



# Reflexive control in emergency medicine

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## ABSTRACT

Emergency physicians (EPs) navigate high-pressure environments, making rapid decisions amidst ambiguity. Their choices are informed by a complex interplay of experience, information, and external forces. While cognitive shortcuts (heuristics) expedite assessments, there are multiple ways they can be subtly manipulated, potentially leading to reflexive control: external actors steering EPs' decisions for their own benefit.

Pharmaceutical companies, device manufacturers, and media narratives are among the numerous factors that influence the EPs' information landscape. Using tactics such as selective data dissemination, framing, and financial incentives, these actors can exploit pre-existing cognitive biases like anchoring, confirmation, and availability. This creates fertile ground for reflexive control, where EPs may believe they are acting independently while unknowingly serving the goals of external influencers.

The consequences of manipulated decision making can be severe: misdiagnoses, inappropriate treatments, and increased healthcare costs. Ethical dilemmas arise when external pressures conflict with patient well-being. Recognizing these dangers empowers EPs to resist reflexive control through (1) critical thinking: examining information for potential biases and prioritizing evidence-based practices, (2) continuous education: learning about cognitive biases and mitigation strategies, and (3) institutional policies: implementing regulations to reduce external influence and to promote transparency.

This vulnerability of emergency medicine decision making highlights the need for awareness, education, and robust ethical frameworks. Understanding reflexive control techniques is crucial for safeguarding patient care and promoting independent, ethical decision making in emergency medicine.

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## 1. Introduction

Emergency physicians (EPs) operate in high-pressure environments that require rapid decision making amidst complex and often ambiguous situations. A complicated interplay of information, experiences, and external factors influences their decisions. The sources and quality of this information influence the decisions they make.

A diverse array of information sources can overwhelm EPs. These sources include powerful industries, such as pharmaceutical companies and device manufacturers; health industry leaders, such as medical societies and hospital administrators; and the media, encompassing both traditional and online sources that are increasingly AI generated. In addition, EPs are besieged by public expectations, legal constraints, liability fears, and financial incentives when making clinical decisions. No existing model has effectively captured this complex interplay of inputs, EP responses, and how their effect can be moderated. This paper attempts to fill that gap.

## 2. Heuristics

To manage the information onslaught, EPs incorporate this input into simplified, mental shortcuts (heuristics) that they use to rapidly assess patients, prioritize interventions, and make initial diagnoses under time pressure and uncertainty. Using heuristics, EPs identify patients' key signs and symptoms, then match the picture they see to their knowledge and experiences to make rapid initial decisions that they can later refine with additional information. Developed through years of medical education and training, heuristics allow physicians to navigate complex scenarios efficiently. They streamline decision making, particularly in high-pressure situations, and contribute to improved patient outcomes.

While heuristics enable EPs to make rapid assessments and initiate timely interventions, reliance on these mental shortcuts also leaves them vulnerable to manipulation as well as to cognitive biases and oversimplification that may cause them to overlook important information in complex cases. Dual-process theory explains this by distinguishing actions based on automatic, intuitive responses (System 1) from

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reflective, deliberate thinking (System 2) [1]. When EPs employ heuristics, they use System 1 “intuition” to make decisions without conscious reasoning. They gain this ability based on years of experience and exposure to a wide range of clinical scenarios. Some patients and novice clinicians view this ability as “magic” [2].

The application of clinical heuristics can be distorted by manipulating various cognitive biases [3]. *Anchoring bias*, for example, over-emphasizes initial information or presumptive diagnoses. *Confirmation bias* seeks evidence that confirms existing beliefs about a diagnosis or treatment while overlooking contradictory evidence. *Availability bias*, that most affects heuristics, prioritizes readily available information. While external sources contribute to all these biases [4], the effect of external influence is most prominent with availability bias [5].

### 3. Reflexive control

The process of manipulating EPs' heuristics may best be viewed through the lens of “reflexive control,” a Soviet military concept initially called *maskirovka* (deception) [6]. Reflexive control incorporates psychological tactics, disinformation, and strategic messaging designed to induce the target to make decisions that serve the controller's interests. Using a deep knowledge of the target's behavior, it incorporates multiple methods, actors, and modalities, “while concealing its true intentions and surreptitiously influencing its competitors' decision-making algorithms” [7,8] (Table 1).

With the proliferation of social media, the use of reflexive control has become more obvious in military campaigns, politics, and advertising. Biased messaging and strategic information leaks or misinformation frequently frame issues and use emotionally charged language to evoke predictable responses from their audience. These influence the recipients' perspective and, ultimately, their behavior [9]. Political campaigns, for example, often selectively provide voters with carefully chosen information that highlights certain aspects of candidates or issues while downplaying others. They also use emotionally charged language or imagery to evoke fear, hope, or anger, and often present voters' choices as being binary or mutually exclusive, framing the preferred candidate or policy as the only viable option given the voter's cultural and political background. Reflexive control has long been used in other non-medical fields, including sports and strategy games. In football, a quarterback executing a play-action pass feigns a handoff to a running back, inducing the opposing defense to react automatically and predictably based on their training, creating an opening for a successful pass play. (That is one

**Table 1**  
Elements of reflexive control.

<p>Reflexive control involves influencing an adversary's decision-making process by shaping their perceptions and beliefs while maintaining the illusion of independent action. Key elements include:</p> <p><i>Defining Desired Outcome:</i> The manipulator/controller's strategy is to define their objective and influence the target's decision making in a way that benefits the manipulator's own goals or desired outcomes.</p> <p><i>Framing and Narrative Control:</i> Controllers frame information and the narrative around an issue to influence the target's interpretation and decision making. They feed biased, selective, or inaccurate information to the target, shaping their understanding of the situation [10].</p> <p><i>Cognitive Shortcuts:</i> The controller exploits cognitive biases and shortcuts (heuristics) to influence the decision-making process, steering the target's actions towards their desired outcomes.</p> <p><i>Complexity of Influence:</i> Multiple controllers may be involved, each contributing to manipulating the target.</p> <p><i>Emotional Manipulation:</i> Controllers appeal to the target's emotions to sway their decision making in a predetermined direction.</p> <p><i>Limited Awareness:</i> Controllers operate subtly and indirectly, keeping the target unaware of the extent and nature of external control and preserving the target's illusion of autonomy.</p>
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reason opposing teams study game tapes.) Similarly, expert players use reflexive control to manipulate their opponent in chess, checkers, dominoes, Jenga, Go, and many other games.

### 4. The controllers

Reflexive control theory posits that controllers can manipulate individual or groups' decision-making processes by controlling the flow and nature of information available to them. In emergency medicine (EM), reflexive control is triggered by strategically presenting information to guide EPs' decision making. EPs are encouraged to incorporate such information into key parts of the clinical heuristics that affect their decision making. Those who provide this information often operate subtly, through tactics like framing information (i.e., putting it in its most favorable light), setting agendas, and applying pressure that can bypass critical thinking and lead to suboptimal decisions.

Understanding the complex interplay between external pressures and the EPs' use of this information in their clinical heuristics is crucial for safeguarding physician autonomy. EP autonomy is vital, since it ensures that “care decisions are aimed at promoting the patient's well-being [and] are guided by the best available medical evidence and professional standards” [11].

As EPs synthesize information into their clinical heuristics, the imprint of these multiple external influences becomes pronounced. Some examples of ways controllers influence EPs include:

- Framing new medications or protocols as “faster and more efficient,” potentially leading to their adoption without thorough evaluation of possible side effects or increased costs.
- Highlighting the potential benefits of new diagnostic tools or software without considering their actual effect on patient outcomes or the broader ED workflow.
- Changing ED protocols prompted by media scrutiny and public complaints without proper evaluation of their long-term effect on staff morale and efficiency.

Just as a puppeteer manipulates a marionette, external controllers subtly pull decision-making strings. As a result, EPs may believe they are acting independently and in their patient's, best interests, even when they are being manipulated to make decisions that align with the controllers' goals. Table 2 lists many of the most important controllers in health care. This list of influencers is not exhaustive. Other controllers include the media, pervasive culture, religion, researchers, educators, and peers.

External influencers (controllers), motivated by diverse agendas, have an array of “strings” with which to manipulate EPs. Major controllers and their most effective methods of influence are listed below. Note that, in accordance with reflex control theory, controllers often cooperate with each other, thus their strings may overlap. Table 3 lists possible effects of these influences on EPs (marked by \*). See Table 4 for a detailed description of how the pharmaceutical industry manipulates EP heuristics to meet their objectives.

### 5. Benefits of reflexive control in EM

Clinical heuristics and the reflexive control elements that feed into them can be valuable clinical tools, enhancing EPs' ability to manage the vast amount of medical information they encounter. Heuristics can improve clinical accuracy, efficiency, and pattern recognition, but only if they are based on accurate and evidence-based knowledge.

**Table 2**  
 Controllers and influence methods.

<i>Government Agencies and Regulatory Bodies (Licensing Boards, Regulatory Agencies, Legislation)</i>	
• Drug enforcement and prescription monitoring*	
• Laws, regulations, and guidelines	
• Licensing and continuing education requirements	
• Monitoring and enforcement of EPs' clinical behavior	
<i>Pharmaceutical/ Medical Equipment Industry</i>	
• Aggressive marketing tactics (highlighting benefits; minimizing detriments)	
• Financial relationships and incentives (see Table 4)	
• Sponsored educational events, teaching materials, conferences, research	
• Support, collaborate with, or market to patient advocacy groups	
<i>Healthcare Institutions/Systems</i>	
• Administrative policies and procedures	
• Electronic health records (EHRs)/ clinical decision support systems (CDSS)*	
• Peer review and feedback/quality improvement initiatives	
• Performance metrics and reimbursement models	
<i>Insurance Companies (Private and Government)</i>	
• Complex billing, claims denials and appeals processes	
• Limited coverage for specific treatments, medications, and clinicians*	
• Restricted formularies	
• Telehealth policies	
<i>Professional Organizations</i>	
• Set certification and recertification requirements	
• Develop clinical protocols and guidelines*	
• Provide educational modules, workshops, resources, and conferences	
• Provide ethical guidance and professional standards for clinical practice	
<i>Legal System</i>	
• Court-established legal standards of care	
• Malpractice lawsuits*	
• Regulatory compliance	
• Reporting requirements	

**Table 3**  
 Examples of how "strings" influence EPs' clinical heuristics.

Drug Enforcement and Prescription Monitoring	<ul style="list-style-type: none"> <li>• <i>Heightened awareness of potential drug misuse and diversion:</i> Influences their prescribing habits and decision making.</li> <li>• <i>Increased scrutiny of patients:</i> EPs might focus on identifying potential misuse red flags, such as past drug abuse history, high dosage requests, or doctor shopping. This can lead to biased prescribing practices and discrimination.</li> <li>• <i>Defensive prescribing:</i> Fear of legal repercussions or disciplinary actions might lead EPs to adopt heuristics favoring safer but potentially less effective medications or stricter prescribing practices.</li> <li>• <i>Reduced access to essential medications:</i> Fear of misuse might lead EPs to adopt heuristics that restrict access to necessary medications for legitimate pain management or chronic conditions.</li> </ul>
Electronic Health Records (EHRs)/ Clinical Decision Support Systems (CDSS)	<ul style="list-style-type: none"> <li>• <i>Algorithmic bias:</i> CDSS algorithms, like any AI system, can be susceptible to biases present in the data they are trained on, potentially leading to biased suggestions, and reinforcing existing heuristics in an unhelpful way.</li> <li>• <i>Templating effect:</i> Overly rigid EHR templates can hinder the development of individualized heuristics by encouraging a "fill-in-the-blank" approach instead of encouraging critical thinking and tailoring based on the specific patient.</li> <li>• <i>Provide data and prompts to refine existing heuristics:</i> Both systems can remind EPs of crucial information or potential diagnoses they might have forgotten, updating their mental shortcuts based on new evidence or patient context.</li> <li>• <i>Reminders and alerts:</i> CDSS can provide real-time reminders and alerts based on established protocols and guidelines, helping EPs avoid potential errors or omissions and prompting them to consider specific heuristics in relevant situations.</li> <li>• <i>Introduce biases and limitations:</i> Inaccurate data and rigid algorithms in both systems can introduce biases into the heuristics used by EPs, potentially leading to suboptimal care.</li> </ul>
Limited Insurance Coverage for Specific Treatments, Medications, and Out-of-Network Clinicians	<ul style="list-style-type: none"> <li>• <i>Cost-conscious decision making:</i> Knowing the limitations of insurance coverage, EPs might subconsciously favor heuristics and outpatient treatment that can lead to less expensive interventions, even if they are not the most clinically optimal (e.g., generic medications, less invasive procedures, or delaying referrals to specialists).</li> <li>• <i>Referral heuristics:</i> EPs may develop heuristics that favor referring patients to in-network specialists covered by insurance, even if out-of-network providers have greater expertise or better patient outcomes.</li> <li>• <i>Cognitive biases:</i> Awareness of limited coverage can exacerbate cognitive biases like anchoring bias, leading EPs to fixate on covered options and neglect potentially better alternatives, even if not explicitly covered.</li> </ul>
Clinical Protocols and Guidelines	<ul style="list-style-type: none"> <li>• <i>Reduced cognitive load:</i> Standardized approaches in guidelines can streamline decision making in high-pressure situations, allowing EPs to focus on individual patient nuances and critical thinking.</li> <li>• <i>Over-reliance and "cookbook medicine":</i> Rigid adherence can stifle critical thinking and hinder adaptation to unique cases, potentially leading to suboptimal care.</li> <li>• <i>Outdated heuristics and slow updates:</i> Guidelines might not keep pace with rapidly evolving evidence, leading EPs to rely on potentially outdated heuristics. Regular updates and transparency are crucial.</li> <li>• <i>Discourage innovation and critical thinking:</i> Overly strict protocols might discourage EPs from trying new approaches or critically evaluating established practices, hindering advancements in EM and the development of more effective heuristics.</li> <li>• <i>Anchoring and mitigating biases:</i> Well-developed protocols can serve as anchors, preventing EPs from solely relying on individual biases or limited experience. This can improve diagnostic accuracy and reduce the influence of cognitive biases like availability bias, which can lead to misdiagnosis or inappropriate interventions.</li> </ul>
Malpractice Lawsuits	<ul style="list-style-type: none"> <li>• <i>Risk aversion:</i> Adopting more conservative heuristics and avoiding shortcuts that might be risky or deviate from standard practices.</li> <li>• <i>Defensive medicine:</i> Overusing diagnostic tests, procedures, or interventions to mitigate the risk of legal action. Bias towards over-diagnosis or over-treatment.</li> <li>• <i>Bias:</i> Can reinforce cognitive biases, such as availability bias (overestimating the likelihood of rare but highly publicized adverse events) or recency bias (placing undue weight on recent negative experiences), which may distort physicians' clinical heuristics.</li> </ul>

5.1. Benefits include

5.1.1. Streamlined decision making

Reflexive controls can guide and streamline decision making, especially in critical situations requiring swift responses.

5.1.2. Training and simulation

Exposing EPs to various training programs' scenarios and simulations enhances their skills, improving their responses in real-life situations.

5.1.3. Standardized care

Standardized protocols and guidelines established through reflexive control promote consistent and evidence-based practices, enhancing the efficiency and consistency of patient care. These external influences, like pre-defined procedures, help ensure uniformity and quality across different situations.

5.1.4. Improved patient outcomes

Integration of advanced technologies like CDSS and EHRs can provide physicians with timely and relevant information, influencing their decisions towards better patient outcomes, despite potential drawbacks associated with these technologies.

5.1.5. Patient-centered priorities and values

A positive and supportive organizational culture that emphasizes patient-centric and ethical considerations can influence EPs' decision making.

**Table 4**  
An example of reflexive control in medicine: the pharmaceutical industry.

EXTERNAL ENTITY
Pharmaceutical Industry: Manufacturers; Pharmacy Benefit Managers; Wholesalers/Retailers
DESIRED PHYSICIAN BELIEFS/BEHAVIORS
<i>Manufacturers:</i> Want physicians to prioritize prescribing their medications over competitors. They encourage early intervention and escalation of therapy, which can increase drug sales. Often want EPs to enroll patients in drug studies and encourage their patients to participate, to generate data for drug development and approval. Some manufacturers may push for protocols that benefit their drugs, even if alternative approaches exist.
<i>Pharmacy Benefit Managers (PBMs):</i> Want physicians to prescribe medications that are on their formulary to benefit their profitability.
<i>Wholesalers/Retailers:</i> Generally interested in promoting the use of the pharmaceutical products they sell.
INTERVENTIONS USED TO GUIDE PHYSICIAN BELIEFS/BEHAVIOR
Providing Selected Information/Misinformation
<i>Framing:</i> Entities can control the information physicians receive, presenting issues in ways that favor their interests. This includes funding research, sponsoring conferences, and providing biased information through publications and media outlets [12].
<i>Education:</i> Medical schools and professional organizations can be influenced by entities, shaping the curriculum and training materials used to educate physicians. The pharmaceutical industry also distributes favorable product information through medical journals, online platforms, and scientific conferences. This can lead to subtle biases being ingrained in EPs understanding of medicine.
<i>Marketing:</i> Pharmaceutical companies and medical device manufacturers use extensive marketing campaigns to promote their products, often highlighting potential benefits while downplaying risks [13]. Their representatives visit physicians to promote their products, provide slanted information, and distribute free samples to try to sway physicians' perceptions and prescriptions. Targeted marketing to consumers puts additional pressure on physicians.
<i>Economic incentives:</i> Entities can directly incentivize physicians through research grants, meals, consulting fees, speaking engagements, travel, and gifts. Such incentives establish a sense of obligation and indebtedness, creating a conflict of interest, and influencing a physician's decision-making process [14–16].
<i>Cognitive biases:</i> Humans are naturally prone to cognitive biases that the industry can use to subtly influence physicians' decision making. <i>Anchoring:</i> By presenting their drug as the "gold standard" or the "market leader," the industry can anchor a physician's thinking and make them more likely to prescribe it, even if there are equally effective or better options available. <i>Availability heuristic:</i> Flooding physicians with information about their newly launched drug can make them think that it is more effective, even if the evidence base is still weak. <i>Confirmation bias:</i> Physicians who already have a positive impression of a drug are more likely to interpret industry-sponsored studies favorably, reinforcing their existing beliefs [13,17].

Using the pharmaceutical industry as an example, this table provides more detail on how reflexive control can be used to guide EPs' prescribing patterns, diagnostic choices, and treatment recommendations, thus aligning their behavior with the industry's desired outcome.

## 6. Harms of reflexive control in EM

EPs can overuse or inappropriately use clinical heuristics. Overreliance on familiar patterns can lead to errors, and rigid mental models can hinder adapting to unique cases. When used manipulatively, reflexive control poses additional ethical and patient safety concerns.

Excessive standardization may cause EPs to fail to notice the uniqueness of individual cases, resulting in suboptimal or inappropriate treatments. When reflexive control is used to manipulate physician behavior for external motives such as financial incentives or pharmaceutical interests, it can compromise the integrity of medical decision making and potentially harm patient outcomes. Striking a balance between the efficiency gained through reflexive control and the need for individualized, patient-centered care is crucial to ensuring positive outcomes in health care.

The manipulative form of reflexive control has the potential to exacerbate healthcare disparities. Financial incentives and pharmaceutical influences may disproportionately impact prescribing patterns, favoring certain treatments that may not be universally applicable. Standardized protocols driven by manipulative reflexive control may inadvertently neglect cultural nuances and individual patient circumstances,

perpetuating disparities in care. Additionally, when reflexive control is leveraged to meet institutional targets, such as patient satisfaction scores, it may inadvertently neglect the diverse needs of marginalized or underserved populations.

Misguided decisions influenced by manipulated information can lead to:

- Misdiagnoses and inappropriate treatments due to overreliance on biased information or heuristics, due to confirmation bias.
- Increased healthcare costs due to unnecessary procedures or medication overuse.
- Ethical dilemmas that arise from conflicts between external pressures and patient well-being.
- Overuse or inappropriate use of medications or devices.
- Failure to consider alternatives, including potentially more effective options.
- Exacerbated health disparities.

## 7. Prevention/mitigation: The role of EPs, management, systemic safeguards, and artificial intelligence (AI)

Prevention and mitigation of reflexive control's effect on EPs depends on continuous efforts by the physician, management, and the healthcare system.

Individual awareness and education are key. EPs must hone their awareness of biases and manipulation tactics, while prioritizing evidence-based practices and individual patient factors. Continuous training in cognitive bias management and information appraisal will further equip them to make informed, autonomous decisions. In essence, understanding the role of heuristics in our decision-making processes and the potential for manipulation empowers EPs to make more informed choices. The next section contains specific recommendations and cases that deal with this.

ED and institutional management play crucial roles in mitigating the negative effects of reflexive control and safeguarding physician autonomy. Navigating the complex healthcare landscape requires ED leadership to actively counter external pressures and prioritize patient well-being. This starts with promoting evidence-based practices and ensuring that protocols and resource allocation are driven by rigorous research and patient needs, not external influences. Open communication and collaboration, fostered through transparency, allows diverse perspectives to inform decision making and mitigate the sway of individual agendas. Empowering staff through education and awareness training in critical thinking and media literacy equips them to resist undue influence. Additionally, advocating for policies that support physician autonomy and professional judgment ensures ethical considerations remain at the forefront of decision making. Ultimately, ED management succeeds by prioritizing long-term patient outcomes and sustainable resource utilization, resisting the allure of short-term metrics or external pressures, and ensuring optimal care for their communities.

Systemic safeguards are equally vital. Recognizing the vulnerabilities exposed by reflexive control necessitates proactive strategies to mitigate its influence and promote informed, autonomous decision making in EM. This requires a multi-pronged approach targeting both individual physician awareness and systemic safeguards. Transparent and robust policies are crucial to safeguard against external pressures. These policies should promote financial independence and prioritize patient-centered care, minimizing influence from pharmaceutical companies, device manufacturers, and other stakeholders. Fostering a culture of transparency and accountability within healthcare institutions further discourages manipulative practices and encourages open communication.

AI has the potential to enhance decision-making processes by providing data-driven insights, thus reducing the effectiveness of reflexive

control mechanisms influenced by external pressures. This may lessen the impact of manipulative reflexive control tied to financial incentives or industry influences. By analyzing vast datasets and identifying patterns, AI can support physicians in making more objective and patient-centric decisions. However, ethical considerations and challenges may arise, since the design and programming of AI systems can inadvertently introduce biases, influencing decision-making in ways that parallel or exacerbate manipulative reflexive control [18,19].

By adopting a multi-faceted approach that combines individual physician awareness and education with systemic safeguards, EPs can effectively mitigate the negative effects of reflexive control and ensure decisions are informed, autonomous, and ultimately in the best interests of the patient.

## 8. Methods for emergency physicians to avoid being manipulated by reflexive control

The following are some concrete steps EPs can take to diminish the effects on them of reflexive control and maintain their autonomous decision making.

### 8.1. Use valid, independent information sources, particularly evidence-based medicine

Base clinical decisions on rigorous scientific evidence rather than on promotional materials or pressure from industry. Emphasize the importance of evidence-based medicine in discussions with patients and colleagues. Seek information and guidelines from independent medical associations, not industry-funded sources. Be wary of industry-sponsored research, textbooks, and continuing medical education (CME) courses. Look for independent, evidence-based resources.

### 8.2. Be alert to educational bias

Industry-funded medical education, including funding speakers and providing unrestricted grants, is always designed to promote their products [20]. Industry-funded continuing medical education (CME) courses may present a biased view of treatment options, favoring the drugs or devices the company sells, minimizing or omitting drug harms, or creating markets for their drugs (e.g., erectile dysfunction) [15,20,21]. Accredited continuing medical education (CME) offered by academic institutions, medical societies, and government agencies provides physicians with opportunities for ongoing education and professional development. They are typically free from industry influence and focus on evidence-based practice and clinical skills enhancement.

### 8.3. Beware of ghostwritten medical articles

Drug companies often hire physicians to put their names on research or review papers written by company employees—without acknowledgement. This can mislead other physicians about the true effectiveness and safety of a drug, potentially resulting in patient harm [22]. Some companies have had official programs to identify willing physician ghost authors who have had positive results with the drug (and occasionally device). These studies often downplay risks and exaggerate the benefits of those drugs [23–25]. Spotting ghostwritten medical journal articles can be challenging, but some signs include inconsistencies between the stated authors of the article and the individuals who are acknowledged for their writing or editorial assistance, overly polished language and writing, and funding from pharmaceutical companies or other organizations.

### 8.4. Use clinical guidelines with caution

Undue industry influence on the development of clinical guidelines has been documented in various medical fields. Many panel members

involved in developing clinical practice guidelines have financial ties to the pharmaceutical industry, raising questions about the objectivity of guideline recommendations [26]. To avoid being manipulated in their clinical practices, EPs should use information sources most likely to be current and free of industry influences [26]. These include peer-reviewed medical journals and research databases, such as PubMed, JAMA Network, NEJM, Cochrane Library, and UpToDate. Other sources are independent drug letters, such as The Medical Letter, and government agencies, such as the Food and Drug Administration (FDA), the Centers for Disease Control and Prevention (CDC), and The World Health Organization (WHO).

### 8.5. Avoid incurring reciprocal obligations to industry

Be cautious about accepting gifts, favors, or incentives from industry representatives since they expect some type of reciprocity [27]. The optimal position is to refuse to participate in industry-sponsored events and to decline all gifts, consulting fees, meals, and research funding [15,28,29]. Sales representative-physician interactions contribute to irrational prescribing despite physicians' widespread belief to the contrary. It has been shown that these interactions, gifts, and feelings of reciprocity make them more receptive to the marketed drugs and devices. Physicians are more likely to prescribe medications after meeting with drug representatives, attending pharmaceutical-sponsored seminars, or accepting drug samples [30–35].

Pharmaceutical and medical equipment companies only spend money on marketing that works. Between 2014 and 2022, they spent \$60.1 million to provide 50.1% of EPs with gifts, meals, and consulting fees [36–38]. Most of these payments are related to the marketing of specific drugs [38]. More than 700 physicians in some specialties have received \$1 million or more as incentives to prescribe, advocate for, or use drugs or devices in patients [39–42]. Overall, 48% of physicians received \$2.4 billion in industry-related payments in 2015 [43]. The federal government reports these amounts and physician names online [44].

### 8.6. Beware of deceptive and unethical marketing tactics

In numerous cases, pharmaceutical companies have used aggressive and illegal marketing tactics to influence physicians' prescribing behaviors. For example, Purdue Pharma's marketing of OxyContin involved downplaying the risks of addiction and aggressively promoting the drug for chronic pain management [45]. Investigators responding to whistleblower information found that the centerpiece of this marketing to physicians included self-serving presentations of the literature, free samples, direct financial incentives, and underwriting teaching and research [46].

### 8.7. Keep industry relationships transparent

Disclose any financial or non-financial relationships with industry or management that could potentially influence decision-making or patient care. Transparency builds trust with patients and colleagues and helps mitigate conflicts of interest. Document and report concerns. Keep detailed records of any instances where industry or management influence appears to compromise patient care or professional autonomy. Report concerns through appropriate channels, such as institutional compliance offices or professional associations, to ensure they are addressed appropriately. If EPs witness industry influence harming patient care, they should report it to appropriate authorities within the healthcare system.

### 8.8. Exercise caution with exaggerated claims and off-label marketing

The US Department of Justice frequently settles cases with pharmaceutical companies for illegal marketing practices, including misleading

doctors about drugs and pressuring doctors to prescribe certain medications for indications outside their intended purpose [47–50]. Some prominent cases, described below, involved misleading doctors.

*Improper interactions with physicians* have resulted in major legal cases involving pharmaceutical companies. Purdue Pharma, maker of OxyContin, admitted to misleading doctors about the addictive nature of the drug and its diversion program, contributing to the opioid crisis [51]. GlaxoSmithKline settled a lawsuit in 2012 for \$3 billion after the US government charged that it was illegally marketing three drugs (Paxil, Wellbutrin, and Avandia) for off-label and potentially dangerous uses. It also admitted to paying for positive publications about the drugs, concealing adverse safety information, and misstating the drugs' efficacy [52]. Merck & Co. withdrew its painkiller drug Vioxx from the market due to safety concerns regarding increased risk of heart attacks and strokes. Subsequent investigations revealed aggressive marketing practices by Merck, including allegations of improper payments to physicians and manipulation of clinical trial data [53]. An estimated 27,000–60,000 patients died while taking Merck's drug Vioxx between 2000 and 2004 [54].

### 8.9. Advocate for independent research funding

As a specialty, EPs should advocate for increased public funding for medical research to reduce reliance on industry grants. Drug company-funded research and the way the outcomes are released and reported have often been biased in favor of the company's products [15,55,56]. Obtaining public research grants mostly avoids proprietary influences.

### 8.10. Be leery of industry-funded patient advocacy groups

Patient advocacy groups, often for specific diseases, can influence EPs through patients, their families, advertisements, or directly. Industry funds between 20% and 83% of these groups. The stances adopted by these groups tend to support the sponsor and play a significant role in advocacy efforts. This is the case regardless of whether their positions align with the best interests of patients or the public [57].

## 9. Limitations of applying reflexive control to physician behavior

While the concept of reflexive control offers insights into how external forces may affect physicians and other clinicians, it is crucial to acknowledge its limitations.

### 9.1. Internal factors

Physician behavior is not solely dictated by external pressures and incentives. Their extensive education, knowledge, beliefs, values, and professional judgment also heavily influence their decision making. They are not automatons, blindly reacting to external stimuli, but rather critical thinkers capable of evaluating information, considering options, and making conscious choices.

### 9.2. Varied responses

Physicians exhibit diverse responses to external influences. Some may be more susceptible to pressure, readily adapting their behavior to meet external expectations. Others may resist or even counter external forces, upholding their professional autonomy and ethical principles. This variability highlights the complex interplay between external pressures and individual factors.

### 9.3. Complexity

External influences rarely exist in isolation. Often, multiple pressures coexist, potentially interacting and conflicting with each other in

intricate ways. For example, financial incentives might clash with evidence-based guidelines or patient needs, creating a complex decision-making environment for physicians.

By acknowledging these limitations, we can develop a more nuanced understanding of how external factors influence physician behavior. Recognizing the interplay of internal and external forces as well as the variability in individual responses is crucial for designing effective interventions and promoting ethical healthcare practices.

## 10. Conclusion

The concept of reflexive control illuminates the complex interplay between external pressures and internal decision-making processes in health care, with profound consequences for both physicians and patients. Recognizing the significant yet often overlooked role of reflexive control in shaping EP behavior is crucial for promoting informed, autonomous, unbiased, and patient-centered decisions. While exposing potential vulnerabilities to manipulation, it also offers valuable insights into the nuanced ways external forces shape physician behavior.

Recognizing its multifaceted effect necessitates a comprehensive approach. On an individual level, physicians should actively cultivate critical thinking skills, become aware of cognitive biases, and embrace evidence-based practices. At the institutional level, policies should be implemented to safeguard against undue external influences and promote transparency in healthcare decision making. By grasping the mechanisms of reflexive control and implementing strategies to mitigate potential negative effects, physicians can make more informed, autonomous, unbiased, and patient-centered decisions, thereby enhancing healthcare quality for all.

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## CRediT authorship contribution statement

**Kenneth V. Iserson:** Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Software, Resources, Project administration, Methodology, Investigation, Formal analysis, Conceptualization.

## Declaration of competing interest

The author has no financial or personal relationships with other people or organizations that could inappropriately influence (bias) his work, including employment, consultancies, stock ownership, honoraria, paid expert testimony, patent applications/registrations, and grants or other funding.

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