Physician Behavior and Health Outcomes

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UNIVERSITY OF OSLO
HEALTH ECONOMICS
RESEARCH NETWORK
Working paper 2023:3

Health Economics Research Network at the University of Oslo
ISSN 1501-9071 (print version.), ISSN 1890-1735 (online), ISBN 978-82-7756-277-3

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Abstract: There is increasing empirical evidence of patient harm and resource waste from over-diagnosis, over-treatment, medical errors, and the underuse of effective care. This chapter reviews recent literature on physician behavior and health outcomes. Research on the economics of physician behavior takes a classical economic perspective based on using financial incentives to solve information problems in healthcare markets. The evidence on payment methods, competition and market organization, and information interventions is summarized. Incentives matter, but may matter less in the presence of altruistic motives amongst most physicians, as well as the presence of complex multi-tasking decision environments. More contemporary research on physician behavior has taken a behavioral perspective where it is acknowledged that physician decision making can be biased even in cases where incentive and information problems are absent. The large health services research literature on professional behavior change incorporates behavioral and psychological perspectives yet integration into economic models of physician behavior is still in its early stages. Though research on incentives continues to dominate the health economics literature, evidence suggests that behavioral approaches are important not only in understanding incentives, but in changing physicians' behavior using non-pecuniary interventions.

1 Introduction

Physicians play a central role in providing medical care to restore and improve health and well being, alongside patients' own health-related behaviors and human capital and health investments. In most countries, the aim of health policy is to ensure the provision of high-value (efficient) health care and fairness in access to healthcare for the population. Population ageing, the rising prevalence of chronic conditions and technological innovation continue to influence health policy and the optimal allocation of resources to meet societal goals. But to improve efficiency and equity of medical care, it is necessary to first change the behavior of physicians who hold significant market power due to the peculiarities of health and healthcare.

In his seminal analysis of medical care markets, Arrow (1963) takes the perspective that the widespread societal demand for restricting entry to the medical profession must result from significant market imperfections. By describing how the potential for market imperfections is rooted in the inherent characteristics of the medical care market that clearly distinguish it from the competitive market of neoclassical economics, Arrow inspired a research agenda that formed the basis of Health Economics.

An unregulated market for medical care will create incentives for rational decision-makers to behave in ways that are bad for society's aggregate welfare. The issue is then how to regulate the market to achieve desirable societal outcomes, usually defined as efficiency and horizontal equity. Of particular relevance to this chapter is the asymmetry of information between doctors and patients, which creates a weak demand side characterized by a lack of information and choice. This principal-agent relationship, and the possibility for supplier-induced demand, where the supplier exploits

*Financial support by the Research Council of Norway's grant to NORCHER (grant No. 296114) and the National Health and Medical Research Council Partnership Centre on Health System Sustainability (9100002) is acknowledged.

asymmetric information to provide health services that would not have been demanded by an informed patient, creates the need for careful regulation and the design of financial incentives and markets to motivate rationally behaving decision-makers to choose the optimal solution for their patients and society.

For many years, financial incentives through financing, payment mechanisms, and market structure, have become core in economics research in attempting to influence physician behavior. This research has been complementary to a range of health policies that use funding mechanisms to change behavior to meet societal goals. Research specifically solving the informational problems themselves, the source of market imperfections, has included the conduct of economic evaluation alongside clinical trials that produce new evidence on the costs and benefits of the vast range of medical treatments and technologies. Some countries use this evidence to directly influence funding decisions. But the uptake and translation of this evidence into changes to doctors' behavior has been more difficult and, apart from the use of incentives such as pay-for-performance, is where economics researchers have traditionally played much less of a role relative to health services research and behavioral science, with (behavioral) economists only recently beginning to examine these issues using an economics lens.

Existing theoretical models of physician behavior have relaxed restrictive assumptions on the absence of imperfect information, transaction costs, non-homogeneous goods, and homogeneity in behavior. These models recognized long ago that physicians are altruistic which can mediate the effect of financial incentives (Mooney & Ryan 1993) though the measurement of physician altruism in laboratory experiments is much more recent (Hennig-Schmidt et al. 2011, Godager & Wiesen 2013, Li 2018, Wang et al. 2020).

Sometimes as 'nudges', financial incentives may prompt behavior change for some who are close to indifference or with a high marginal utility of income. Still, they may not cause fundamental changes for others with strongly held beliefs and low marginal utility of income, even with large financial incentives. However, the fact that some physicians continue to make choices that are bad for themselves, their patients and others, even when incentive failures are absent, has traditionally received little attention in the health economics literature. behavioral economics and parallel research in the medical literature using behavioral science shows us that humans — and therefore physicians — are imperfectly rational.

There is broad evidence that some medical care provided by physicians may not improve health and often do harm. Estimates suggest that around 60 percent of all health care provided is evidence-based and effective, and around 30 percent is waste, duplication or of questionable effectiveness. The remaining 10 percent represents iatrogenic illness, medical errors and adverse events (McGlynn et al. 2003, Berwick & Hackbarth 2012, Braithwaite et al. 2018, Shrank et al. 2019). These estimates do not use an economics framework and so do not include care that is not cost-effective, i.e. that is beneficial but too costly. The causes of this allocatively inefficient pattern of health care use are numerous and include inappropriate financing and financial incentives but can occur even when appropriate financial incentives are in place and so can be due to many other reasons (Saini et al. 2017).

Though principal agent models focus on physicians having more information than patients, physicians themselves have imperfect knowledge and beliefs that do not accord with evidence-based medical practice where such evidence exists. New information is costly to acquire, interpret and use for both physicians and patients. There is a range of behavioral biases and heuristics that can influence physicians' and patients' decision making (Saini et al. 2017). These drivers of behavior can provide new avenues of research to better understand how physicians can improve health outcomes in addition to using financial incentives. Financial incentives are sometimes necessary but not always sufficient to successfully change physician behavior.

The aim of this chapter is to review the literature on the relationship between physician behavior and health outcomes. The literature on the economics of physician behavior is relatively large, so the focus is on studies that link interventions targeted at physicians and which measure or use proxies for health outcomes. Studies that examine process and volume measures as outcomes, e.g. number

of referrals, prescriptions, services provided, were excluded unless the measures are compared to clinical guidelines, as by themselves they do not indicate an impact on health outcomes. This is not a systematic literature review, so it will be partly biased by the authors opinions and selection of studies to include. The aim is to include the most influential and recent studies to provide a constructive overview of current knowledge and the state of the art of contemporary empirical research. In addition, research in this area is multidisciplinary, and though the focus will mainly be on contributions from economics, key contributions from other disciplines are included when relevant.

The rest of this chapter is organized as follows. The first half of the chapter focuses on the more traditional economics literature on the role of financial incentives through different payment models for physicians and the role of market organization and competition and how these influences physicians' decisions and health outcomes. The final section of the chapter focuses on interventions that seek to change either consumer or physician information, such as feedback of information, social norms, and the public reporting of data on quality of healthcare providers. Contributions to behavioral economics, including lab experiments to study physician behavior, are highlighted throughout, and studies in behavioral science that do not use financial incentives are also included. The chapter concludes with a summary and sketches out an agenda for future research for economists working in this area.

2 Payment models for physicians

Health outcomes can be influenced by how physicians are paid (Ellis & McGuire 1990, Gosden et al. 2000, Robinson 2001, Petersen et al. 2006, Christianson et al. 2008, Mehrotra et al. 2009, Scott et al. 2011, Flodgren et al. 2011, Eijkenaar 2013, Jia et al. 2021). Physicians can be salaried employees or self-employed in private group practices. How they are paid usually depends on how health insurers contract with physicians. In most countries, fee for service (FFS) was the traditional method of payment, encouraging a higher volume of services (e.g. visits, procedures, diagnostic tests) compared to other forms of payment. FFS can also encourage over-treatment and over-diagnosis compared to salary and capitation (Jia et al. 2021).

Over the past 50-60 years, the growth of various forms of private and social health insurance to reduce out-of-pocket costs for patients has meant that fees are regulated or subsidised, or FFS has been either superseded by or blended with other forms of payment. These include salaried payment, where incentives for improved health outcomes are largely absent apart from subjective performance evaluations linked to progression up a salary scale or being fired for poor performance (Prendergast 1999). Capitation payment is where physicians with a registered list of patients are paid per patient, with payments risk-adjusted to ensure that the payment is higher for more costly and more complex patients. Otherwise, incentives exist to treat only the healthiest patients, thereby reducing access to medical care. Like salary, there are no direct financial incentives within capitation payment to increase health outcomes, apart from the possibility of losing or gaining patients depending on the extent to which patients can assess performance and switch physicians. Changes between FFS, salary and capitation payments contain incentives to change the volume of services provided and shift financial risk between providers and patients (Ellis & McGuire 1986). Increases in the volume of care provided can indirectly reduce health outcomes if it means physicians see more patients per hour. This could mean they rush and make mistakes and medical errors or do not spend enough time with patients leading to lower compliance with treatment recommendations (Saultz & Lochner 2005). However, FFS for primary care physicians means that they are more likely to look after patients themselves than to refer to more expensive specialized and hospital-based care. For example, Brekke et al. (2020) found that the probability of experiencing an emergency admission to a hospital within two weeks of a GP consultation is almost 16 percent lower for GPs paid by fee-for-service compared to those paid by salary.

More recently, laboratory experiments have been conducted in various countries with medical students and physicians, which also find that fee-for-service leads to over-provision of treatments relative to capitation, which leads to under-treatment. For example, Hennig-Schmidt et al. (2011)

show that under FFS payment, patients frequently received services in excess of the service quantity that maximises health benefits. Conversely, patients were more likely to receive fewer services than optimal under capitation. Other experiments have produced qualitatively similar results even when varying financial incentives and recruited subjects' characteristics (Godager et al. 2016, Brosig-Koch et al. 2016, Lagarde & Blaauw 2017, Keser et al. 2020, Wang et al. 2020).

2.1 Pay for performance

Pay for performance (P4P) is the only payment method with a direct link to the improvement of health outcomes. P4P can be targeted at processes (e.g. taking blood pressure) or at behaviors known to be correlated with improved health outcomes (e.g. making sure blood pressure is within a specific range according to clinical guidelines). Often blended into other existing payment models, P4P has been used and studied extensively across many countries, with most schemes from the US and UK (Roland 2004, Mullen et al. 2010). There have also been many systematic reviews of the effectiveness of these schemes (Christianson et al. 2008, Van Herck et al. 2010, Diaconu et al. 2021, Eijkenaar 2013, Petersen et al. 2006, Scott et al. 2011, 2018, Zaresani & Scott 2021). Over the years, these reviews have found that P4P has mixed results on behavior. This seems to hold across many countries and settings. Most of these systematic reviews are narrative reviews — that is, they synthesise the results qualitatively and do not conduct quantitative meta-analysis, mainly because of the wide heterogeneity in outcomes and intervention designs. One recent study by Zaresani & Scott (2021) overcame this challenge, and the meta-analysis found that from 116 studies that evaluated 62 P4P schemes, close to 50 percent of effect sizes were statistically significant.

A range of reasons is proposed as to why many of these schemes do not work. In many cases, there is poor reporting of the specific design of each scheme. Thus, it is difficult to empirically examine the mechanisms behind the success or failure of these schemes and difficult to replicate the design. Though many reviews cite the often low size of incentives (often less than 5 percent of revenue), Zaresani & Scott (2021) show that the size of incentives was not associated with the probability of a statistically significant effect size. Prendergast (1999) and others cite multi-tasking concerns. In jobs where workers undertake many different and complex tasks, such as in healthcare, the focus of P4P on one or two measurable outcomes may lead to an increase in those outcomes. This could come at the cost of reducing effort on other outcomes, many of which are unobservable, such that the net impact of the scheme could be negative or negligible. Notably, very few empirical studies examine these spillover effects because the full range of activities and their outcomes cannot be observed in healthcare. However, there is some evidence that spillover effects can be positive (Sutton et al. 2010, Sherry et al. 2017). Strong P4P schemes can also lead to gaming and other unintended consequences (Gravelle et al. 2010). It could be that schemes with strong incentives are less necessary where altruism or intrinsic motivation is strong (Mooney & Ryan 1993, Kolstad 2013). The presence of altruism being used to argue for less strong P4P is similar to external incentives crowding out intrinsic motivation. However, again there is little empirical evidence of the crowding-out effect of P4P in healthcare. There is also the issue that many schemes make the measurement of performance and comparison with peers explicit, which may impact behavior in its own right, separate from the effect of the financial incentive.

Another issue is the salience of such schemes to physicians working in large organizations such as hospitals or large medical groups where the payments are made to the organization and possibly not separated from other payments. It is far from clear in most published studies if and how these payments are devolved to physicians and/or their teams (Kristensen et al. 2014).

A final issue is that in many case,s the empirical study design is of poor quality. This has been shown consistently across systematic reviews (Scott et al. 2011, Diaconu et al. 2021). Zaresani & Scott (2021) show that studies that use randomized controlled trials or difference-in-difference methods have a lower probability of finding a statistically significant effect size relative to studies that use weaker study designs.

3 Market organization and physician behavior

There is a rich diversity in how health care is organized and provided. There is no consensus on how to best organize the healthcare sector to encourage efficiency and equity. In terms of physicians, market entry is usually heavily regulated through education capacity, legal requirements of licensing and certification and lengthy training requirements to ensure minimum quality standards. These regulations often come at the cost of the flexibility of supply and distribution to changes in need and demand. Market structure is sometimes influenced by regulations around where physicians can locate, including policies directing physicians to rural areas or areas of high health care need. On the demand side, consumers maybe encouraged to exert choice or to enrol/register with healthcare providers. These regulations are also influenced by informational deficiencies on the demand and supply side.

3.1 Do more doctors lead to better health?

Increased physician supply can lead to improved health by reducing the costs of accessing medical care and by improving health through increased competition. However, more doctors might not always be optimal. The marginal benefit of an extra doctor can be less than the marginal cost, for example, in countries or geographical areas where physician supply is already high. The opportunity costs of increasing the number of doctors include the forgone benefits of other policies that impact health and wellbeing (e.g. education, sugar taxes, other health professionals). Increased physician supply will only lead to health improvements if treatments provided are effective, and this outweights the iatrogenic and psychological harms of low- value (ineffective) healthcare and medical errors. Often the focus is on health outcomes defined in terms of reductions in mortality and morbidity, or increased Quality Adjusted Life Years (QALYs). However, doctors can also increase utility and wellbeing even if health outcomes do not improve since patients value the provision of information and reduction in anxiety independently of health improvements, and society values the equitable distribution of doctors.

Most empirical studies focus on the supply of primary care physicians. The most cited studies find positive correlations between primary care physician supply and health outcomes (e.g. Macinko et al. 2003, Laditka 2004, Starfield, Shi & Macinko 2005, Riehm et al. 2019). Similar studies find no positive effects of more specialists on population health (Shi et al. 2004, Starfield, Shi, Grover & Macinko 2005).

Endogeneity is a key issue in this literature and studies have used a variety of approaches to account for this. Gravelle et al. (2008), Morris & Gravelle (2008), Basu et al. (2019), Farahani et al. (2009) and Bailey & Goodman-Bacon (2015) found a positive impact of primary care physicians on health outcomes. Iizuka & Watanabe (2016) found that reducing the number of physicians led to worse health outcomes. Aakvik & Holmås (2006) found no effect of the number of GPs on mortality rates in Norway, but Kinge & Grytten (2021) found that policies to recruit GPs to rural areas in northern Norway caused improvements in birthweights and neonatal health. Gibson et al. (2022) found that adding staff of any type (e.g. nurses, allied health, GPs) to general practices is associated with improved quality and outcomes as measured by the points scored in the quality and outcomes framework.

Several studies examine different aspects of expansions in physician supply in Brazil. Russo et al. (2019) and Hone et al. (2020) found a positive impact on mortality whilst Mattos & Mazetto (2019) and Carrillo & Feres (2019) found no impact.

3.2 Competition and choice for patients

Many countries have implemented policies to stimulate competition in healthcare markets aiming to reduce costs and improve quality. Such policies can combine changes to market structure with demand-side policies to facilitate and inform consumer choice, or lower transaction costs for switching providers. Theoretical studies of competition and physician behavior produce ambiguous predictions regarding how competition affects health outcomes and societal welfare (Gaynor & Town 2011,

Brekke et al. 2014, Godager et al. 2015, Gaynor et al. 2015, Brekke et al. 2018). Results depend crucially on assumptions about cost and demand conditions, and on the assumptions about physician's having so-called *patient-regarding preferences*, a term used for describing preferences of individuals who care about the well-being of patients (Galizzi et al. In Press). In modelled examples where competition reduces equilibrium quality, the effect can be driven by competition causing relatively large changes to the price-responsiveness of the demand-side, and relatively small changes to the quality-responsiveness. Laine & Ma (2017) show that when a private and a public provider compete, the quality outcomes in the market can be difficult to predict. A number of empirical studies have examined the impact of competition on quality and health outcomes.

Markets with regulated prices

Several studies on competition and physician behavior have focused on the quantity of services provided but not quality or health outcomes (e.g. Iversen & Ma 2011, Godager et al. 2015, Bennett et al. 2015, Kann et al. 2010, Schaumans 2015, Brekke et al. 2019). These studies assume that patients prefer a higher quantity of care and that doctors facing more competition are more likely to meet these demands and 'do something' rather than nothing.

Using rich panel data including 8000 English general practices over the years 2005–2012, Gravelle et al. (2019) study whether primary care practices improved their quality in response to more local competition. Patient-reported quality measures included satisfaction with opening hours, overall care and whether they would recommend the practice. Clinical outcomes included achievements in the national quality pay for performance scheme and frequency of avoidable hospital admissions. The study found that quality measures are positively associated with increases in the number of practitioners competing in the market. The associations are found to be stronger for the patient reported measures. The results can be interpreted as providing some support for policies promoting competition through improving consumers' information and relaxing of entry restrictions.

Dietrichson et al. (2020) study the impact of market reforms that increased patient choice and reduced barriers to entry in Swedish primary over the period 2005–2013. They employed a difference-in-differences estimation strategy that exploits the heterogeneous impacts of the reforms. The study found some small improvements in patients' overall satisfaction with care but no significant effects on avoidable hospitalization rates or waiting times. In a randomized trial, information interventions in the form of letters informing patients of alternative primary care providers encouraged a small proportion of patients to switch GPs (Anell et al. 2021) but did not influence a range of quality measures almost four years after the intervention (Anell et al. 2022).

Public reporting of the relative performance of physicians can influence choice, demand and physician revenue (Dranove et al. 2003, Prang et al. 2021). In systems where doctors charge fees, price transparency websites have been introduced but their impact on patient choice, competition and costs has been mixed (Zhang et al. 2020).There is some evidence that online physician performance ratings can influence patients' choices and physicians' revenue (Bensnes & Huitfeldt 2021, Chen & Lee 2021, Luca & Vats 2013), but less evidence on whether this changes health outcomes.

Markets with price competition

Unlike England and Scandinavian countries, primary care doctors in Australia may set their own prices, and there is no patient enrolment with GP practices. Gravelle et al. (2016) measured competition amongst Australian general practices using distances to rivals and found GPs facing more competition charged lower prices, but there was no effect on quality as measured by consultation length. Johar et al. (2014) measured competition as the number of other GPs seen by the patients of each GP and found that GPs facing more competition charged lower prices and provided lower quality as measured by fee claims for guideline-based chronic disease management. Scott et al. (2022) used consultation-level data to measure 'low-value' care — care which is not effective according to guidelines. They found that GPs facing more competition provided more low-value care.

Laboratory experiments have also been used to study the effect of competition on physician behavior and health outcomes for patients. In these experiments, physician payment, patient characteristics

and the degree of competition vary systematically over experimental conditions. Patient benefits in the form of money are determined by the joint market behavior of participants, and are transferred to real patients using a procedure similar to that of Hennig-Schmidt et al. (2011). Brosig-Koch et al. (2017) find that more competition causes an increase in patient health benefits. Provider competition is also found to improve health outcomes in the experiment by Ge & Godager (2021*b*). Their experiment varied the intensity of competition by shifting the number of providers competing in the same market. Decision-makers experience being either a monopoly, one of two providers, or one of four providers competing in the market. Ge & Godager (2021*a*) estimate the decision-makers' relative valuation of profit and patient benefit, assuming a quantal response equilibrium choice model — a model that allows for imperfectly rational behavior. Reported estimates of patient regarding preferences in this strategic situation are similar to those found in non-strategic settings (Godager & Wiesen 2013, Wang et al. 2020). Ge & Godager (2021*a*) show that behavioral responses observed in the experiment can be attributed to decisions becoming less random as competition intensifies, possibly due to decision-makers exerting more cognitive efforts when exposed to market competition.

3.3 Cooperation, integration and teams

Informational problems may lead to long-term relationships between referring doctors, for example, GPs who refer to the same specialists and specialists who refer to and work with each other or other health professionals. These long-term relationships between healthcare providers might lead to horizontal and vertical integration, again as ways to reduce informational asymmetries and search costs, and to benefit from scale and scope economies. This influences market structure and competition.

Patients' health care needs are sometimes complex and long-lasting, and patients may receive treatment from different health professionals such as physicians from different specialties, nurses, and allied health professionals, and across different settings such as hospitals or primary care. For a patient with a specific health condition, coordination and information sharing is required between these health professionals. This is increasingly being facilitated in some richer countries by electronic shared medical records. In addition, there is regulation as to what type of tasks each health professional is trained and allowed to undertake. For example, in many countries, nurses are not allowed to prescribe medication. (Gibson et al. 2022).

Results from theoretical work offer some guidance for designing payment mechanisms for groups of healthcare providers working in teams. For example Jack (2005), Chone & Ma (2011) and Liu & Ma (2013) have shown that when the regulator does not know experts' motivation, it can become challenging to introduce payment mechanisms that encourage medical doctors to choose optimal medical treatments. The theoretical study by Liu et al. (2018) characterizes the optimal incentive structure in a case where the contribution from two different experts is necessary for solving the problem at hand. They predict that such a group of providers act more efficiently and provide better care quality if they are paid by a mixture of payment components rather than pure capitation or pure fee-for-service.

There are mixed results from empirical studies of initiatives for introducing multidisciplinary teams and integrated care and no evidence on the effects of team-based payment in healthcare. Though many studies of pay-for-performance target organizations rather than individual physicians, this literature is largely silent on the internal organizational and payment structures required to ensure optimal performance from within such organizations.

The existing literature focuses largely on scale and scope economies and the size of teams, rather than on internal payment mechanisms. For example, whether physician practices are organized as group or solo practices can influence patients' health outcomes. Epstein et al. (2010) study obstetric practices and find that high-risk patients in group practices match with specialists more often than patients in solo practices. Furthermore, this improved matching process has a positive effect on clinical and health outcomes for mothers.

organizational structures characterized by the participation of primary care physicians and specialty care physicians in the planned delivery of care can be referred to as *shared care* systems. Shared

care systems will typically have some degree of internal data sharing, such as medical records, and meetings are organized between specialists and primary care team members (Hickman et al. 1994). Smith et al. (2017) provide a systematic review of research studies on shared care interventions targeting chronic conditions, such as diabetes and depression. While some studies report a positive impact on clinical outcomes such as blood pressure management, and several studies report improvements in outcomes for patients with depression, effects on clinical outcomes are not consistent across different studies.

Health sectors in many countries are considering the introduction of multidisciplinary teams in primary care (OECD 2020). Team-based primary health care delivery has been proposed to improve quality and efficiency in the primary care sector and often highlights the needs of patients with chronic illness and/or complex needs. Trials and pilots experimenting with organized multidisciplinary teams in delivering primary care services provide challenging opportunities for empirical research. The implementation of multidisciplinary teams is heterogeneous, and physician and patient participants are typically recruited by voluntary opt-in, leading to empirical concerns around selection bias.

Swietek et al. (2018) found that patients with diabetes and hypertension enrolled with *Patient-Centered Medical Homes* (PCMH) in the United States were more likely to receive care and tests consistent with the medical guidelines. Other studies on PCMH found changes in health care delivery such as frequency of specialty visits; and use of emergency department or breast cancer screening, but did not provide clear evidence on health outcomes for patients (Sinaiko et al. 2017, Xu 2016, van den Berk-Clark et al. 2018). Evaluations of *Family Health Teams* and *Family Medicine Groups* in Canada did not provide evidence of multidisciplinary teams influencing patient experience or health outcomes (The Conference Board of Canada 2014, Strumpf et al. 2017).

Reeves et al. (2017) systematically reviewed research on strategies to improve inter-professional collaboration between providers. They concluded there is a lack of clear evidence on how interventions to improve collaboration affect work processes, continuity of care and patient-reported outcome measures. The short observation periods in many studies have been proposed as explanation for the mixed and inconsistent results of organization interventions. On average, studies that examined shared care interventions described by Smith et al. (2017) lasted only 12 months. An additional element highlighted by Lukewich et al. (2014) is that it can be challenging to accurately describe the study setting, organizations and interventions in ways that facilitate meaningful comparison of results from different study settings or the 'scaling up' of interventions.

4 Information interventions

4.1 Agency relationships and shared decision making

The efficient functioning of any market requires equal and complete information on both sides of the market. The doctor-patient relationship is a key source of informational asymmetries in healthcare. Physicians are knowledgeable experts holding information about diagnoses and treatments that are superior (and unobserved) to that of patients and the payers. This classic asymmetry of information in the doctor-patient relationship (Arrow 1963) means it is often not possible for patients to assess the quality of the health services they receive over and above what is most easily observable, such as bedside manner, recommendations from others, or their own experience which in many cases may not be high. But patients also hold information doctors do not have about their own values and preferences and experience of their illness that should influence diagnostic and treatment recommendations. Therefore, information asymmetry is two-way.

These informational problems often mean that one-off market transactions are replaced by longitudinal relationships between patients and doctors, especially in primary care settings or for patients with long-term chronic disease. Such relationships are characterized by repeated transactions, trust and shared decision-making. Primary care physicians may get to know whole families and their social and economic circumstances, which will be relevant in recommending treatments that can be adhered to and contribute to broader wellbeing.

A frequently reported finding from theoretical analysis is that imperfect information reduces the

quality of health services (Gravelle & Masiero 2000). This suggests that interventions that target patients and improve their information could be beneficial. This may include supporting continuity of care, shared decision-making with doctors, and public reporting on the quality of healthcare providers.

In a range of countries, continuity of care is encouraged either by the requirement for patients to register or enrol with their primary care physician or in vertically integrated insurance-provider systems where patients can see only physicians recommended by their health insurer. Switching providers is possible but sometimes costly, though in large medical group practices, patients can shop around within a particular medical group. Evidence from countries with patient registration, such as England and Norway, suggests that patients choose primary care doctors based on observable practice characteristics as well as quality and health outcomes (Biørn & Godager 2010, Iversen & Lurås 2011, Godager 2012, Santos et al. 2017, Dahlgren et al. 2021). Though several systematic reviews have found mostly positive associations between continuity of care and patient and professional satisfaction, medication compliance, increased preventive care behaviors and lower use of hospitals and emergency departments (Saultz & Lochner 2005, Van Walraven et al. 2010, Baker et al. 2020, Wright 2019), there has been only one randomized trial,and so the evidence is not causal. Associations with health outcomes (e.g. mortality rates) and measures of clinical quality of care are mixed and inconclusive. The systematic review by Baker et al. (2020) focused only on mortality rates. Of the 12 included studies, nine found a positive association of continuity of care on mortality rates, but these studies were again not causal. Wright (2019) also found mixed results for the association between continuity and clinical quality of care. More recently, Skarshaug et al. (2021) found that the likelihood of hospital admission for Ambulatory Care Sensitive Conditions (ACSC) rises when a discontinuity of patient-GP relations occurs. Sandvik et al. (2021) use Norwegian primary care data and found that more durable relationships between GP and patients were associated with a lower likelihood of acute hospitalizations and death, whilst another study from Norway finds no association with mortality rates (Hetlevik et al. 2021). Johar et al. (2014) found evidence indicating that continuity improves primary care quality measured by the volume of fee claims for chronic disease management. Generally, there seems to be a more consistent association between continuity of care and lower hospital costs and less consistent results for the association with health outcomes.

Shared decision support tools that explain the risks and benefits of alternatives to patients and help them have informed discussions with their physicians have been shown to lead to less invasive and lower-cost care (Veroff et al. 2013). However, a systematic review found mixed evidence from many low-quality studies (Légaré et al. 2014). Information on alternative providers (and treatments) is available to consumers over the internet, significantly reducing search costs for consumers. Information on treatments does not necessarily translate to knowledge, so consumers still require the advice of physicians to help interpret this information, which may be most useful to those who are more health literate and educated.

Physicians report that patients are important drivers of low-value care, such as antibiotics for sinusitis (Hardy-Holbrook et al. 2013). Evidence from a systematic review suggests that patients have high expectations, overweigh benefits and underestimate harms from medical treatments and diagnostic tests (Hoffmann & Del Mar 2015). This could be due to incorrect information, issues around understanding probabilities and risk, the value of the physician 'doing something' rather than nothing, or that physicians are unable to persuade some patients to take more conservative courses of action. Physicians may acquiesce to patients' preferences for the provision of low-value care to please patients and feel that they have helped them. This may also interact with financial incentives under capitation and FFS payment, where patients may go elsewhere if they are not satisfied, and doctors lose revenue. Scott et al. (2022) have shown that an unintended consequence of competition could be to drive the provision of low-value care.

4.2 Physicians' responses to public reporting on performance

Public reporting of performance can change patient choices but also influence physicians' behavior directly because they are concerned about reputation and social and professional norms (Bénabou &

Tirole 2006, Prang et al. 2021). A key issue with such public reporting is that unless performance measures are adequately risk-adjusted, physicians may respond by selecting only the healthiest (less complex) patients to treat if that improves their ratings (Dranove et al. 2003, Mak 2017). Quality report cards can, in theory, improve quality if the data are risk-adjusted, it is costly for providers to select healthier patients, and the cost of improving quality is low (Chen & Sivey 2021).

The study by Kolstad (2013) examined the introduction of quality report cards for surgeons performing coronary artery bypass graft (CABG) surgery in Pennsylvania. They found that information on performance that was new to surgeons and unrelated to patient demand led to an intrinsic response that was four times larger than surgeon response to profit incentives. They concluded that while the introduction of report cards led to quality improvement for CABG surgery, the larger part of improvements in health outcomes was caused by information observed by surgeons and not by changes in financial incentives.

A recent systematic review of the impact of public reporting of performance (Prang et al. 2021) found mostly positive effects on health outcomes such as mortality, other clinical outcomes and patient experiences. However, the results were dependent on only a few studies and the context, and there was no systematic critique of the quality of this evidence. Laboratory experiments have been used to study the effects of disclosure of performance information to peers. Godager et al. (2016) compared decisions made in a regime of private information with a more transparent regime where performance information was disclosed to peers. The regime with performance disclosure was more likely to maximise patient benefits than the regime with private information. Kesternich et al. (2015) examined how behaviors and health outcomes were affected by reminding medical students in the lab experiment of professional norms and the Hippocratic Oath, a historical oath of ethics taken by Greek physicians in the classical era. Their results indicated that professional norms affect patient-regarding preferences and health outcomes.

4.3 behavioral interventions to change physician behavior

Though physicians have more information than patients, their information is not always complete and up to date. The ongoing development of their skills through investment in human capital is a key issue. Incentives for physicians to invest in human capital are very strong during medical training because of career incentives and a competitive career structure. However, once qualified as independently practising physicians (e.g consultants, fellowship of medical colleges), incentives for further human capital acquisition are largely through reputational benefits and involvement in academic work and teaching that can increase demand through enhanced expertise in their field. However, many physicians, once qualified after lengthy postgraduate training, do not keep up to date, whilst others may rely on formal continuing professional education programs, including conference attendance.

A particular issue is physicians' adherence to evidence-based clinical guidelines and how to change deeply entrenched clinical behavior. As more evidence becomes available on the effectiveness of medical care and innovations in diagnostics and treatments, this new evidence is difficult to implement. Clinical autonomy usually prevents treatment mandates. Low-value treatments and diagnostic tests are beginning to be identified (Elshaug et al. 2012, Schwartz et al. 2014). The belief is that these interventions should be 'low-hanging fruit' in the pursuit of efficiency, as they seem to be obvious candidates for disinvestment and for clinicians to stop offering to patients. Yet they continue to be funded and continue to be used (Elshaug et al. 2017).

The spread of new information and evidence can be influenced by peer networks (Barrenho et al. 2021, Keating et al. 2020) and financial incentives from pharmaceutical and medical device companies that can potentially bias clinical decisions (Carey et al. 2021).

A large literature in health services research has examined how to change physicians' behavior through a range of interventions based on psychological theories of behavior change. These theories have been synthesised into the Theoretical Domains Framework (Atkins et al. 2017). This has influenced the design of specific information and educational interventions, including designing audit

and feedback interventions for physicians (Eccles et al. 2001, **?**, Kolstad 2013, Ivers et al. 2014, Östervall 2017). Audit and feedback are now regarded as effective interventions based on managing overconfidence, cognitive dissonance and loss aversion (Ivers et al. 2014).

behavioral economics is useful in identifying why it is difficult to change physician behaviors. There is an ethical imperative to 'do something' rather than do nothing, including 'the rule of rescue' (Cookson et al. 2008). The desire to 'do something' and intervene is also common in non-life-threatening conditions. This is a fundamental part of medical practice: to do everything possible for individual patients regardless of financial and opportunity costs. This bias for action may lead to tests and treatments even when it is not in an individual's best interest (i.e. the individual benefit is negative) and when there are no financial incentives to do so.

This tendency to intervene is reinforced by a number of psychological biases that emphasize benefits and downplay costs. This includes the tendency for the brain to take short-cuts and use heuristics to reduce cognitive effort (Frank & Zeckhauser 2007, Kahneman 2011). For example, optimistic bias and overconfidence have been studied in psychology and economics and are widely referred to as the most significant biases in a range of decision-making contexts (Akerlof & Dickens 1982, Bénabou & Tirole 2002, Moore & Healy 2008, Moore et al. 2015).

Overconfidence means clinicians are likely to ignore new information and data since confidence in their expertise, intuition and experience dominates any new information. Overconfidence may also play a role in medical errors, which can also lead to harm (Berner & Graber 2008). Cognitive dissonance, where new information shows current beliefs about clinical practice in a negative light, and confirmation bias, where one only takes account of new information if it confirms prior beliefs, are other reasons why new information may be ignored and fail to curtail the provision of low-value care (Roman & Asch 2014, Akerlof & Dickens 1982). These biases are also related to status quo bias and loss aversion, where losses have a bigger impact than gains such that clinicians will favour the status quo and find it difficult to stop providing interventions (Roman & Asch 2014). Maintaining the status quo is cognitively easy and a way to avoid the perceived higher risks of untried courses of action. The salience of events is also given prominence through the availability heuristic, whereby the most recent salient events influence decisions regardless of their true probability of occurrence (Tversky & Kahneman 1973).

The way choices and decisions are framed can also be altered to nudge decisions in the desired directions. The context and delivery of the intervention may influence behavioral responses. This is also the case for changes in funding and financial incentives (Giacomini et al. 1996). For example, the use of defaults, reminders, opt-ins or opt-outs and checklists in electronic medical records, for both diagnosis and treatment, could be an effective means of nudging clinicians towards higher value options where diagnostic or therapeutic alternatives exist (Ko et al. 2011, Free et al. 2013, Shojania et al. 2010). How these interventions are designed and delivered is still an issue, as there is much heterogeneity in the different types of diagnostic and treatment interventions. Many evaluations of physician behavior change strategies are of single rather than combined and complex interventions (Squires et al. 2014). The delivery of such interventions using digital technology is an ongoing development where clinical guidelines can be built into decision support systems (e.g. dashboards, reminders, predictive analytics), with complete automation of clinical diagnostic tasks in some settings such as radiology, (Lyell et al. 2021).

5 Summary

This chapter has reviewed the recent literature on the relationship between physician behavior and health outcomes. It has covered three broad areas of evidence: payment methods, market organization and information interventions. Physicians are the key decision-makers in health systems. Thus, research that focuses on their behaviors is essential for improving efficiency and equity in healthcare.

Contemporary theories of physician behavior typically start with the assumption that physician preferences combine altruistic motives with self interest and examine more complex contexts where patient health outcomes are determined by efforts from several physicians or other types of health

personnel.

Recent empirical research has largely confirmed earlier results that physician payment methods can influence health outcomes but that the effects are usually mixed. However, more intense competition between physicians does not guarantee more welfare to society. The impact of competition between physicians on costs and health outcomes remains uncertain, depending on the extent of informational problems on the demand side and the degree of product differentiation on the supply side. Indeed, cooperation and integration as well as shared decision making are more commonly advocated as ways to overcome informational problems. Given the wide range of product markets in healthcare, it is less likely that competition will work for patients with complex conditions and chronic diseases who require co-ordinated care from a wider range of health professionals.

There are several areas that can benefit from future research. Heterogeneity in the effects of financial incentives and competition requires further attention, especially how effects can be muted because of physician altruism. How to best deliver new information to physicians is also a key area of research, and research on the role of physician networks and digital technologies is important to pursue. It is also clear that though financial incentives and market structure can support the broad direction of behaviors, the design of information and educational interventions to counter common biases and heuristics can also play a role in changing physician behaviors to improve health outcomes. Providing stronger incentives for physicians to invest in their human capital across medical careers is an important issue.

New linked administrative datasets provide much more scope to evaluate natural experiments. However, it can still be problematic to find good data linking rich physician characteristics and traits to the health outcomes of their patients. The number of field experiments is relatively small and focused on the demand side, where it is perhaps easier to intervene. However, it is the supply side where more research is needed, given the extent of physicians' market power. The use of behavioral economics is a more recent development, including the use of incentivized laboratory experiments. This has included, for the first time, the measurement of altruism and patient-regarding preferences. The large and existing literature from health services research on professional behavior change contains important lessons on the design of information interventions to change physician behavior and improve health outcomes.

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