis of ASD was given at 2063 (52%) visits. First to open, Alpha clinic accounts for 51.2% of patient visits. Bravo clinic, second to open, accounts for 34.1% and Charlie clinic accounts for 14.7%.

[Insert Table 1 here]

Table 2 shows four models of the probability of ASD diagnosis during a clinic visit. Model 1 includes only the indicator variables for the two clinics, with Charlie clinic serving as the reference category. The coefficients correspond to the values shown previously in Figure 9. The coefficient of Alpha clinic is 0.305 and significant at the 0.001 level, while the coefficient of Bravo clinic is 0.041 and significant at the 0.1 level. The model indicates that the probability of diagnosis is 30.5 percentage points higher at Alpha clinic than at Charlie clinic. Model 2 includes the vector of controls including patient characteristics and visit number. In this model, the magnitudes of the Alpha clinic and Bravo clinic coefficients decrease slightly, but Alpha clinic remains statistically significant with a value of 0.281. The probability of diagnosis is higher for

\textsuperscript{17} Education is measured on a seven point scale: 1 for less than an 8\textsuperscript{th} grade education, 2 for some high school, 3 for high school graduate/GED, 4 for some college, 5 for an associate degree, 6 for a bachelor’s degree, and 7 for a graduate degree.
males, with a coefficient of 0.047 but other demographic controls do not affect the probability of
diagnosis. Visit number does increase the probability of diagnosis as expected. Model 3 adds
fixed effects for year and for pediatric office. The coefficient of Alpha clinic is still significant and
actually increases to 0.317. The interpretation is that children - from the same pediatric office, in
the same year, holding demographic characteristics constant - are still 31.7 percentage points more
likely to be diagnosed with ASD at Alpha clinic than at Charlie clinic.

[Insert Table 2 here]

Model 4 includes fixed effects for five-digit zip code. This directly addresses the possibility
that the difference between ASD clinics is driven by localized environmental toxins or other
factors that are not explicitly controlled. The coefficient of Alpha clinic in this model is 0.355 and
statistically significant. Patients living in the same zip code, but going to different ASD clinics
still have substantially different chances of diagnosis. Remarkably, demographic controls, medical
office fixed effects and zip code fixed effects do not diminish the magnitude of Alpha clinic
coefficient. Overall, regression analysis provides strong evidence of a difference across clinics that
is independent of patient characteristics.18

18 We find the substantive finding holds regardless of whether linear probability models or logit models are
used.
5.3 Conventional organizational accounts for diagnostic variation

Organizational sociologists offer two general accounts for this difference – resistance and customization – but neither resonates in the case of Allied Health. An organization-level resistance interpretation of events is not appropriate because the fact that the clinics were established in the first place indicates an earnest effort on the part of Allied to change ASD diagnosis. The process of diagnosing ASD was fundamentally changed by the establishment of the clinics. Before reform at Allied, diagnosis was ad hoc and carried out on a sequential basis by individual health care providers. In the creation of the clinics, office space was leased, new health care providers were hired, and diagnostic work was centralized. Allied elaborated its formal structure (c.f. Edelman 1992), committed substantial resources and changed work processes. Mere symbolic compliance in this case may have been achieved by much less - perhaps the creation of ASD guidelines or even the creation of a central office that advised existing departments (e.g. pediatrics, psychiatry, neurology) about diagnosis.

A customization interpretation of events at Allied is not appropriate either because at no point did managers identify differences between parts of the organization and tailor diagnostic practices to each unit’s needs. Because the ASD organization and the three clinics were created ex nihilo, there was no existing organization or organizational sub-unit that could resist or customize the change. More importantly, Allied’s goal was to establish three clinics that would be equally effective at diagnosis, consistent with the behavior expected of a well-run HMO. According to internal documents, “adherence to the model...screening, referral, evaluative and case management
processes and tools” was a “pre-requisite to open shop.” Alpha clinic - the first to open – was to be the prototype that would be replicated by future clinics.

Furthermore, it was not even clear to many clinicians that Alpha, Bravo and Charlie were diagnosing differently which suggests, *a fortiori*, that they did not intend to produce that difference through customization. Very few people have directly observed the work processes at more than one clinic and systematic data was not presented until an internal report was produced in September 2010. Even then, there was no attempt at Allied to disentangle (as our regression models do) the impact of diagnostic practices from the impact of patient characteristics.

6 Imprinting in organizational adaptation

The explanation advanced in this paper articulates a role for imprinting in organizational adaptation to field-level change. Professionals are known to develop rationalized, coherent approaches when exercising judgment (Bittner 1967; Huisung and Silbey 2011; Iyengar, Van den Bulte and Valente 2011) which can remain stable over time (Barley 1986; Zucker 1977). The same can generally be expected for the clinicians at the Allied ASD centers but what makes this case interesting and informative are a number of key details. Where did the approaches come from? How do they explain the diagnostic differences across clinics? What is the mechanism for persistence?

In this section, we explain how (1) each clinic has a different diagnostic orientation that relates to diagnostic outcomes, (2) these diagnostic orientations were shaped by key individuals early in the history of each clinic, and (3) diagnostic orientations likely persist over time because of the team-based structure of ASD evaluations. Consistent with the theoretical sampling
approach mentioned previously, the empirical evidence in this section is drawn from two clinics -
Alpha and Charlie.

6.1 A framework for contrasting diagnostic approaches

Health care providers at both Alpha and Charlie clinics try to make what they consider to
be correct diagnoses, but conceive of correct diagnoses in philosophically different ways.
Diagnostic practices at each of the clinics reflect different points of resolution along two
fundamental tensions in medicine: (1) standardization versus clinical judgment and (2) sensitivity
versus specificity.

The first tension is between standardization of care versus clinical judgment (Dawes, Faust
and Meehl 1989; Sackett et al. 1996; Timmermans and Berg 2003). On one hand, it is well known
that medical practices for the same medical problems can differ substantially (Wennberg and
Gittelsohn 1973) and many health care providers are not using the most up to date diagnostic and
treatment methods (Berwick 2003). This suggests a substantial opportunity for improved medical
care by simply standardizing medical care. On the other hand, professional knowledge cannot be
fully distilled into a set of guidelines for diagnosis. The job of the professional is to apply abstract
knowledge to specific cases and it is unrealistic to expect the standardized procedures to anticipate
all patient contingencies. Moreover, when professionals apply their knowledge to unusual cases,
they learn from observing the outcome and the knowledge of the entire profession can be
expanded.

The second tension is whether to prioritize sensitivity or specificity in diagnosis. The ideal
diagnostic test would identify all individuals with the condition and only those individuals, but all
tests exhibit some error. The test may not detect some individuals who truly have the condition (i.e., a false negative), and might indicate some individuals have the condition when they truly do not (i.e., a false positive). The fundamental dilemma is in deciding which error is worse.

Emphasis on sensitivity prioritizes detection of all individuals with the condition, which can be critical for initiating medical treatment, but risks over-diagnosis. The urge for sensitivity can be particularly powerful in the case of children, possibly to a fault (Timmermans and Buchbinder 2012). Emphasis on specificity prioritizes detection of only individuals with the condition, which reduces the unnecessary emotional and economic burden of an erroneous diagnosis, but risks under-diagnosis.

While clinicians at Alpha and Charlie agree on the importance of accurate diagnosis, clinicians at Alpha clinic place greater emphasis on standardization and on sensitivity, while clinicians at Charlie clinic place greater emphasis on professional judgment and on specificity. These differences in positions lead to different biases, different tacit rules in diagnosis, and different diagnostic outcomes.

6.2 The origins and impact of diagnostic orientations

The differences in diagnostic approaches are unexpected because the clinics were opened by the same ASD regional office and there was little precedent for how these clinics, prior to ASD diagnostic reform, should run. As the clinics opened, diagnostic practices developed along different paths at each clinic, leading to different diagnostic orientations and different diagnostic outcomes. How did this unfold?
Diagnostic orientations seemed to have been shaped early in the history of each clinic by key individuals who served as a kind of raw material that seeded the subsequent development of diagnostic approaches of each clinic. The key individual at Alpha clinic is an external consultant from an elite research university in California who was closely involved in contemporary autism research, while the key individual at Charlie clinic is the initial director who had become an autism expert in the early 1990s under the tutelage of a conservative mentor.

6.2.1 The consultant at Alpha clinic

When the plan to establish Alpha clinic was approved in 2002, it was a generalist child psychiatrist who was chosen both to develop Allied’s system for ASD diagnosis and to lead the first ASD clinic, Alpha. As a child psychiatrist, she was familiar with ASD, but had to learn much more to diagnose ASD confidently. She contacted a former colleague - with whom she completed her residency - for guidance. This former colleague was actively involved an ASD research at an elite nearby university, closely followed contemporary research, and was informed by the nascent scientific bent towards diagnostic sensitivity. A clinician at Alpha spoke about the influence of the consultant in the following way:

“The first few years were us learning through our mistakes and slowly developing a very sharp eye of just how subtle autism can be. There were no experts in [Allied] to say ‘This is autism. This is how you assess it.’ We had to bring in someone from the outside, from a research institution...to train us. Until she came in, we were in a period of stumbling. [The consultant] only stayed with us for a couple years before she went back to [her university]. She got us on the right track.”

The consultant was influential because of the clinic director’s desire to develop a well-respected, research-based model for ASD diagnosis at Allied, and the consultant had the clinician-
researcher qualifications to guide Alpha clinic along this path. The following quote illustrates the director’s admiration of research:

“I’m not an epidemiologist, or any other type of researcher, but I’ve been involved in research projects because, like you, I feel very fortunate to work in [Allied], and I know this is a gold mine, where we can educate the field.”

As part of establishing a respected ASD clinic, the director also sought to become involved in the broader autism community in the region and engage with scientists in Allied’s research division. She participated in statewide efforts in 2002 to establish a set of ASD diagnostic best practice guidelines and in other expert panels organized by the state legislature. She organized trainings and workshops for psychologists in Allied, staff in the state’s Department of Human Services, and local school districts.

Achieving a research-level diagnostic standard was key part of the director’s plan. Clinicians maintained close ties with a group of autism epidemiologists at Allied’s research division. Research subjects were frequently recruited from patients who were seen at Alpha clinic, and Alpha clinicians would conduct ASD evaluations as part of research studies. Research-quality evaluations are considered superior to “clinical” evaluations because of the high degree of effort in achieving reliability both within the research site and with other research sites across the ASD scientific community.

6.2.2 The initial director at Charlie clinic

Unlike the Alpha clinic director, the Charlie clinic director had prior experience diagnosing autism and therefore she, not an external consultant, served as the local subject matter expert.
She was shaped by her medical training at one of the top medical schools immediately prior to joining Allied Health in the early 1990s. Her psychiatry fellowship included a six month rotation at an ASD clinic run by a notable, conservative autism expert.

This training gave Charlie director assurance in her knowledge of ASD. Even before the opening of Charlie clinic in 2008, she went out of her way to conduct team-based (i.e., higher-quality) ASD evaluations. For several years before the clinic opened, she coordinated schedules with a local Allied psychologist and a behavioral pediatrician, and carved out time from her regular child psychiatry duties to conduct joint ASD evaluations.

Charlie director’s fellowship experience was integral to her orientation towards diagnostic specificity. When we asked Charlie director via email about a possible intellectual link to her fellowship, she wrote, “The local clinic I developed here [at Charlie] in 2003 very much reflected the training I’d had years before at [my fellowship]…of course I used the same model in my regional clinic once I agreed to open and direct one here.”

The model was developed by Charlie director’s former mentor, who has a distinct reputation as a conservative, no-nonsense clinician who pulls few punches with families. In the media, USA Today quotes her as saying that she does more “un-diagnosing” than “diagnosing” of Asperger’s disorder (Leigh 2007b), and on blogs, she has been called the “Ann Coulter of autism experts.”20 SFGate writes:

“Others parents have been antagonized by her [Charlie director’s mentor] apparent stinginess with dispensing autism diagnoses. [The medical school], like many other high-ranking universities, is conservative with its labeling of autism, and [Charlie director’s mentor] is dismissive of psychologists who ‘see autism in everyone.’ She attributes this to a desire to show competence in recognizing the condition as well as bowing to pressure from…parents.” (Leigh 2007a : p1)

One thing Charlie director learned from her mentor was to emphasize the importance of professional judgment acquired over time through master-apprentice training. This emphasis is revealed by an internal controversy at Allied. Soon after Charlie opened, Allied researchers noticed that rates of diagnosis at Charlie seemed different from those in Alpha. This suggested for the first time the possibility that Charlie, Alpha, or both might not be diagnosing appropriately. Charlie’s response is illustrative. Wanting to check her approach to diagnosis, the Charlie director contacted her former mentor and asked her to conduct an independent review of Charlie clinic’s practices. The former mentor largely approved, affirming the professional judgment of the Charlie clinic director. Alpha clinic, by contrast, received and continues to receive affirmation from their participation in research studies and formal tests of diagnostic reliability. With a belief that a good diagnostician uses her own professional judgment, the Charlie clinic director was less swayed by post-1998 field-level developments calling for greater diagnostic sensitivity.

6.2.3 Key individuals and the development of tacit rules

These key individuals were influential in shaping diagnostic outcomes at their respective clinic because staff clinicians lacked a pre-existing diagnostic orientation and well-developed prior beliefs about diagnosis when they joined. Most clinic staff were newly-hired psychologists who had recently received their PhD or PsyD in clinical psychology and completed a post-doctoral
fellowship. Some clinicians at Alpha worked part-time at the clinic and part-time at mental health departments elsewhere in Allied. Because ASD diagnosis is highly specialized within psychiatry, nearly all clinicians had to learn both the formal psychological instruments and the informal rules for diagnosis (i.e., clinical judgment). The effect on staff clinicians is exemplified by a psychiatrist, who worked part-time in Alpha clinic and part-time in a mental health department. Here, she describes how her experience at Alpha broadened her definition of autism as compared to her definition acquired during her residency years before:

“For about two years I went down [to Alpha] once a week and worked actually in the diagnostic center as one of the clinicians, and then worked here the other three days a week. Really, really enjoyed that. And it really helped me further develop my understanding of autism, which has changed a bit since my [residency] training. It’s almost a completely different thing, now it’s a little more broad-based umbrella, what we call autism these days.”

Clinicians do not openly express a preference for diagnosing one way or the other. All clinicians we spoke to were concerned first and foremost with getting the diagnosis correct and might even take offense at the idea that their individual beliefs might affect their clinical evaluations. However, because staff clinicians started with few prior beliefs about ASD diagnosis, they were sensitive to the diagnostic orientation and tacit rules for diagnosis present during their

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21 One mental health care provider told me: “You’re gonna find that most mental health departments - the clinicians - don’t want to work with autism.” When I asked why, she continued “That’s a specialty. That’s an area all in itself. That’s not a mental health category that really responds to traditional psychotherapy. So clinicians that come to psychiatry are trained in traditional mental health therapies and traditionally autism was just never one of them.”
training. The tacit rules promoted originally by the key individuals later came to be internalized by individuals throughout each clinic.

Tacit rules refer to clinicians’ scripts for interpreting evidence and are an essential part of diagnosis because, even using formal criteria, professionals must interpret idiosyncratic patient behaviors in abstract terms (Rosenberg 2002). Medicine conceives of disease and other conditions as ideal types, abstracted away from specific individuals. The application of general medical categories like ASD to specific individuals with idiosyncratic symptoms requires a degree of judgment. Unlike medical conditions such as tuberculosis or HIV, there is no definitive, specific test for diagnosing ASD. Diagnosis of ASD is made on the basis of behavioral criteria in the DSM; out of the 12 criteria (see Table 3) for ASD, patients must meet a threshold number to be positively diagnosed.22, 23, 24 Accurately determining whether a patient meets these criteria requires the reliable application of tacit diagnostic rules.25

[Insert Table 3 here]

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22 The official version used during the study period (2000-2012) was DSM-IV-TR. The next version, DSM 5, was released in May 2013. DSM 5 removes the five “subcategories of ASD” and uses only a single diagnosis of “ASD.” To diagnose ASD according to DSM 5, the social and communication categories have been combined and include three criteria, all of which must be met. Children must still meet the criteria for stereotyped behavior, but must now meet two of four criteria.

23 Children diagnosed with ASD need only meet some but not all of the criteria. For Autistic disorder, the individual must meet six of the 12 criteria with at least two from the first category (i.e. social), one from the second category (i.e. communication) and one from the third category (i.e. stereotyped behavior).

24 I describe the diagnostic process at Allied further in the Appendix.

25 Even though the “gold standard” diagnostic instrument - the ADOS - provides a sharp lens for identifying social, communication and behavioral deficits in children and improves reliability, the ADOS does nothing to change the fundamental nature of the diagnosis decision.
An example of the gap between formal criteria and patient idiosyncrasies is DSM-IV-TR criterion A3 which reads:

“A lack of spontaneous seeking to share enjoyment, interests, or achievements with other people, (e.g., by a lack of showing, bringing, or pointing out objects of interest to other people).”

Given this criterion, it is easy to conjure image of extreme cases that qualify, e.g., a child who never initiates conversation or interaction with another person, even a parent. However, many cases are not so extreme and can cause disagreement among clinicians pursuing precision. In criterion A3, the part that causes difficulty is the word “lack.” Because the level of “seeking to share enjoyments, interests, or achievements” can vary in degree, this criterion defies a simple yes-no distinction. One psychologist explained:

“I’ve had debates with people about what the word ‘lack’ means. Does it mean a hundred percent, total absence of social or emotional reciprocity, or is it just a deficit? I’m of the personal belief that it doesn’t have to be a complete absence. That seems a little rigid to me, but I know that there are staff who feel differently.”

Making a judgment about this criterion requires that the clinician develop an unstated threshold for deciding when the observed symptoms of the patient fit the criterion. This psychologist refers to an interpretation of “lack” that she believes is appropriate, and notes that other clinicians may have different ways of interpreting “lack.”

It is in the space between formal criteria and idiosyncratic patients that tacit rules are necessary. Clinicians develop tacit rules for maximizing reliability in this space but, without an external reference point, can be susceptible to subtle biases (Gawande 2002). Consistent with research showing that biases can unconsciously influence professional decision-making (Castilla
even the most dedicated ASD clinicians may diagnose differently from one another without being aware. In this setting, tacit rules may include a list of symptoms known to be equivocal, alternative explanations for each symptom and thresholds of evidence for ruling out alternatives.

Systematic differences in tacit rules can produce different outcomes in diagnosis at the clinic level. In the previous example of DSM-IV criterion A3, differences in the rules for interpreting symptoms have a clear influence over the probability of diagnosis. The quoted clinician would conclude that the criterion is met even if the patient had a mere “deficit” in reciprocity, while other clinicians would only consider the criterion met if the patient has a “total absence” of reciprocity. *Ceteris paribus*, this clinician will be more likely than other clinicians to give a diagnosis of ASD.

More generally, relevant tacit rules seem to relate to the search for alternative explanations besides ASD. As a first step, the clinicians must gather evidence of social, communication and behavioral deficiencies and then decide whether they are severe enough to meet the DSM criteria. As a second step, clinicians must decide whether the child’s unusual behavior can be explained by alternative psychiatric disorders besides ASD (e.g. speech delay, attention deficit hyperactivity disorder).

The first step is easy, but the second task is extremely difficult: A child’s behavior can be consistent with the DSM-IV criteria for ASD and the ADOS, but the etiology of that behavior
may not be ASD.\textsuperscript{26} Relative to other psychiatric conditions, ASD is marked by a complex set of symptoms. If only a subset of symptoms are identified, clinicians may diagnose another, more narrowly-defined disorder (Gallo 2010).

6.3 Diagnostic orientations at Alpha and Charlie

With clinicians lacking strong priors about ASD diagnosis and key individuals providing contrasting guidance at each clinic, the tacit rules that emerged at Alpha and Charlie were different. These tacit rules appear to have a certain coherence, which we refer to as a diagnostic orientation. The diagnostic orientation at Alpha clinic places greater emphasis on standardization and on sensitivity, while the diagnostic orientation at Charlie clinic places greater emphasis on professional judgment and on specificity. Clinicians do not state their positions overtly but their orientations are revealed by the way they discuss matters related to ASD diagnosis.

6.3.1 Diagnostic orientation at Alpha clinic

At Alpha clinic, emphasis on standardization is reflected in clinicians’ attitudes towards scientific research and use of the ADOS diagnostic instrument. Clinicians at Alpha clinic work alongside Allied researcher scientists on studies of autism, carrying out clinical evaluations for ASD on research subjects. They believe that participating in research keeps them on the cutting edge of clinic practice. Interactions with full-time research scientists present opportunities to

\textsuperscript{26} This task is analogous to disentangling causation from correlation. Correlation is easy to observe but it is often driven by a multitude of factors besides the hypothesis of interest. Substantial effort is therefore required to rule out alternatives.
learn about the latest developments in ASD and challenge their current knowledge. When one of us arrived at Alpha clinic to shadow a psychologist as part of the fieldwork, he was given a tall stack of research papers about the diagnosis of ASD. This clinician told him that research was a major selling point and, if she were not allowed to participate in research, she would probably leave.\textsuperscript{27}

Alpha clinic takes pride in the skilled use of the ADOS instrument and is uncompromising about its reliability. The ADOS is considered the “gold standard” psychological instrument for the diagnosis of ASD (Lord et al. 1999; Lord et al. 1989). Standard training is normally at the “clinical” level and involves a two to three day workshop with a certified instructor. Alpha clinic pursues a “research reliable” rating, which entails substantially more training\textsuperscript{28} and is a de facto prerequisite to participate in a research study. One clinician explained:

\begin{quote}

\textsuperscript{27} Readers may be concerned about the possibility that biased hiring and turnover processes may lead to systematically dissimilar clinicians at Alpha and Charlie, which then drives the diagnostic difference. For example, conservative clinicians hire other conservative clinicians and drive away non-conservative clinicians. However, this is unlikely to be the case because (1) most clinicians are hired with little prior ASD diagnostic experience and have no apparent diagnostic proclivities to be selected on and (2) evidence from the only clinicians to work at more than one clinic shows that the clinic difference persists even in the same individuals (compare Figure 6 with Figure 8). Moreover, the moving of the group of clinicians was exogenous to their experience at Alpha because the move was planned when they were first hired into Allied, before working at Alpha and Charlie.

\textsuperscript{28} “Research reliable” training qualifies clinicians to identify individuals with ASD at an acceptable standard for research studies (e.g. to evaluate the effectiveness of treatment), for which researcher must be certain research subjects truly have ASD (e.g. Dawson et al. 2010). Research-level training consists of three additional days of training working with certified instructors. After the course, the trainee must videotape herself conducting six independent administrations of the ADOS, send in those tapes to a certified trainer and achieve 80\% inter-rater reliability at the item-level. Amazingly, clinicians in Alpha clinic not only undertake research-reliable training but even go a step further as part of their research. They test their
“[Alpha clinic] is trained to a research level, so maybe we do have a different threshold from everyone else. [Alpha clinic] has always been interested in research. Whereas the other clinics were asked to be involved in research and they declined. They are ‘clinically reliable’ but not ‘research reliable.’ ”

Alpha clinic’s emphasis on sensitivity is reflected in clinicians’ concern about the burden autism poses for families. Speaking to a clinician at Alpha clinic, we asked about the overall upward trend in autism prevalence estimates and whether she was worried about over-diagnosis. The narrative she gave in response emphasizes the plight of the parent and illustrates how sensitivity to ASD can be a way to lessen parents’ burden. A positive diagnosis opens the door for the family to receive supports from the state, the school and the medical system. She explained:

“Actually a bigger problem is under-diagnosis...parents go through this horrible period of blaming themselves. ‘What if I didn’t do this, or if I did that?’ It’s really terrible. We reiterate to them that they didn’t do anything. And we try to take out the blame. It can really be heartbreaking. But when parents connect with the diagnosis, they can really do some amazing things.”

The clinic’s emphasis on early diagnosis is another indicator of its commitment to diagnostic sensitivity. Another clinician explained: “When someone is diagnosed late, they lose a lot of the opportunity to improve. It’s really best to diagnose at 2 years old and we’ve been getting better about diagnosing kids earlier.” To diagnose at earlier ages, clinicians must attend inter-rater reliability among themselves every three months and regularly test their inter-rater reliability with other research sites.
to a new set of subtle signs and symptoms which, by definition, require clinicians to be more sensitive to ASD than they had been in the past.

### 6.3.2 Diagnostic orientation at Charlie clinic

At Charlie clinic, the emphasis of professional judgment is illustrated in clinicians’ idealized image of a good clinician, discounting of the ADOS instrument, and approach to training new psychologists. A good clinician is one who has an extensive amount of experience and has developed a broad understanding of many psychiatric disorders. This understanding allows the clinician to carefully sift through patient information and behavior, consider possible alternative diagnoses, and arrive at a diagnosis of ASD once alternatives have been ruled out. A senior clinician at Charlie clinic explained:

“You’re not a good internist unless you know the differential diagnosis of chest pain. If you don’t know that chest pain can be due to esophageal problems, or all sorts of other things, then you can’t do the full diagnosis. Autism is a psychiatric disorder. Especially as they get older, you have to really know typical development, its minor aberrations that can affect functions but be below the threshold. You need to know what other things that can present within psychiatry that can lead to aberrant social development. It’s much harder to teach this than it is to teach one single test.”

The single test the quote refers to is the ADOS. While the ADOS is considered essential at Alpha clinic, it is explicitly considered secondary to clinical judgment at Charlie clinic.

This is reflected in Charlie clinic’s use of standardized instruments when the clinic first opened in 2008. At first, the approach to evaluation at Charlie was unstructured – to simply interview the parents about their concerns and observe the child in free play. Standardized psychological instruments were used, but were used in different combinations and were used
selectively. Clinicians were to be sensitive to signs and symptoms of a range of psychiatric disorders, and to allow those signs to direct the clinician to the appropriate instruments and diagnosis.

Although this clinic now uses the standardized protocol of instruments, the emphasis on clinical judgment persists. The ADOS is now used at every Charlie clinic evaluation, though it is still described as only one part of a complete assessment. One clinician recounted explained that, during an ADOS training session with one of original developers of the ADOS, the instructor acknowledged the instrument’s limitations:

“[The instructor] admitted it up front that the reliability of the ADOS - for ASD versus typically developing [children] - is high. But the reliability of ADOS for ASD versus other child psychiatric disorders...the reliability is low. No matter how high it is, it’s still a test.”

Charlie clinic’s approach to training is consistent with an evaluation approach that relies on good professional judgment. Training at Charlie clinic emphasizes learning-by-doing under the tutelage of a more experienced clinician, rather than training in specific psychological instruments like the ADOS. A senior clinician at Charlie explained “a good psychologist can just learn another test. Much more important is whether they truly understand the differential of ASD.”

Relationships among new clinicians and established clinicians at Charlie were described as hierarchical, while relationships among clinicians at Alpha were described as egalitarian. New

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29 Interestingly clinicians at Alpha say the same thing and we have observed ASD evaluations at both clinics in which the ADOS results were combined with the results of other psychological instruments. What is suggestive of different clinician orientations is that they emphasize different points.
clinicians at Charlie conduct evaluations only with experienced clinicians and meet with a senior mentor on a regular basis.

Charlie clinicians emphasize specificity in their clinical evaluations. Clinicians at Charlie agree with clinicians at Alpha that a diagnosis would allow families to initiate treatment, but are more concerned with the potential drawbacks of making a positive diagnosis. A diagnosis of ASD initiates an often dramatic response by the family, health care providers, and the school system. A false positive error may lead unnecessarily to severe distress in the family, be a permanent part of the patient’s medical record, and possibly affect health insurance premiums. Given a truly borderline case of ASD, clinicians at Charlie clinic would choose not to make an ASD diagnosis.

One clinician expressed it this way:

“I am definitely more comfortable being conservative if I’m not sure about an autism diagnosis, I’d much rather not make the diagnosis versus make it and then be, you know, incorrect, and have to take it away later. Because I think that’s unfair to do to a family.”

This is nearly the opposite of what is said at Alpha. Wondering how psychologists could hold such different views, we pressed and prompted the clinician with what we had heard from Alpha clinic.

**Interviewer:** I’ve heard people sort of argue the opposite, that, “Hey, you know, if these kids might have ASD, we want to get them in speech therapy, or what-not, ASAP. Let’s not worry too much about what we call it, so long as they get the therapy that they need.

**Respondent:** No, I totally understand that. I get that. Usually...I would say for a response...the kids where this has been an issue, we’re not suggesting that they go away and get no treatments. We’re suggesting options. Could be a social skills group, or it could be treatment with a psychologist, that sort of thing. And we’re usually asking that whoever’s working with them at [Allied], to kind of keep an eye on them, see what they think, and reevaluate as they go along.
It turns out that there is general agreement on the gravity of an ASD diagnosis and the importance of seeking treatment, but clinicians at Charlie consider the drawbacks of not diagnosing to be \textit{less severe} than the clinicians at Alpha. Emphasizing specificity over sensitivity, they were more reluctant to give a positive diagnosis.

\subsection*{6.3.3 The effect of diagnostic orientations and tacit rules on diagnosis}

A consistent application of formal technology across multiple sites requires consistency in tacit rules (Collins 1974) and diagnostic differences across clinics reflect differences across the tacit rules at each clinic. Emphasis on sensitivity makes clinicians less likely to find alternative explanations for symptoms consistent with ASD, while specificity makes clinicians more likely to find alternative explanations for symptoms consistent with ASD. Emphasis on standardization makes clinicians more receptive to the wider public and scholarly discussions about autism, which during this time period advocate more sensitive diagnosis. Emphasis on professional judgment rather than standardization means clinicians are less aware and receptive to public and scholarly discussions advocating sensitivity.

Figure 5 and Table 4 show how these differences manifest at Alpha and Charlie. Figure 5 illustrates the distribution of psychiatric diagnoses at each clinic. Particularly notable is the finding that both clinics diagnose a non-psychiatric disorder at about the same rate – 19\% at Alpha, 25\% at Charlie – which suggests that clinicians largely agree on whether a disorder is psychiatric or non-psychiatric, but disagree in differentiating among psychiatric disorders. Table 4 confirms this pattern, presenting results from linear probability models of other common clinic diagnoses, with controls for patient characteristics, year dummies and pediatrician office fixed
effects. The coefficient of Alpha clinic is nearly zero in the model predicting *No psychiatric diagnosis*, is notably higher in the models predicting *Autistic disorder* and *Asperger’s disorder*, and is notably small in models predicting *Specific delays in development, Neurotic disorders, Hyperkinetic syndrome, Disturbance of conduct* and *Mild mental retardation*. Our argument suggests that the symptoms interpreted as ASD at Alpha are interpreted as other psychiatric disorders at Charlie.

[Insert Figure 5 here]

[Insert Table 4 here]

### 6.4 Persistence of clinic differences

The final piece of the empirical puzzle is the remarkable persistence in differences across clinics. One might expect that these differences ought not to persist because the very premise of an HMO is to provide health services efficiently. Allied should be proficient in developing optimal medical care policies and implementing them throughout the organization, or at least disseminating the knowledge from one part of the organization to another. However, Figure 6 shows the trend of diagnostic rates at Alpha and Charlie, exhibiting little convergence over time.\(^{30}\)

\(^{30}\) Readers may interpret the decline in diagnosis rates at Alpha as evidence of convergence, but this pattern is actually an artifact of the study sample. Figure 6 is based on data from eight birth cohorts and, by 2010, many of the children with ASD have already been identified. Thus the observed diagnosis rate confounds the diagnostic practices of clinicians with the cumulative number of past ASD diagnoses within the cohort. Figure 10 uses supplemental data that helps to tease these apart. Data from all evaluations at Alpha from
Why did the differences between the clinics, which were established initially by key individuals, persist even among general staff years into the future?

Although the founding director orientation and the receptiveness of new staff may explain initial differences between the clinics, the persistence of clinic differences over time requires additional explanation. Persistence and homogeneity of clinic diagnosis, we contend, is shaped by the internal organizational structure of autism evaluations, which are team-based and have a rotating membership.

6.4.1 Influence of internal organizational processes

ASD evaluations at Allied involve two or more clinicians who administer psychological instruments, interview parents, and observe the child throughout the day. The clinicians gather and interpret data jointly, deliberate and come to a consensus diagnosis. This means that the informal rules for interpreting evidence in terms of the formal ASD criteria are not developed and accessed on an individual basis, but are intersubjective. Joint-interpretation requires a common basis for recognizing critical evidence and inferring meaning. At every ASD evaluation, the tacit rules of each clinic are renegotiated, re-enacted and reinforced by clinicians.

To illustrate the negotiation of tacit rules, we show an excerpt of dialogue between two clinicians who are interpreting the results of the ADOS diagnostic instrument. The ADOS 2009 to 2012 introduces new children to the risk set which offsets the diagnosed children who leave the risk set. Using these data, the rate of diagnosis remains stable.
involves a series of standardized play interactions between a clinician and a patient. During the test, clinicians observe the behavior of the child for symptoms of ASD. After the ADOS interactions are completed, the clinicians go into a separate room and (in their language) “score” the ADOS. They work through a booklet with about 30-35 questions about the nature of the interactions. Depending on how the child responded during the interactions, a certain number of points will be given for each item and, at the end, the points will be added to generate a composite score indicating whether the child has autistic disorder or ASD. In the exchange below, two clinicians are assessing the patient’s score for the social skill of “giving.”

**Clinician 1:** I gave a zero for giving.

[A higher score is more suggestive of autism.]

**Clinician 2:** Yeah. I gave a one and thought I should’ve given a zero. She gave the flower to the Dad and put it to his nose. So it was kind of functional sharing.

[Here, the clinician is referring to an interaction when the child took a toy flower and gave it to her father. By putting the flower to the father’s nose, it suggests that the child is aware that the father would enjoy smelling the flower. This does not suggest a social deficit.]

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31 An example of a standardized interaction involves an ordinary balloon, blowing it up slowly and then releasing it, causing it to zip around the room. This sound and sight of the flying balloon typically captivates and delights the child who may smile, clap her hands and squeal in amusement. Having captured the attention of the child, the clinician will then pick up the balloon, blow it up again and release it. This continues several times. The balloon is used to create a situation where the child should interact socially with the clinician or a parent. The clinician will look to see whether the child makes eye contact with the clinician, or with a parent in the room, as evidence that the individual is “sharing enjoyment” (c.f. DSM-IV criterion A3 from before). After blowing up the balloon a few times, the clinician will ask the child if she should release it before actually releasing it. Here the clinician is looking for the way the child responds to the question, e.g., does the child respond in a socially appropriate way? Does the child make eye contact?

32 The ADOS is not used exclusively to grant a diagnosis. Clinicians consider its composite score as one of several pieces of information when making a diagnosis.
Clinician 2: But she also used his lap as a table, put the toy on his lap even when the Dad tried to be responsive.

[The clinician is referring to another earlier interaction when the child wanted to play with a toy and placed it on the lap of her father who was sitting in a chair. If this action is interpreted as “sharing” than it would not be suggestive of ASD. If this action is interpreted as serving only the interests of the child, who needed a table for the toy, then it would be suggestive of ASD.]

Clinician 1: The key is whether we think she was trying to share the block or pop up [i.e. the toy].

[Beginning here, the clinicians are re-enacting tacit rules for interpreting symptoms.]

Clinician 2: Yeah but she didn’t seem to observe what happened with the object and Dad after she gave it. The frequency of sharing seemed age appropriate, but not the quality of sharing.

[In a good social interaction, the child would have put the toy on Dad’s lap and then made eye contact with Dad to see how he would respond to the toy. By not paying attention to Dad or the toy, this action suggests a social deficit consistent with ASD. In the end, the clinicians gave a score of one on this item]

This exchange illustrates the first organizational ingredient of clinic-level diagnostic stability – the constant team-based renegotiation and reinforcement of tacit rules. The two clinicians were initially unsure about how to evaluate the patient’s behavior, but came to a consensus that distinguishes between the frequency and quality of sharing behavior. Assuming clinicians learn from their experience, they should apply this improved understanding, i.e., an updated tacit rule, to similar patient evaluations in the future.

The second ingredient of diagnostic stability is rotation in team-membership. Every clinician works with most if not all other staff clinicians on a regular basis. This provides stability because a single clinician cannot drift in their own judgment nor can a clique of clinicians develop their own tacit rules. Clinic-level change in tacit rules is more difficult because it would require
simultaneous, compatible shifts among all clinicians. Figure 7 displays the network of joint-evaluations at Alpha clinic. The first panel shows the evaluation network for a typical week, the week of May 3, 2010. All clinicians work with at least two others in that week, with some working with as many as seven different clinicians. Panels 2 through 6 show the evaluation network each day of the week. The fact that each network is different indicates constantly-shifting team membership. Finally, Panel 7 shows the evaluation network for the entire year of 2010 and, in all but two nodes, clinicians are well-integrated into a single component.

[Insert Figure 7 here]

The effect of team-based, rotating evaluation can be powerful. This is best illustrated by a group of clinicians who moved from Alpha clinic to Charlie clinic in 2008. When they started at Alpha clinic in late 2006, they were trained initially according to the rules of Alpha clinic and, when they moved to Charlie clinic, they were not merely blank slates (as most clinicians are) but were in fact predisposed to diagnose ASD in a diametrically different way from Charlie clinicians. Their rates of diagnosis while at Alpha are consistent with the clinic average - a 69% chance of diagnosing ASD in 2007 and a 71% chance in 2008 – but, once they moved to Charlie clinic, their diagnostic outcomes changed dramatically.

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33 This may explain why diagnosis rates are stable over time, while the rates of diagnosis in the broader organizational field increase.
34 These were the only clinicians in the data who switched clinics.
Figure 8 presents the probability of diagnosing ASD for these clinicians between 2007 and 2012. In 2007 and part of 2008, when they were at Alpha clinic, their average diagnosis rate of ASD was about 70%, consistent with the Alpha clinic average (see Figure 6). However, starting in October 2008 and continuing through to 2012, their rate of ASD diagnosis dropped precipitously by about 30 percentage points to within the Charlie clinic average.

6.4.2 No evidence of coercion by clinic directors

One may wonder if persistence is driven by direct coercion of the clinic directors. Our data suggest that this is not the case. In general, coercion is unlikely in this setting because all providers are governed by professional medical ethics and have a primary organizational role in diagnosing their patients. Yet, as an empirical check, if coercion were to occur, it would be strongest in evaluations in which the director directly participated (and could actively shape the interpretation of evidence) and would be weakest in evaluations in which the director did not directly participate (and had no firsthand knowledge of patient symptoms). However, Figure 9 shows there is little difference between evaluations with and evaluations without directors. In Panels 1 and 2, the lines in Figure 9 indicate the rates of ASD diagnosis with and without directors. While diagnosis with directors is noisier (as would be expected given fewer observations), the probability of diagnosis appears the same.

Directors have also become less influential over time. Figure 9 shows that the proportion of evaluations with founding directors is small and, in the case of Charlie, decreasing. The Charlie founding director is currently focusing considerable attention to new ASD-related projects (i.e. the
development of ASD treatment programs at Allied) while the founding director of Alpha stepped down in 2008 and works in the clinic without a formal leadership role.

Panel 3 of Figure 9 best illustrates the dynamic by which the behavior of clinicians take on the behavior their new clinic, independent of any possible coercion. The figure shows the diagnosis data of the group of clinicians who moved from Alpha to Charlie. From 2006 to the first half of 2008, they diagnosed about 70% of their cases with ASD. From the second half of 2008 through to 2010, their rate of diagnosis decreased and rates of diagnosis with the Charlie director matched rates of diagnosis without the Charlie director. After 2010, they largely stopped working with the Charlie director but their rates of diagnosis remained stable relative to the 2008 to 2010 time period. This suggests that, whatever their approach to diagnosis between 2008 and 2010 (when they sometimes worked with the director), it persisted even without director intervention.  

6.4.3 Little influence from outside each clinic

Our argument is that internal processes at each clinic contributed to stable differences in diagnostic practices and outcomes, but one might ask why the clinics were not influenced by external parties. For example, the clinics might be expected to learn from one another (Darr, 35)

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35 In the Appendix, I argue that this difference does not reflect coercion by more senior staff at Charlie.
Argote and Epple 1995). Knowledge transfer (Argote 1999) should lead to homogenous practices across clinics, especially within the same organization (Kogut and Zander 1996). As a second possibility, the central ASD office at Allied has authority over each clinic and it was the central office that imposed uniformity in the use of psychological instruments, team-based evaluation structure and rules for referral. Why did the central office not modify the practices at Alpha and/or Charlie (especially once Allied researchers noticed differences in diagnosis rates)? We argue that external stability was provided by the difficulty of transferring tacit knowledge and by the overwhelming shroud of uncertainty over ASD.

Knowledge transfer across clinics does not attenuate the differences in the diagnostic outcomes because the knowledge that generates the diagnostic differences is tacit and therefore difficult to transfer (Argote, McEvily and Reagans 2003; Hansen 1999; Nonaka 1995). Staff clinicians rarely interact with other ASD evaluators outside their clinic, though clinic directors do see one another more often when attending meetings. However, discussion is far too vague and abstract for clinicians and directors to reach consensus on diagnostic approaches. Clinicians are taught to put patient symptoms in a broader context and consider the family situation, comorbidities, and other evidence gathered during the evaluation. Tacit rules shape how these symptoms are interpreted for or against an ASD diagnosis. Although information may be exchanged (e.g., in a short conversation after unrelated meeting), the recipient does not have sufficient contextual information for that knowledge to be meaningful (as would be the case in a shared evaluation). Communication may be simply too thin to convince clinicians that a particular symptom should be interpreted differently, that they should update their tacit rules.
Senior managers outside the ASD clinics did not impose corrective actions because of the substantial uncertainty over ASD. While the Alllied researchers did suspect that differences in diagnostic approaches lead to different rates of diagnosis, they did not have enough independent evidence to motivate an intervention. Clinicians themselves speculated that, because Alpha and Charlie clinics cover largely different geographic areas, it was quite possible that the differences were attributed to different patient compositions, localized environmental factors, and referral patterns of primary care providers. They were unsure whether different diagnostic rates result from consistent practices with dissimilar patients, or inconsistent practices with similar patients. For example, one clinician at Charlie speculated that families in an area north of the clinic were more “loosey goosey” than those south of the clinic.

Even if senior managers at Allied were convinced that practices across the clinics were inconsistent, they would still be confronted with the larger mystery surrounding ASD prevalence. Because the true prevalence of ASD is unknown and estimates continually change in scholarly research, it is unclear which clinic required intervention. Senior managers did not know which clinic was most accurate in diagnosing true ASD cases: Alpha might have been over-diagnosing while Charlie might have been under-diagnosing, both might have been over-diagnosing, or both

They had not done the calculation presented in this paper shown on Table 2 using medical office and zip code fixed effects. Also, this is why the external review of Charlie clinic by the director’s former mentor did not prompt intervention. Her conclusion was consistent with the possibility that diagnostic practices were uniform, while patients were different. The belief in uniform practices has a certain appeal because acknowledging differences raises uncomfortable questions about service quality which cannot be easily resolved.
may be under-diagnosing. When a gold standard outcome is unavailable and there is no
benchmark against which to assess performance, practitioners often strive to enforce the integrity
of processes (e.g. Lind and Tyler 1988). Accordingly, the formal aspects of the diagnostic process
are the same across clinics, but formal aspects alone are insufficient for ensuring similar diagnostic
outcomes.

7 Discussion

7.1. Imprinting variation in organizational adaptation

Let us summarize the empirical findings of this study. Allied Health initiated
organizational change in response to the passage of the state Mental Health Parity law and did so
in a way consistent with the contemporary scholarly conception of ASD. Three clinics were
established but, unexpectedly, diagnostic outcomes varied considerably across clinics. Evidence
indicates these differences are not driven by different patient populations but instead, are driven
by different clinical orientations towards diagnosis. Alpha clinic emphasizes standardization and
sensitivity, while the Charlie clinic emphasizes on professional judgment and on specificity. These
orientations were the consequence of a combination of factors – the degree of interpretation
required in apply of formal diagnostic criteria, the lack of pre-existing conceptions of ASD
diagnosis by clinicians, and influential individuals at each clinic with contrasting approaches to
diagnosis. These orientations appear to persist over time because of the rotating, team-based
structure of evaluations. While each of these empirical details may seem unsurprising and even
prosaic, together they provide considerable theoretical insight.
These events teach us about the theoretical relationship between imprinting and organizational adaptation to field-level change. The case of ASD diagnosis at Allied demonstrates the concept of *imprinting variation*, which is an organizational outcome consisting of: (1) the shaping by prior imprints of a particular distribution of new practices and (2) the locking-in of these practices at a sub-unit level.

To elaborate on the first element, while neoinstitutional theory and social contagion can explain Allied’s formal commitment of resources and increased ASD diagnosis organization-wide, they offer little to explain the precise pattern of diagnosis at Allied, namely variation in diagnostic rates across clinics. Variation in ASD diagnoses across clinics is driven by an adaptation process that unintentionally incorporated existing elements from the organization--directors and their ASD mentors--and generated a set of diagnostic practices that became imprinted at the clinic level.

Differences in the diagnostic orientation of each clinic were seeded by differences between the initial directors, their training, and prior relationships to ASD experts. Acquired during a sensitive time period and persisting over time, the diagnostic approach of Charlie director reflects an individual imprint shaped by early educational experiences (e.g. Ding 2011; Tilcsik 2010). Similarly, the relationship between Alpha director and the consultant at Alpha developed during a formative stage in psychiatric education and can be understood as part of a network imprint (e.g. Marquis 2003; McEvily, Jaffee and Tortoriello 2012); it was this social tie that led to the

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37 In the Appendix, we consider two other theoretical accounts – institutional logics and translation – but argue that neither explains our empirical findings as well as imprinting variation.
consultant’s involvement and influence at Alpha. The imprints on the initial directors in turn shaped the diagnostic orientations at each clinic. The new theoretical insight is that, when field-level changes prompt the organization to adapt, the distribution of prior imprints can shape the pattern of new practices.

To elaborate on the second element, as the organization undertook change, a second set of imprints emerged at the clinic level. The orientations of initial directors were particularly influential because almost none of the newly hired staff had prior experience diagnosing autism and learned on-the-job at each clinic. These differences persisted because the team-based nature of evaluations served to lock-in the informal diagnostic rules that are continually negotiated and reinforced at each team-based evaluation.

This study demonstrates the importance of imprinting under a strict set of conditions under which homogeneity would be expected. While prior research has argued that imprints can persist in the face of market selection pressures (Baron, Burton and Hannan 1999), markets are rarely perfectly competitive and firms, given some distinctive capability, may survive despite deviating on some dimensions from homogeneity. This paper shows that imprints can also persist even in the face of direct intervention by organizational actors. That imprinting still matters under conditions where institutional and internal organizational factors promote homogeneity is evidence that imprinting is a more powerful and more ubiquitous organizational process than has been previously recognized.

This work also offers insight into the organizational mechanisms of imprinting. With few exceptions, previous scholars infer imprinting based on a correspondence between initial conditions
and present-day organizational behavior. The act of imprinting is left a conceptual black box.

Prior work understates the degree of organizational work involved in the formation of an imprint, essentially relegating the act of imprinting to a conceptual black box. It is deceptively easy to use imprinting to explain an observed empirical pattern *post hoc*.

By offering further insight into the mechanisms of imprinting, this paper provides leverage for unpacking boundary conditions. Seemingly minor decisions had a startling effect on the nature of new practices. The decision to select particular individuals to serve as the initial directors set into motion a sequence of events that amplified pre-existing individual differences into clinic-level differences. While the individual-level imprints had already been in existence in the organization, they effectively remained latent until Allied decided to reform its diagnostic practices for ASD. Paradoxically, it was the effort to adapt and conform to field-level changes that in a sense “activated” these imprints and led to clinic differences.

Counterfactual scenarios are illustrative here. Consider the Allied health care providers who were *not* selected for the initial director position; whatever their background with ASD and their diagnostic orientation, it was essentially irrelevant in shaping the clinic- and organization-level practices. In effect, the decision not to choose these individuals neutralized the effect of any prior imprints they may have had. A similar logic applies to staff clinicians; as illustrated in the group of clinicians who moved from Alpha to Charlie, any prior imprints on newly-hired staff were negated.

Alternative ways of staffing the evaluation teams may have led to drastically different diagnostic patterns. Diagnostic orientations persist at the clinic level because of the way ASD
evaluations are staffed – on a rotation basis with other members of the same clinic. If Allied had decided to establish a single large clinic or rotate individuals between clinics, it would likely eliminate variation (and the Allied case could have been seen as a standard case of neoinstitutional theory). Similarly, if membership in evaluation teams was not rotated and clinics worked with a long-term partner, our argument suggests that diagnostic variation would be at the team, rather than the clinic level. The decision to structure clinic staffing in a particular way made diagnostic variation a clinic-level, not an individual-level or an organizational-level, property.

7.2 Where else might there be imprinting variation?

This paper describes how imprinting variation arises at a large health care organization. While the prevalence of imprinting variation is ultimately an empirical question, there is reason to believe that it is fairly common.

First, imprinting variation is likely to occur when organizations adapt in response to field-level change regardless of the level of resistance or attempts at customization. In the Allied case, we ruled out the usual explanations of resistance and customization as drivers of diagnostic variation, which was essential for identifying a new source of variation. However, there is no reason to expect that imprinting variation is limited to cases when organizations neither experience resistance or nor pursue customization. It is instead likely that the effects of prior imprints co-occur with other drivers of practice variation but have simply not been recognized by prior research.
Second, imprinting variation should be possible wherever organizational actors have some degree of discretion, which includes many professional settings. The case of health care may at first seem unusual in that clinicians have advanced degrees and a great deal of autonomy within the organization. However, there is no reason to expect imprinting variation is limited to only cases with a high degree of discretion. Elements of prior practices may infiltrate adaptation efforts because new practices are ultimately developed and implemented by individual actors who have come to embrace the assumptions of prior imprints. Individuals are the top of the organization may envision a uniform set of practices in the abstract but they are divorced from practices on the ground and must rely local actors to implement new practices. So long as local actors are left to formulate some portion of the organizational response to field-wide change, prior imprints practices should shape organizational adaptation.

7.3 Implications for medical variation and autism epidemiology

This paper also offers insights for healthcare scholars and policymakers. The literature on small area variation attempts to explain substantially different rates of health care expenditures and surgical rates among nearby geographic areas (Wennberg and Gittelsohn 1973). A major explanation is the development of physician-specific practice styles (Epstein and Nicholson 2009; Grytten and Sørensen 2003) that affects the use of surgical procedures, spending, and ordering of tests. Evidence shows that these practice styles can be stable, even after moving to a new work location.

Our findings suggest that, in the case of team evaluations of very difficult-to-diagnose disorders, practice styles may be a property of the workgroup rather than the individual. Most
poignantly, this is illustrated by the groups of clinicians who moved from Alpha clinic to Charlie clinic. Along with Wennberg (2010), we point out how tacit forces at the local organizational level can constrain physician-specific behavior. This paper however goes further by articulating a sociological account of the behavior of health care providers and resulting clustering of medical practices.

For epidemiologists and policy-makers focused on autism, this paper can help explain two puzzling patterns in observed cases of ASD. First is the drastic increase in the number of ASD cases in recent decades, with the autism caseload in California increasing by more than 600% (Croen et al. 2002; Fombonne 2003; Newschaffer et al. 2007). Second is the clustering of autism cases in select geographic hot spots, where local autism incidence is approximately twice that of surrounding areas but cannot be satisfactorily explained by known localized risk factors (Hagberg and Jick 2010; Hertz-Picciotto and Delwiche 2009; King and Bearman 2009). This paper proffers a new explanation for both patterns.

Geographic clustering of ASD cases may reflect the distribution of clinicians with particular diagnostic approaches. The differences between Alpha clinic and Charlie clinic likely reflect of diagnostic uncertainty in the broader community of health care professionals. If anything, we would expect variation to be attenuated within a single organization, Allied Health. The roughly 30 percentage point difference found within Allied likely underestimates the diagnostic variation at large.

Similarly, increased ASD diagnosis may be driven by the distribution of health care providers who have specialized in ASD in recent years and have been affected by recent public
and scholarly debates. Although it is common wisdom that autism awareness has led to the increase in ASD diagnosis, the mechanisms are unclear. This work suggests that the ASD increase may in part reflect a rise in a new generation of diagnosticians who have been shaped by the current progressive orientation towards diagnosis.

### 7.4 Future Research

These findings suggest several areas for future research. First, because this study uses retrospective accounts, the description of past events may be incomplete and inaccurate (Christensen-Szalanski and Willham 1991; Golden 1992; Podsakoff et al. 2003). We attempted to mitigate these concerns by relying on the testimony of multiple respondents and triangulating accounts with historical documents and quantitative data, e.g., patterns in the electronic medical records. The argument laid out in the paper is based on a constellation of quantitative and qualitative evidence from which a coherent account is weaved. Future research could use data collected in real time as an organization adapts to environmental changes.

Second, our data collection efforts deliberately focused on Alpha and Charlie because they represented the most extreme outcomes. Based on a logic of theoretical sampling, we believe this choice offered the greatest theoretical insight given a finite amount of research resources. From our current understanding of Bravo, there is nothing inconsistent with the grounded account of the differences between Alpha and Charlie and, more importantly, there is no evidence that contradicts the broader theoretical findings of this paper. Future research could examine a larger number of intra-organizational units, from which an even richer research findings might be extracted.
8 Conclusion

Adaptation and inertia appear to be two sides of the same coin: pressures for adaptation seemingly compete with pressures for inertia and one or the other dominates in any given case. The finding in this paper is surprising because it demonstrates a more complex and complementary relationship between the two. Imprints, typically associated with inertia, can play two roles during organizational adaptation to field-level change. First, existing imprints on key individuals can serve as the raw materials for new practices as organizations implement change. Meyer and Rowan (1977) write “the building blocks for organizations come to be littered around the societal landscape; it takes only a little entrepreneurial energy to assemble them into a structure” (p345). This paper takes this insight a step further by showing that the building blocks of new practices can be found not only in the societal landscape, but also in the existing practices and network ties of the organization. The effect of existing practices can be unintentional and emerge only during efforts to adapt.

Second, existing imprints can play a role in locking in the new practices post-adaptation. As new practices take hold within organizations, practices can become stable and persist despite limited managerial oversight. Organizational decisions, seemingly-minor, can shape the way that new practices are imprinted. In these ways, imprinting plays a subtle but significant role in shaping and lending persistence to organizational adaptation to field-level change.
**Tables and Figures**

**Figure 1: New ASD diagnoses in Allied Health, 1994-2012**

*Source: The state’s Developmental Services agency.*
Figure 2: Percent of cohort diagnosed with ASD by age 5

Birth Year (cohort)

ASD Prevalence

Fraction of all child psych diagnoses

ASD prevalence

ratio of cohort percentage diagnosed with ASD to cohort percentage diagnosed with any child psychiatric disorder
Figure 3: Observed rates of diagnosis at three clinics

Note: 95% confidence intervals shown.
Figure 4: Diagnosis rates of individual clinicians

*The index variable is based on an underlying randomly assigned number drawn from the uniform distribution between 0 and 1. Observations are sorted in value and assigned an ordinal rank. This rank is the index variable.
Figure 5: Distribution of diagnosis in Alpha and Charlie clinics*

Note: Visits with multiple diagnoses are omitted. The individual bars from left-to-right correspond to the list from top-to-bottom. For example, the leftmost bar is Autism Spectrum Disorder, the next bar is Specific delays in development, etc. The small width of some bars made differentiation through fill patterns difficult.
Figure 6: Rates of diagnosis at Alpha and Charlie clinics, 2005–2012*

*with 95% confidence bands
Figure 7: Evaluation networks at Alpha clinic*

*Tie represents joint evaluation of a single patient; square node is the founding director

Panel 1: Week of May 3, 2010

Panel 2: Monday, May 3

Panel 3: Tuesday, May 4

Panel 4: Wednesday, May 5

Panel 5: Thursday, May 6

Panel 6: Friday, May 7

Panel 7: Year of 2010
Figure 8: Average probability of diagnosing ASD for the “movers” by clinic*

*with 95% confidence bands
Figure 9: Clinic evaluations involving founding director

Panel 1: Alpha clinic

Panel 2: Charlie clinic

Panel 3: Movers at Alpha and Charlie clinic
Figure 10: Evaluations and diagnosis rates of Alpha clinic

Note: Our main analyses are based on data of eight birth cohorts, but this does not represent all Allied patients seen at Alpha clinic. The data used to produce this figure is based on all patients seen at Alpha, which was drawn from a proprietary database maintained at Alpha clinic.
Figure A 1: Average probability of diagnosing ASD for the “movers” with and without senior clinicians

Note: 95% confidence bands shown.
### Table 1: Descriptive statistics of sample

<table>
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<th></th>
<th>Mean Full sample</th>
<th>Std Dev Full sample</th>
<th>Mean with ASD</th>
<th>Mean without ASD</th>
<th>Mean Alpha patients</th>
<th>Mean Bravo patients</th>
<th>Mean Charlie patients</th>
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<td>34.26</td>
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<td>33.06</td>
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<td>N (visits)</td>
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<td>3957</td>
<td>2063</td>
<td>1894</td>
<td>1482</td>
<td>964</td>
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</table>
Table 2: Regression results

Linear Probability Models
Outcome: 1[diagnosis of ASD]

<table>
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<tr>
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<th>M1</th>
<th>M2</th>
<th>M3</th>
<th>M4</th>
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<tr>
<td>Alpha clinic</td>
<td>0.31***</td>
<td>0.28***</td>
<td>0.317***</td>
<td>0.36***</td>
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<tr>
<td></td>
<td>(0.02)</td>
<td>(0.03)</td>
<td>(0.03)</td>
<td>(0.05)</td>
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<tr>
<td>Bravo clinic</td>
<td>0.04+</td>
<td>0.02</td>
<td>0.03</td>
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<td></td>
<td>(0.02)</td>
<td>(0.03)</td>
<td>(0.06)</td>
<td>(0.09)</td>
</tr>
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<td>Male</td>
<td>0.05*</td>
<td>0.05*</td>
<td>0.07*</td>
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</tr>
<tr>
<td></td>
<td>(0.02)</td>
<td>(0.02)</td>
<td>(0.03)</td>
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</tr>
<tr>
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<td>-0.09</td>
<td>-0.16</td>
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<tr>
<td></td>
<td>(0.12)</td>
<td>(0.11)</td>
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<tr>
<td>Asian</td>
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</tr>
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<td></td>
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<td>(0.11)</td>
<td>(0.17)</td>
<td></td>
</tr>
<tr>
<td>Black</td>
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<td>-0.11</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.12)</td>
<td>(0.12)</td>
<td>(0.17)</td>
<td></td>
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<td>-0.16</td>
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<td></td>
<td>(0.12)</td>
<td>(0.12)</td>
<td>(0.17)</td>
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<td>(0.12)</td>
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<tr>
<td>Age</td>
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<td>0.01</td>
<td>0.01</td>
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<td></td>
<td>(0.004)</td>
<td>(0.01)</td>
<td>(0.01)</td>
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<td>Mother education (1-7)</td>
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<td>-0.00</td>
<td>-0.00</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.01)</td>
<td>(0.01)</td>
<td>(0.01)</td>
<td></td>
</tr>
<tr>
<td>Mother age</td>
<td>-0.00</td>
<td>-0.00</td>
<td>0.00</td>
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</tr>
<tr>
<td></td>
<td>(0.00)</td>
<td>(0.00)</td>
<td>(0.00)</td>
<td></td>
</tr>
<tr>
<td>Father education (1-7)</td>
<td>0.01</td>
<td>0.01</td>
<td>0.00</td>
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</tr>
<tr>
<td></td>
<td>(0.01)</td>
<td>(0.01)</td>
<td>(0.01)</td>
<td></td>
</tr>
<tr>
<td>Father age</td>
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<td>0.00</td>
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<td></td>
</tr>
<tr>
<td></td>
<td>(0.00)</td>
<td>(0.00)</td>
<td>(0.00)</td>
<td></td>
</tr>
<tr>
<td>Visit number</td>
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<td>0.03*</td>
<td>0.02+</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.01)</td>
<td>(0.01)</td>
<td>(0.01)</td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>0.35***</td>
<td>0.23+</td>
<td>0.21</td>
<td>0.40*</td>
</tr>
<tr>
<td></td>
<td>(0.02)</td>
<td>(0.13)</td>
<td>(0.15)</td>
<td>(0.19)</td>
</tr>
</tbody>
</table>

Year FE: Yes, Office FE: Yes, Zip code FE: Yes, Clustered robust SE: Yes
N: 3957, 3726, 3726, 2608

+ p < 0.1, * p < 0.05, ** p<0.01, ***p<0.001
Table 3: DSM-IV-TR Criteria for ASD

A. Qualitative impairment in **social interaction**, as manifested by at least two of the following:
   1. marked impairments in the use of multiple nonverbal behaviors such as eye-to-eye gaze, facial expression, body posture, and gestures to regulate social interaction
   2. failure to develop peer relationships appropriate to developmental level
   3. a lack of spontaneous seeking to share enjoyment, interests, or achievements with other people, (e.g., by a lack of showing, bringing, or pointing out objects of interest to other people)
   4. lack of social or emotional reciprocity (note: in the description, it gives the following as examples: not actively participating in simple social play or games, preferring solitary activities, or involving others in activities only as tools or 'mechanical' aids)

B. Qualitative impairments in **communication** as manifested by at least one of the following:
   1. delay in, or total lack of, the development of spoken language (not accompanied by an attempt to compensate through alternative modes of communication such as gesture or mime)
   2. in individuals with adequate speech, marked impairment in the ability to initiate or sustain a conversation with others
   3. stereotyped and repetitive use of language or idiosyncratic language
   4. lack of varied, spontaneous make-believe play or social imitative play appropriate to developmental level

C. Restricted **repetitive and stereotyped patterns of behavior**, interests and activities, as manifested by at least two of the following:
   1. encompassing preoccupation with one or more stereotyped and restricted patterns of interest that is abnormal either in intensity or focus
   2. apparently inflexible adherence to specific, nonfunctional routines or rituals
   3. stereotyped and repetitive motor mannerisms (e.g hand or finger flapping or twisting, or complex whole-body movements)
   4. persistent preoccupation with parts of objects
Table 4: Regression models for other diagnoses

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>Coefficient of Alpha indicator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Autism Spectrum Disorder**</td>
<td>0.32***</td>
</tr>
<tr>
<td>Autistic disorder</td>
<td>0.23***</td>
</tr>
<tr>
<td>Asperger’s disorder</td>
<td>0.09*</td>
</tr>
<tr>
<td>Pervasive development disorder - NOS</td>
<td>-0.00</td>
</tr>
<tr>
<td>Specific delays in development (e.g. language disorder)</td>
<td>-0.13***</td>
</tr>
<tr>
<td>Neurotic disorders (e.g. obsessive-compulsive disorder)</td>
<td>-0.06**</td>
</tr>
<tr>
<td>Hyperkinetic syndrome (e.g. ADHD)</td>
<td>-0.09***</td>
</tr>
<tr>
<td>Emotional disturbance (e.g. selective mutism)</td>
<td>0.00</td>
</tr>
<tr>
<td>Other mental retardation</td>
<td>0.00</td>
</tr>
<tr>
<td>Episodic mood disorders (e.g. bipolar disorder)</td>
<td>0.00</td>
</tr>
<tr>
<td>Disturbance of conduct not classified</td>
<td>-0.04**</td>
</tr>
<tr>
<td>Mild mental retardation</td>
<td>-0.01*</td>
</tr>
<tr>
<td>Moderate to profound mental retardation</td>
<td>-0.00</td>
</tr>
<tr>
<td>Other mental retardation</td>
<td>0.00</td>
</tr>
<tr>
<td>No psychiatric diagnosis</td>
<td>0.00</td>
</tr>
</tbody>
</table>

+ p < 0.1, * p < 0.05, ** p<0.01, ***p<0.001

Note: Models are the same as M3; they include controls for patient characteristics, year dummies and pediatrician office fixed effects, but use different outcome variables.

Autism spectrum disorder is an umbrella term that includes several more specific disorders including: Autistic disorder, Asperger’s disorder, and Pervasive development disorders – NOS (not otherwise specified).
Appendix

A.1. Assessing the selection problem in regression models

It is worthwhile at this point to discuss one possible issue with this analysis: selection. It is well-known that fixed effects analysis can be undermined by the presence of selection (Ashenfelter and Card 1985). While clinics cannot pick and choose patients, patients have some latitude to select a clinic; patients are automatically referred to a clinic based on catchment area, but Allied would honor a specific patient request to go to a different clinic. Although much of the within-pediatric office variation comes from organizational changes to the catchment area, some may be driven by parent requests. This section assesses the magnitude of this problem and argues that this is ultimately a minor issue.

First, there are reasons to believe patient-driven selection is not common. The distance between centers (about two hours apart) makes it impractical for parents. Two hours may not seem very problematic for most people, but it is more difficult for parents who have a child with behavioral problems. It might also be possible to get some estimate of the number requesting particular clinics by looking at the number of patients who seek second opinions from another clinic. Of the 3112 patients seen at the clinic, 819 are seen at least one more time and only 53 patients (6.5%) go to a different clinic. Of the 53, up to 30 may be because the alternate clinic was not open at the time of the visit to the first clinic. If switching clinics is uncommon, then requesting a different clinic at initial referral is likely to be just as uncommon and almost certainly would not be frequent enough to drive a roughly 30% difference between the clinics.
The second reason selection is a minor issue is that, even if it did occur, the direction of bias is unclear and bias would rely on fairly strong assumptions about parents. It is unclear whether parents seek out or avoid ASD diagnoses. On one hand, government and school services are available to children with autism, giving parents some incentive for a positive diagnosis. On the other hand, autism carries life-long consequences for the family, and parents may defend and normalize their children’s behavior as long as possible. Systematic bias requires a belief one way or the other by parents. Because it is unclear how many parents seek out a diagnosis, how many avoid a diagnosis and how many are neutral, it is unclear how parent selection would result in bias.

Even if we are willing to assume parents systematically seek (or avoid) an ASD diagnosis, other assumptions about parents are still necessary. Selection is only a problem when it changes characteristics of the treatment group and these characteristics are associated with the outcome variable, e.g., in estimating the economic returns to schooling, individuals with higher “ability” tend to choose more schooling. For it to be a problem here, we would have to be willing to make several assumptions about parents, without which there would be no bias. First, we would have to assume that enough parents have knowledge of each clinic’s reputation. If we do not assume this, then there can be no bias from parent preferences. Second, we would have to assume that enough parents have some estimate of their child’s likelihood of having ASD. If we do not assume this, then selection is essentially random with respect to ASD risk, i.e., high and low risk parents are going out of catchment area, leading to no net change in the clinic probability of ASD; there is no bias from parent preferences.
Even if we are willing to make the first *two* assumptions, then bias still depends on a third assumption, that parents’ decisions to seek (or avoid) an ASD diagnosis is correlated with their ASD risk estimate. If parents seek or avoid an ASD diagnosis but this is not correlated to their ASD risk estimate, then selection is also essentially random with respect to ASD risk. Even if it is correlated, then it must be correlated in a particular way. Parents seeking a diagnosis must be more inclined to choose Alpha when ASD risk is high (or parents avoiding a diagnosis must be inclined to choose Charlie when ASD risk as low). More likely, the opposite is true. Parents seeking a diagnosis will be more inclined to choose Alpha when ASD risk is low because it is when ASD risk is low when choosing Alpha confers the greatest benefit (or parents avoiding a diagnosis will be more inclined to choose Charlie when ASD risk is high because it is when ASD risk is high that choosing Charlie confers the greatest benefit). When the opposite is true, parent selection actually works against the regression results.

A.2. **The diagnostic process at Allied Health**

Autism is characterized by impairments in three general areas: impairments in social interaction, impairments in communication, and repetitive and stereotyped behavior. The DSM lays out four criteria for each area and requires patients meet a threshold number of criteria. At Allied, clinicians describe their work as first attempting to develop a complete picture of the child’s history and pattern of development, before reviewing and making a diagnosis based on the DSM-IV-TR criteria. Over one or more full days at the clinic, health care providers conduct a series of psychological tests (including the ADOS), interview the parent or guardian, and review
the responses from standardized questionnaires as well as the patient’s medical and psychiatric history. A fairly typical set of psychological tests would include a speech test (e.g. Preschool Language Scales, Fifth Edition), an adaptive skills test (e.g. Adaptive Behavior Assessment System, Second Edition), a cognitive test (e.g. Mullen Scales of Early Learning), and an autism specific test (i.e. the ADOS). Standardized questionnaires would be completed beforehand and include the Child Behavior Checklist (completed by a parent) and the Teacher’s Report Form (completed by a teacher). The parent interview would be structured based on the Autism Diagnosis Interview (ADI-R) instrument.

After these data are collected, clinicians working in teams of two or more discuss the findings from each instrument and create a profile of the patient’s deficiencies and strengths. They then walk through each of the DSM criteria and make a diagnosis.

A.3. Robustness check: senior clinicians and the movers

One may worry that the new lower diagnostic rate of the moving clinicians may have been driven by coercion by not just the founding director but all senior clinicians. Although they joined Charlie when it was first started, there were three clinicians who had worked together in an informal mini-clinic. Consistent with the master-apprentice model of training at Charlie, they were treated as junior members of the evaluation team and were almost always paired with a senior clinician, i.e., a clinician who had worked at the informal mini-clinic that was a precursor to Charlie. Therefore, the drop in diagnostic rates could just as easily be explained as the senior clinicians trumping junior clinicians.
However, Charlie clinic continued to hire new clinicians and senior clinicians participated on a smaller share of evaluations (See Figure 9). Even as the percentage of evaluations conducted with senior clinicians declined, the rates of diagnosis remained stable. It appears that the clinical judgment of the movers remained stable even as they were conducting evaluations with each other or newly hired clinicians. confirms this by showing that the rates of ASD diagnosis both working with and without senior clinicians remained the same. The overall interpretation is that movers’ informal rules for diagnosis changed once they moved to Charlie and, while it may have been though pressure from senior clinicians at the beginning (e.g., through dominance, persuasion, teaching, etc.), a new stable set of informal rules was established and drove consistent ASD diagnosis thereafter.

[Insert here]

A.4. Two alternative interpretations - institutional logics and translation

It is worth considering two other scholarly perspectives – besides resistance and customization - that might offer an alternative interpretation of the research findings. Some scholars might contend that the observed pattern could be explained by a translation interpretation. This interpretation highlights the socially constructed nature of adoption and contends that institutionalized meanings simply do not diffuse, but are actively reshaped by local actors (Czarniawska-Joerges and Sevón 2005; Sahlin-Andersson 1996; Zilber 2006). Actors construct idiosyncratic problems, solutions and rationalized myths which then drive adaptation. This interpretation is not incorrect but our explanation is more precise in identifying the role of
imprints in the way the adaptation is enacted and the way that new practices come to exhibit persistence over time.

According to an institutional logics approach, variation in practices may be a consequence of overlapping and conflicting institutional orders (Friedland and Alford 1991; Greenwood et al. 2011). When multiple logics apply to a single organization, actors have latitude in choosing a justifiable response (McPherson and Sauder 2013). An institutional logics interpretation of ASD diagnosis at Allied might be that tension between conflicting institutions is resolved differently across clinics. However, it is not apparent what those conflicting institutions might be. There are certainly different approaches to the diagnosis of autism at the clinics, which reflect long-standing debates in medicine. Perhaps this part of the allied story could be explained in terms of the medical logics of science and care (Dunn and Jones 2010) along with a logic of professions (Thornton and Ocasio 1999), but such an account would still ultimately require an explanation for why logics were resolved differently across clinics and how the differences remained stable over time.
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