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Impact of Behavioral Economics on Enhancing Health Professionals' Adherence to Infection Control Standards

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Abstract

In recent years, the manipulation of microeconomic and behavioral theories has been considered as a way to improve the effectiveness of healthcare in reducing infection rates. Since it is especially suited for health consumers and professionals, this adjustment has the potential to enhance the way health professionals adhere to infection prevention control standards. Aligned with the publicly articulated "dual standards of care" and "no blame culture" of the health services, the observational and review literature suggests that the safety of patients is highest when health professionals adhere to standard practice as a means of safeguarding patients from unnecessary risk. The potential of using behavioral economics and microeconomic theories grew from evidence of the wide disparity between compliance rates with infection prevention and control practices and IPC failure rates, which are often excessive in healthcare, and is also effective in models of public health interventions.

The development of behavioral nudges and incentives could provide the theoretical basis for a public health intervention that draws on economic theory to improve adherence to IPC procedures through health professional behavior. Behavioral nudges are environmental influences that lead to predictable irrational behavior. Incentives are factors that motivate an individual to perform an action and are often economic or fiscal in nature. Over recent years, however, there has been a growing number of examples of the efficacy of 'nudges' in public health via wide-ranging changes in clinical and operational practice through minor tweaks. This essay will review recent evidence and conclude with a behavioral theory framework that can support the underlying premise indicated by research findings. It will also provide some examples of effective interventions, as well as the benefits of an economic practice. Finally, public health benefits will be included in a discussion of positive disease patterns and the state of public health epidemics, providing that the "ideal" action is taken or not. (Rao et al.2024)

1. Introduction

Infection control is one of the most pressing issues in healthcare globally. Despite implementing numerous interventions, non-adherence among healthcare professionals remains. This is mainly due to organizational as well as behavioral reasons, with significant literature arguing that the lack of incentive is the primary driver. Therefore, this study focuses on the behavioral side, evaluated through behavioral economics. Behavioral economics combines psychological insights with economic theory to better understand human choices and behavior. It provides an explanation for healthcare professionals' non-adherence to infection control by assuming they act based on irrationalities and inconsistencies. Therefore, it has become increasingly relevant for public health because irrational behavior is often blamed for driving unhealthy choices. Given the substantial interest in the topic and its relevance for public health, there is an extensive and growing research agenda into the use of behavioral economics in designing interventions to improve patient adherence. Nevertheless, much of the literature on infection control currently only focuses on patients, and therefore, in this essay, we will provide an overview for healthcare professionals. Infection control has become increasingly important globally due to the emergence of public health crises, which has forced most countries to rethink infection control practices. Adherence to infection control standards relies heavily on human behaviors. It is important to understand this behavior not only for building a good theoretical picture but also for developing interventions to alter key behaviors. Infection control already raises significant challenges in healthcare facilities, as one major cause of non-adherence to infection control is why healthcare professionals report not doing it. (Fawzy and Gomaa2022)

1.1. Background and Rationale

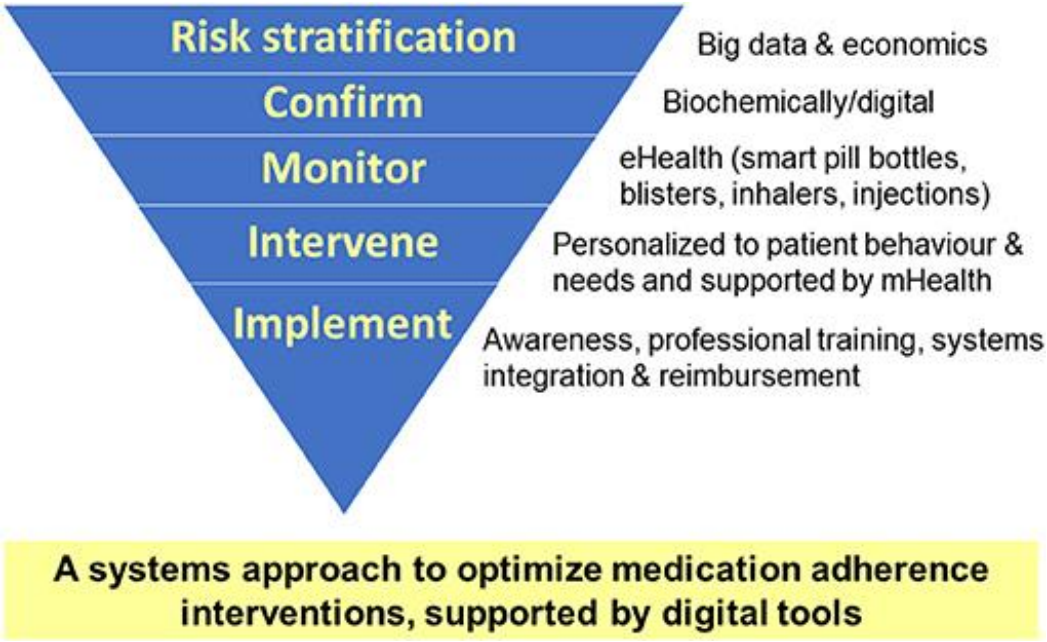
Ever since standardized infection control precautions were established as a result of the outbreak of syphilis, healthcare settings have been confronted with the challenge of

complying with a variety of infection control and prevention guidelines. Although environmental cleanliness, waste management, antimicrobial use, immunization standards, and isolation precautions help prevent healthcare-associated infections, some guidelines need to be followed by every health professional for every patient, as failure to do so can lead to the spread of infectious agents. Based on patients' length of stay in a hospital and the risk of acquiring a healthcare-associated infection, infection foci can become connected and overlap with each other, creating an interconnected web that transcends healthcare settings and patients. Even short-term hospital admissions can increase the chances of a combination of mixed infections. Non-adherence rates for various procedures commonly exceed perfection by 20% to 67%. Compliance levels with standard precautions for every patient were just 5-7%. (Dixon et al.2020)

A variety of psychological and economic theories have been suggested to explain such noncompliance. Health professionals are not averse to taking risks in general, and compliance behavior is not always rational. Therefore, a gap between their attitudes and their behavior, and a departure from utility maximization, does not rule out departure from rationality. There is a consensus among researchers and policy analysts that the gap between evidence-based knowledge and actual practice must be remedied in order to improve patient outcomes while reducing costs. However, current strategies that focus on information dissemination, changes in payment systems, or guidelines for practice have demonstrated limited success because they do not take into account the behavioral complexities of professionals. Better understanding of the behavioral patterns of professionals at the individual or group level could provide effective control strategies for infection control that do not rely solely on economic incentives.

1.2. Scope and Importance of Infection Control Standards

Infection control standards primarily pertain to methods and tools used for disease prevention in healthcare, from the prevention of infection transmission to environmental decontamination. Infection control programs branch into standard and additional precautions; standard precautions are meant for all patients and serve as the foundation of infection control. The outcomes from an infection control program aim to protect patients and healthcare personnel from nosocomial acquisition of pathogens without undermining human rights and freedoms. In various healthcare settings, the different strategies for infection control are described as being transmission-based, categorized, or outpatient infection control standards. The basic outcomes of adherence to infection control standards are interruption and suppression of transmission, which lead to a reduction in morbidity and eradication of transmissions, facilitating zero deaths. The rising annual total of healthcare-associated infections is either due to an ongoing problem of adherence to guidelines or an untimely lack of guidelines when and where required.



A systems approach to optimize medication adherence interventions, supported by digital tools

The disregard of recommended infection control practices by staff members has a depressing effect on the quality of healthcare activities and can lead to the emergence of multidrug-resistant organisms. Noncompliance with infection control guidelines is the cause of many healthcare-associated infections. Healthcare services have stated that a range of 4 to 57 percent of healthcare staff do not comply with infection control standards. This heterogeneity could be valid due to inconsistency globally. It becomes obvious from these examples that compliance with infection control guidelines overall remains inconsistent and inadequate. Internationally, there is a legislative effort to require healthcare staff to comply with infection-free standards. Several countries have already implemented significant regulations, although the infrastructure and policy vary from one country to another. No systematic overview of global adherence remains relevant to infection control standards for healthcare services to assure policymakers of appropriate assistance. From this groundwork, it becomes evident that all evaluated staff members are in critical need of flawless strategies for cooperating in program improvement, certification, training, legal procedures, and discharge inclusion to include their responsibilities in coordination alternatives to help minimize the diffusion of nosocomial infections. Clinical implications: make use of the resources presented here to provide good practice adherence compliance to the chronic infection control standards of healthcare workers. Further research is required into the primary injury or harm that decreases the therapist's attendance and approach to define preventive and rehabilitative programs. (Buković et al.2021)

2. Understanding Behavioral Economics

Behavioral economics integrates insights from psychology and economics and offers a broader understanding of individuals' decision-making processes. It suggests there is substantial evidence showing that human decision-making is not purely rational and logical, but is underpinned by heuristics and biases, and heavily shaped by context and environment. A heuristic is a rule of thumb and "mental shortcut" that allows people to

solve problems and make judgments quickly and efficiently. In brief, a heuristic is the means by which people simplify the process of information filtering by highlighting specific aspects of the decision context, screening out alternatives, and allocating insufficient cognitive resources. As decision-making shortcuts, heuristics allow fast decision-making, but may compromise rationality. They are particularly important in risky decision-making, when little or unstructured information is available and time is limited. Related to this, it is said that the rational choice theory is not so useful when dealing with decisions in real-world environments where scarcity of time, inertia, complexity, and uncertainty are commonplace. (Kurdoglu et al.2023)

An extensive literature on the psychology of judgment and decision-making suggests that much of human behavior is predictably irrational. Although information has an important role in shaping preferences and ultimately actions, empirical evidence illustrates how information alone often has little or no influence. According to behavioral economics, intransigent behaviors that are unresponsive are caused by standard-based interventions that overlook individuals' irrationality, and not due to deeply held moral beliefs, selfishness, or corrupt behavior. Therefore, policy interventions that consider and target heuristics and the limits of human reasoning and control, and that shape the environment to induce change, are more likely to generate a large public health benefit compared to standard-based interventions.

There are various deviations from rational behavior at the individual level that can help to explain health professionals' often noncompliance with infection control standards. In relation to this, some examples of heuristics and biases are the availability heuristic, planning fallacy, overconfidence bias, and affect heuristic. Here, the availability heuristic is a cognitive system that drives the judgments and decisions people make on the basis of the information made available to them. Scientific evidence has established the importance of availability judgments in risky decision-making, including health-related decisions. There are growing bodies of evidence indicating that aversion to future regret has an impact on decisions about remedies to health problems. Moreover, a great number of previous field studies in the social sciences have revealed that the representativeness heuristic causes people to hold mistaken beliefs. It has been shown that health professionals and patients hold strong mistaken beliefs about the effectiveness of certain treatments due to the use of the representativeness heuristic. (Elliott et al., 2023)

2.1. Key Concepts and Principles

Behavioral economics, as a combination of insights from both psychology and consumer choice, can be employed to understand, predict, and explain violations of the standard adherence to infection control. These key concepts and principles are described as follows: Bounded rationality: When making choices, individuals do not have the time, cognitive resources, or recollection of all medical data required to adhere to infection control. For instance, a doctor may not be able to recall the last time a patient was placed into isolation, a necessary action to prevent the spread of infection in healthcare settings, when confronted with patients presenting potential infectious diseases. Loss aversion: Refers to the fact that individuals value losses more than they do potential gains of the same magnitude. In healthcare, individuals can be loss averse when relying on an expected utility to make a decision irrespective of the probability and magnitude of the gain or loss. One may argue,

for instance, that health professionals will be averse to breaching infection control standards if the material breach can increase the likelihood of infection of a patient. Framing effect: Describes the impact of the reference point used, particularly the description of options and particularly negative framing upon individuals' utility of decision making. Across different countries, hand hygiene compliance improved as a result of using positively framed signs, i.e., "Hand hygiene prevents infection, protect yourself, use the hand gel." These signs resulted in an overall reduction in healthcare-associated infections in the intensive care unit, compared to a negative framing message displayed prior to patient contact, which read, "It is not allowed to have a negative kind of thinking or feeling. Please shower to prevent infection from spreading." The overall reduction in infection rates declined as a result of the negative message over a ten-week period post-intervention. (Fish et al.2021)

2.2. Applications in Healthcare

In healthcare, behavioral economics has been used as a tool to tackle a variety of problems. For instance, results of focus groups have been utilized in cancer care to design interventions that address barriers in pain assessment and to improve pain management in hospital settings. Another initiative reported success in using behavioral economics to positively influence opioid prescribing decisions, thereby promoting better opioid stewardship. There is strong evidence that even small changes to the default organizational context can have significant and unintended consequences, a case in point being reduced opioid poisoning events.

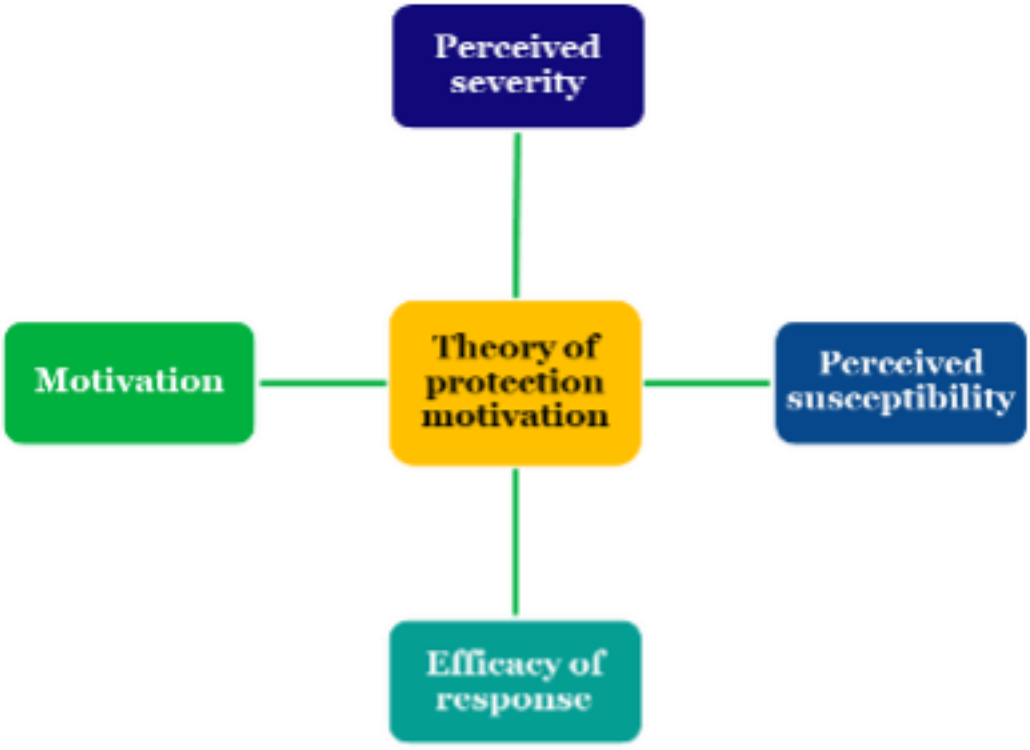
Motivational interviewing has been used to change healthcare provider practice in a number of contexts, including treatment for tobacco use. Even healthcare professionals can be subject to "irrational" influences by using availability heuristics to make clinical decisions. Behavioral contexts affect how we think, as well as influence our practice in many areas. Behavioral economics provides a framework and techniques for guiding decision making to benefit consumers or citizens: it could now be similarly influential in reshaping the delivery of healthcare. The dichotomy of system 1 (automatic, unthinking, and quick) and system 2 (deliberative, slow, and rule-governed) modes of thought can be applied to the behaviors of healthcare professionals. In most cases of healthcare delivery, it is system 1 thinking that dominates. Judging and acting on the basis of clinical intuition—what some call Gestalt-like pattern reasoning—dominates healthcare decision making. Although deliberative thinking based on algorithms and guidelines can improve the objectification of clinical decision making and reduce clinical variance, the variables need to be few, decision trees simple, and patient pathology consistent and narrow-ranging. Behavioral economists' stock in trade is understanding flawed thinking in the general domain, and then using this information to fashion policy, or at least form actions, that align with good decision making. There is a plethora of evidence of the deleterious impact of these intuitive foibles in the deriving of human decision making, and efforts to work around or with this messy domain occur everywhere. (Hagger et al.2020)

3. Health Professionals' Adherence to Infection Control Standards

Health professionals' adherence to infection control standards is influenced by a number of motivating factors, including education, self-efficacy, belief in the potential to reduce

infections, and a concern for personal safety. However, health professionals also perceive a number of barriers to adherence. Workload, a lack of adequate training, and an institutional culture of neglect are the chief reasons why doctors, nurses, and allied health professionals do not have, or do not intend to have in the future, adherence rates that consistently fall within international 'best practice' guidelines. Health professionals also cite habit, or a lack of routine or consistency, and factors such as a lack of information, perceived non-threatening nature of infectious diseases, or a belief that immunization will prevent infection as additional psychological barriers.

The impact of non-adherence is a significant threat to public health, as resistant organisms undermine the effectiveness of antibiotic treatments. Estimates indicate that these organisms cost their respective health services significantly annually. Reduced virulence and a lack of morbidity are associated with hand washing 'neglect' that causes an additional 1,000 deaths each year. Not only do HAIs pose a risk to patient safety, but general ward infections lower the quality of care for all but the least unwell patients within the general patient population and are viewed as 'a failure to prevent complications.' The consequences for infection control programs include 'a reordering of priorities' and a 'resulting backlash' in that some practice improvement interventions have been 'abandoned altogether' and 'isolated' or 'selective' success. Results such as this can be expected because low rates of adherence are evidence of 'errors in the organization of care' rather than 'individual failures.'



With this in mind, one of the ways to maximize the unimpeded adherence of staff to best practice policies is to properly articulate an institution's commitment to supporting professional best practice, backed up by first-rate infection control policy and procedure

and modern infrastructural support. Another is to emphasize the importance of mandated quality and policy initiatives. Despite the 'moral agency' of professionals, the evidence for change is compelling. A multifaceted approach where attention is paid to improving occupational policies for personal safety, addressing the workload issue, and educating staff about the wider cultural and public health impact non-adherence has may bring about the desired result. In a situation where rates are dramatically low in your institution, a multifaceted, mixed-method approach to staff communication, education, and awareness is likely to initiate collective, automatic, habitual behaviors among staff. Additional strategies to enhance adherence could include initiatives targeting charge nurses and experienced staff. (Javanmardifard et al.2020)

3.1. Current Challenges and Barriers

While working in healthcare facilities, health professionals are required to comply with specific infection control standards to reduce the risk of transmitting infections to patients. The compliance rate with these infection control standards is often suboptimal. A large body of work has identified the barriers and facilitators that influence adherence to infection control standards among health professionals. These barriers and facilitators can be addressed at either the organizational or individual level. Key challenges identified that pose potential barriers to hand hygiene practice include the lack of time to perform hand hygiene, not prioritizing hand hygiene during times of high workload, a lack of knowledge or training in hand hygiene, fear of skin irritation, being motivated for self-protection rather than patient protection, and insufficient resources.

Knowledge, attitude, and beliefs of health professionals can impact practice. For example, it has been indicated that those who believe they are more likely than others to become infected appear to have improved compliance rates compared to those who do not believe that they have an increased risk of infection. From a social perspective, it has also been suggested that health professionals who report low social expectations for hand hygiene are more likely to demonstrate low compliance rates, and that peer pressure can influence the likelihood of hand hygiene success. Other concerns have been around organizational culture impacting individual practices, demonstrating that those that do not encourage debate are less likely to change practice. Alcoholic hand rub availability and location have been identified as a barrier to hand hygiene practice among health professionals. A lack of external drivers, such as regulatory requirements, has also been identified to impact the ability of health professionals to perform hand hygiene to a high standard. A comprehensive understanding of these barriers is required to create effective interventions aimed at increasing adherence to infection control standards among health professionals by addressing these concerns. This review will examine some of the ways in which these barriers and challenges can be overcome. (Powell-Jackson et al.2020)

3.2. Importance of Adherence in Healthcare Settings

Adherence to infection control in practice has long been stressed as a critical aspect of operating any healthcare facility. The reason for such emphasis has centered on the direct connection between compliance and the prevention of patients' infections. In an empirical study, it was revealed that the primary risk factor affecting such practices is that employees were suffering from a higher level of perceived stress in cases of non-adherence. Moreover,

compliance with basic hygiene promoted the relationship between healthcare professionals and patients as it increases the level of confidence in the healthcare service provided. Preventing harm to patients is one of the two key principles underlying the need for adherence. A high-quality system protects patients from errors at the time of healthcare. Further, facilitating compliance among healthcare professionals is one way to demonstrate good governance.

Adherence is essential to ensure that professional healthcare workers can return to care for patients after a systematic or sporadic biological incident, such as those caused by infectious diseases. Requiring adherence also increases the wider community's protection. Healthcare professionals infected in the workplace might subsequently infect family members. If these family members infect others, the consequences can be dramatic. Managing human and financial resources efficiently is another reason to make sure the work of healthcare professionals is free of healthcare-associated infections. Healthcare professionals act in accordance with the legal and ethical standards, whether they do it reliably or not. Encouraging adherence is also a great way of promoting the ethical values of fairness, honesty, respect, and responsibility. The fact that healthcare-associated infections interfere with this mission is also persuasive. Compliance needs to be embedded into the work systems, protocols, procedures, people's values, and expectations for these activities. Working with healthcare professionals without reinforcing their need for adherence is like operating an airline without making sure the aircraft is safe. (Health Organization, 2021)

4. Behavioral Economics Interventions

Nudging

A systematic review of the evidence for nudges in healthcare settings found a nudge to be consistently effective in 33 trials across 14 health behaviors. Here, the nudge increased adherence by 0.4–19.7% (median 7.3%), and each percentage increase in adherence was associated with reductions in the severity of illness, healthcare costs, lost productivity, and lost quality of life.

Choice Architecture and System Design

The Salience Amplifier and Process for Adopting Infection Control Ambients has been developed to facilitate the design of ambient interventions. Another methodological advance in the design of ambient scent has been to use machine sniffing or gas chromatography-e-nose to identify the objective chemical constituents of a malodour. It is important to note, however, that not all will experience living in maladaptive ambients, and so we are currently working on ways to create individualized variants of the evidence-based ambient strategies that have shown to be effective in the general population.

The Field of Economics

Nudge units and behavioral insights teams are protecting the psychological welfare of citizens by recognizing that people are human with sometimes complicated lives that affect their decision-making. In behavioral economics, interventions that target employees to change their behaviors need to address employee hesitancy, which might intensify or

increase as they acquire more knowledge. There is also burgeoning practical and academic work that has begun to take a "systems level" approach to addressing adherence, with engagement of multiple intervention targets. The Committee supports the objectives under this heading.

4.1. Nudges and Choice Architecture

Apart from information and motivational interventions, behavioral economics provides practical tools for encouraging appropriate behaviors by health professionals. A nudge is a subtle psychological prompt that steers people towards desired behavior without restricting any options or significantly changing their economic incentives. Nudges based on heuristics can serve as cognitive shortcuts, help individuals decide in favor of their long-term plans or actions, and work in situations when people are motivated to behave in a particular way. In this way, providing heuristics as prompts or as part of the choice architecture has indeed shown utility in enhancing adherence to infection control standards, especially hand hygiene compliance.

Choice architecture principles advocate a design process in the environment related to the arrangement and availability of various choices or alternatives to strongly nudge professionals towards behaviors that are important for patients. Several practical applications of nudges can be found in healthcare settings, such as designing choice environments in a hospital to encourage below-the-knee vein access or providing information or prompts to steer decisions or behaviors. A study described the success of choice architecture as a nudge to increase the choice of healthy foods in a hospital cafeteria. The arrangement and accessibility of the choices offered led people, subconsciously, to opt for more tempting healthy foods. Equally, nudges based on propaganda or cognitive biases or grounded in prejudices could also be effective, yet choices made with this support may not be ethically acceptable for the nudge initiator or society. The creative application of nudges could indeed support better health professional behavior. Given such potential effectiveness, however, the ethical considerations associated with any proposed nudge or change to the choice architecture are, of course, pivotal. Any nudge offered to a professional must be consistent with ethical medical practice and patient safety.

4.2. Incentives and Rewards

Health care institutions and health professionals have been eager to test whether providing incentives for following recommended infection control procedures would improve their compliance. The interest was fueled by the success of microeconomic theories and the extensive experimental research in demonstrating that incentive structures are important determinants of health care professionals' interest in implementing clinical guidelines and research results, even if the procedures have been proven clinically efficient. Intrinsic incentives are supported by a wide range of theories which suggest that they may motivate people to go even beyond what is required or prescribed. These theories include the self-determination theory, which suggests that providing intrinsic rewards for task performance may improve the quality of the task and the quantity of effort dedicated to it, and learning theory, which suggests that offering extrinsic rewards may reinforce behaviors. (Van et al.2022)

The underlying presumption of these theories is that extrinsic rewards or punishments, offered in the form of incentives and disincentives, are powerful motivators, not only because they provide or withdraw something of value to the individual, but also because they promote or inhibit specific behaviors. Thus, the behavioral psychology literature implies that a sufficiently large extrinsic reward, available immediately following a behavior, will increase the rate of that behavior. The reward is thought to work by increasing the anticipated pleasure that the person derives from performing the rewarded behavior. In addition, it can also work by increasing the anticipation of extrinsic rewards. As such, paid incentives may be used as a powerful tool in behavior change campaigns. Paid incentives may suffer ethical problems. One ethical issue that may surface with paid incentives is that of equity and fairness, essentially regarding 'cheating'. This needs to be taken into account in the design of an incentive scheme to ensure maximum intended behavioral change. (Kinley and Ben-Hur2023)

5. Case Studies and Examples

This article presents a selection of case studies that give insights into real-world implementations in different types of settings. Some were intended for healthcare settings and specifically for interventions aimed at enhancing adherence to infection control standards. As such, the selected case studies make use of nudges, changes in choice architecture, or incentives and are still in the process of being published, and/or we were unable to find similar interventions. They were selected based on the meaningful results they report in terms of changes in adherence rates and, where reported, patient outcomes. In light of the variety of strategies that we describe across these cases, especially the combinations of different behavioral economic or social marketing tools, this selection of case studies should both provide practitioner and policymaker readers with a range of evidence-based strategies to consider for a broad range of different types of healthcare settings and staff, and encourage behavioral economics-informed healthcare professionals and researchers to explore different strategies, supported by theory. An alternative approach that policymakers, quality and safety professionals, and researchers could use to find successful behavioral interventions that require behavior change, and especially those developed to improve adherence to infection control standards, would be to look at case studies of real-world implementations—either their own or those of other professionals. Unfortunately, very few case studies are published and shared outside of the organizations where they are used. This selection of potentially unpublished case studies could fill a gap and become a valuable reference point for a number of different professional groups. From a practical point of view, if this work is used or referred to, it is also hoped it will challenge other researchers, practitioners, and policymakers to find and share other behavioral nudge case studies for infection prevention and control, so that together we can build up a public collection of 'what works' in our field. (Health Organization, 2021)

5.1. Successful Implementations in Healthcare Institutions

Several healthcare institutions have successfully applied behavioral economic strategies to enhance adherence to infection control standards. Examples of nudges applied at the bedside to increase adherence to standard precautions include masking trolleys, electronic reminders, and posters in patient rooms. Different hospitals and healthcare organizations also applied choice architecture and incentives to staff, patients, or visitors. A distributed leadership and involvement of personnel for improving controllers' performances against

alcohol and aggressive patients was introduced. For this initiative, the nudge used is an incentive-driven approach; the role of a group leader has been shown to increase performance.

In these hospitals, the projects were initiated by the local infection control team and implemented under leadership that was supportive of behavioral economics and had a good organizational cultural fit. Based on respect for the intended users of the nudge, the trials were initiated using a qualitative user-centered approach that aimed at fully understanding the intended users' perspectives. These are vital characteristics when seeking to develop choices that will be non-coercive and widely acceptable to individuals. In all cases, the nudge was embedded into the local formal routine and linked to a wider change program, with methods put in place to assess the sustainability of the effect. The success of the nudge appeared to depend on the degree to which it became truly normalized within the behaviorscape. For staff to comply maximally with the new nudge, it must be the easiest option, strongly relate to their value system, and be strongly communicated. In addition, there must be insider support to make it work.

6. Evaluation and Impact Assessment

Evaluating and demonstrating the impact of behavioral economics interventions on health professionals' adherence to infection prevention and control practices is an important step. Some of the metrics and indicators used to measure adherence are direct observation, quality dashboards or e-surveillance applications, a range of indicators reported by staff, such as IPC climate and safety, monitoring of compliance with IPC precautions and mandatory components, infections, and surveillance activities. In addition, a behavioral aspect is related to whether and how evaluations are reviewing what is important for those working to see if interventions achieve the desired outcomes and if the outcomes are sustained. A robust evaluation will provide evidence of the value of the intervention to a range of stakeholders.

There are different evaluation strategies that may be used, including pre-and-post intervention comparison, including qualitative exploration of behavioral modifications; periodic or regular monitoring of the intervention components and effectiveness, including the use of process control charts; full retrospective impact assessments of relevance, effectiveness, impact, sustainability, and personal, social, environmental transformation; and developing a theory of change of the complex interventions across healthcare. The evaluation tool and/or methods need to focus not only on what happened but on the effect of what happened on the participants. Also, evaluating the evaluation will help to shape and improve the interventions in the future. It is important to bear in mind that the process of looking at outcomes is not "one hit"; it needs to be continuously iterated and revised to keep the intervention current and relevant. (Chaboyer et al.2021)

6.1. Measuring Adherence Rates

Monitoring adherence rates to health care–associated infection control standards is essential for evaluating the effectiveness of interventions to facilitate adherence. Measurement can be performed through a variety of methods, most of which are quantitative. These include audits or chart reviews, surveys, and direct observation. Each

of these methods yields its own strengths and potential sources of bias. It is always important to link data from different time points or assessors to the same patients, using unique patient identification numbers, to avoid double counting or undercounting. Establishing such a baseline can be a very powerful tool for assessing the uptake and effectiveness of new strategies or interventions to improve adherence. Variability in adherence rates is consistent across studies, suggesting that adherence is not a consistent practice. This may reflect variations such as different institutions or countries or variations between different types of health care professionals or departments. (Tartari et al.2021)

Capturing adherence rates is a challenging element of HCAI control, evidenced by the variable adherence rates for infection control. Using the same methods, two studies have reported adherence rates to standard precautions ranging from 52% to 69%. This suggests that there are many different reasons why health care professionals do not adhere to infection control policies and that a variety of targeted interventions are required. When designing an effective strategy to enhance adherence, it is important that potential variability in adherence rates is recognized. Since adherence is variable, strategies from other institutions or countries that have shown an effect will not necessarily be similarly effective in other settings, so a local evaluation is important. A reliable estimate of adherence rates is important in the process of evaluating the effectiveness of innovations that aim to improve clinician adherence to hand hygiene or infection control practices. It is important to develop standardized protocols and metrics to enable similar 'clean' and 'dirty' care practices to be accurately compared. Previous studies have reported audit tools such as clinical reviews, patient interviews, and direct observations among their methods for recording evidence of care provided. Some have also reported using chart reviews and surveys. (Brooks et al., 2021)

6.2. Assessing Behavioral Changes

The second but last question is something that remains difficult to assess. To what extent have the behavioral changes shown been the effect of the interventions used in the research? A useful distinction to make is to what extent practitioners' behavior has changed (adherence indicators/adherence rates), and to what extent have behavioral determinants changed? Adherence indicators or adherence rates reflect the outcome of practitioners' behavior in terms of the extent to which professional behavior meets the guidelines, promotes quality delivery, is cost-effective, and results in health benefits for the patient, among others. Behaviors such as healthcare workers' adherence to infection prevention guidelines are certainly integral to measure and challenging to manifest adequately. A range of quantitative and qualitative methods to monitor changes in professional behavior have been mentioned in the literature. (Feng et al.2021)

Tools such as interviews and focus group discussions have been viewed as ways to generate new insights into why changes in behavior have occurred, which makes them highly relevant in the context of behavioral economic evaluations. Moreover, using different types of data and employing a range of qualitative and quantitative methods increases the credibility of the results and can also help to clarify findings. Answers to whether and, if so, why the behavioral changes shown were the result of specific interventions are very relevant to the evaluation practitioner. Moreover, they generate a lot of knowledge on the possible factors and mechanisms that underlie a successful (or sometimes not successful)

intervention and suggest ideas on how or under what conditions a successful intervention could be replicated or adapted. This is evident because interventions generating behavioral change suggest that numerous potential biases may arise in obtaining an answer to the question of what caused the change in behavior. Consequently, the evaluation practitioner has many reasons to be concerned with the validity of the results. Research has been conducted on the evaluation studies in the healthcare sector. A model for the assessment of these studies has also been proposed. In the field of hygiene practice, what has previously worked can be used in future hygiene evaluation settings; however, insights about why apparent changes in the use of evidence-based practice guidelines have occurred will be harder to relate to other settings. There are occasions where insight into alternative evaluative techniques may provide a better understanding of these practices and when further application of those scenarios will only act as a burden on the time and resources of the organization. (Miszczynska and Miszczyński2022)

7. Ethical Considerations

Research using behavioral economics can justifiably be criticized for promoting disingenuous behavior because it undermines professional integrity, but these criticisms do not fit when discussing the use of clinical nudges or incentives. The opt-out is not advice at all, and the mistargeting of financial incentives shows disrespect to providers who would perform the same behaviors without incentives. When used, all incentives should be large enough to prevent manipulation, and they should be clear to the practitioners as well as the department responsible for paying incentives to providers, also the ethical review board. In addition, the risks of manipulation with incentives must be minimized. Being paid to perform a behavior is one thing. Being paid to fabricate the behavior in order to receive payment is more on the order of gross manipulation justifying pushing back against those concerns. (Dobuzinskis, 2022)

In all cases, the requirement for informed consent hinges critically on the surrounding structure of the interaction, the potential danger for the patient, the practices of the institution, and so on. This is often the criteria applied by an ethical review board to evaluate recommendations for clinical practices and review a program. Relevant frameworks for this are: principalism; utilitarianism/consequentialism; consequentialism and deontology; deontology and virtue ethics; and ethics of care. In order to reduce ethical reservations regarding informed choice, interventions should be aligned with the broader goal of public health and patient safety. While respecting the right to refuse an intervention, if there is considerable evidence that approach A is likely to engage and change behavior and save enormous costs, this may need serious ethical consideration as part of the risk and benefit of refusing. This age-old challenge to the medical community asserting judgments on behalf of patients should always be made with the temperament of thorough investing and a default position of not asserting global judgment on autonomy. (Health Organization, 2021)

7.1. Privacy and Confidentiality Concerns

Privacy and confidentiality are of concern in the application of behavioral economics interventions in any setting, as they raise ethical and practical implications for potential data that are collected. In healthcare environments, health professionals may fear and

caution that any data on their decision-making collected could potentially have implications for their privacy. Data collected includes personal thoughts and feelings of those involved in the system, which are sensitive and should be safeguarded as far as possible. Furthermore, because of the potential tensions between enforcement and improvement purposes, valid enforcement measures defined by regulatory or funding bodies may utilize an interpretation that also encompasses improvement efforts. In either case, breaches of confidentiality will have severe consequences for the relationships underpinning effective healthcare systems, as they devalue the trust that must govern the patient and health professional relationship.

For researchers collecting data, a concern must be held for the utility, purpose, and information governance around the data. In terms of utility, it is a necessary part of the utilization of behavioral economic interventions that researchers are able to observe the actions of health professionals. Proposals for confidentiality need to show that the intended benefit is not achieved at an unacceptable cost to individual health professionals or the public in general; therefore, safety-relevant breaches of confidentiality are limited. Purpose refers to the need to ensure that all data is collected for valid improvement or research purposes. Relevant ethical guidelines should be developed regarding the use and storage of data that has gone through the anonymization process. Transparency during the consent process around the data to be collected is also relevant, as it allows individuals the right to make an informed choice while participating in an intervention. It is possible that a breach of confidentiality may have no direct effects. Nonetheless, the failure to take the necessary steps to protect individual actions as reported in data as much as possible could result in additional unintended consequences that harm the individual directly or their future actions. (Guo et al.2020)

8. Future Directions and Recommendations

The scale of passion for the application of behavioral economics in the healthcare context was evidenced by a substantial number of abstracts that were considered for review and culminated in the final inclusion of ten papers showcasing a variety of personalized examples on the impact of behavioral economics on changing healthcare professionals' and patients' behaviors. Given that such endeavors are still in their infancy, very few examples were highlighted regarding the impact of integrating insights from behavioral economics in healthcare settings, compared to studies from other non-health disciplines. Despite the paucity of impactful papers, the enthusiasm and potential advantages make this a worthwhile endeavor and raise potential future directions and recommendations for policy and practitioners that emerge from such personalized examples on the integration of behavioral economics and healthcare. (Box-Steffensmeier et al.2022)

Despite the limited examples to date, there is increasing interest in the ability of behaviorally tailored strategies to enhance the importance of experience-dependent feedback and the time taken on the design and implementation of interventions. It is suggested that more causal models and mechanisms can impact healthcare professionals, and some longitudinal work has been initiated to help better develop a theory of how to intervene. In particular, there are calls to further clarify for whom this approach may not work, thought to be done through expansion in testing theory. In this, we need to tackle the complexity of the healthcare context by further tailoring both intervention motives to

healthcare professionals and using network data to create tailored pathways that will improve the impact of interventions. Finally, we build into our approach a strong emphasis on the importance of 'contra-hooding' and its critical value. Our work has the potential to provide an evidence base to inform the way society develops systems to improve disinfection behavior in low-resource countries and elsewhere. It is considered that in the near future, one of the priority areas will be using more complex multi-component interventions targeting individual-level motivators and informing a more detailed behavior change strategy. Given that such associations are still novel, researchers and decision-makers do face some useful case studies here in relation to mapping individual-level motives to known behavior change techniques and tailoring their strategy accordingly. (Tartari et al.)

8.1. Potential for Further Research

Further research is obviously needed. Although advances have been made, current knowledge regarding the sustainability of the effects of behavioral interventions is still very limited. Therefore, recommencement of research on the long-term effects of behavioral interventions is essential. To this end, consideration should be given to using a variety of front-line digital health solutions in addressing adherence, as well as the application of new methodologies that can capture changes in behavior and adherence in relation to changing adherence levels. Diversity in populations is also needed because interventions are not always effective in the same way for sub-thresholds of these populations. Interdisciplinary collaboration is essential for behavioral economics to be increasingly applied across fields such as public health policies. It is necessary that behavioral scientists collaborate with experts on infectious diseases, health economists, and healthcare professionals to further tailor and test behavioral economics applications in healthcare practice and public health. There remains a clear need for future work in this area to guide practice in selecting the best interventions from the widening field of non-randomized designs. (Whitmarsh et al., 2021)

8.2. Policy Implications

Healthcare is one of the main domains that can benefit from considering cognitive biases and adopting changes due to the impact of insights from the emerging field of behavioral economics. In line with existing literature on nudging, we showed that increasing the saliency of performing 'non-normative' behavior can facilitate the adherence of health professionals to clinical recommendations. Hence, hospitals should be more often considered as complex adaptive systems, and efforts should be put into investing in the cultural change necessary to favor successful implementation of any effective intervention at the institutional level. In line with recent regulation strategies, healthcare policymakers should also consider giving process indications, allowing or even facilitating the use of a specific tool or intervention, rather than outcome indications. The results from this study suggest that public health regulations and public policies should be coherent with what is scientifically known about human decision-making and favor the implementation of interventions that have been shown to increase care quality and/or safety. (Pummerer, 2023)

Policymakers could thus see the diagnosis by hospital officers of the reasons underlying the violation of specific infection control practices, owed to health professionals' cognitive biases, as a first indication of the most effective strategies to be implemented. Once the underlying reasons are understood, policymakers themselves should provide means for hospital officers to use the discovered 'soft' controls. Some generic outputs of our research lead to policy conclusion measures favoring adherence if based on these behavioral research findings. In line with recent societal fields of study, although there could be constraints on a given policy due to resistance to changes, sometimes rational, from different stakeholders or final users, policymakers should also try to strongly influence rapid changes in order to avoid possible bad outcomes for all, directly or indirectly.

9. Conclusion and Summary

Summary Ongoing occurrences of healthcare-associated infections occurring worldwide highlight the significance and importance of adherence to infection control standards and guidelines. However, changing behavior within the healthcare environment remains largely uninformed by research. Human behavior is complex and not entirely rational, which is considered of great importance when promoting behavior change, particularly among well-informed health professionals. Behavioral economics presents the potential to translate research into practice and influence human behavior and decision-making. In this review, seven areas of infection control with potential for a behavioral intervention have been identified. This paper has supported the argument that health professionals are not infallible and highlights the potential for infection control standards not being met. (Cloutman-Green2023)

With adequate behavioral interventions that facilitate adherence to infection control standards, the number of health professionals contracting these dangerous infections could be minimized, and patient outcomes and long-term satisfaction improved. We suggest that a proposed framework should also include health services research to address the translation of paradigms from individuals to institutions. In conclusion, although no individual strategy has been shown to provide overall success, behavioral economics does show promise for improving adherence. Our findings also contribute to the accruing knowledge and understanding of the multifaceted complexities of health behavior by highlighting the differing effectiveness of tailored interventions across disease management and disease prevention environments. It is recommended that collaboration between researchers, practitioners, and policymakers continue to ensure that behavioral economics evolves in the context of everyday practice. This integration is important if we are to, pragmatically, capitalize on the advantage of behavioral economics rather than merely academically appreciate it. (Strickland et al.2022)

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