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CASE AND COMMENTARY

Should a Psychiatrist Prescribe a Nanodrug to Help Parents Monitor a Teen's Adherence?

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Abstract

This case explores ethical questions about tracking medication adherence in a 16-year-old patient with schizophrenia. Relevant stakeholders are the teen, the parents, and society. How those stakeholders' interests should be considered is explored here in the context of the psychiatrist's professional care management responsibilities and the burdens each stakeholder must bear over the course of the patient's care.

Case

Dr S is a child psychiatrist who has been seeing BR, now age 16, for about 2 years. BR has been diagnosed with schizophrenia. Given the stress at home, BR has been forgetting to take prescribed medication and has suffered a psychotic episode that required him to be forcibly sedated and hospitalized for 10 days. Dr S considers prescribing BR a nanodrug that can monitor whether (but not necessarily exactly when) BR has ingested the medication. This would help Dr S's staff monitor BR's adherence to the medication and help prevent acute exacerbations, particularly psychotic episodes. BR's parents support this plan for nanopill-assisted surveillance of their son's medication compliance. However, BR is reluctant, stating, "I want to take the medicine, but I don't want to be monitored." BR clarifies that his usual treatments have worked well for him in the past, and he promises to keep taking his medication. BR's parents are adamant that he be prescribed the nanodrug and reiterate that BR has been forgetful and distracted lately and needs the reminders that the wearable patch, which contains a sensor that detects signals from the nanodrug, would trigger. Amidst this disagreement, Dr S is unsure about how to proceed.

Commentary

Aripiprazole, the active ingredient in the nanodrug described in the case, works via a digital health feedback system (DHFS). A patient swallows the drug, and then a nanosensor in the pill is activated by the patient's stomach acid, triggering release of an antipsychotic used to treat mental illness.[1] The sensor sends a signal to a patch worn on a patient's torso; the patch logs the date and time of ingestion and communicates this information to a smartphone app, usually within 2 hours. The patch also logs daily activity (steps) and time spent at rest (sleeping and reclining), which is sent to a

smartphone app. When registered users (caregivers, family members, or others invited—that is, authorized—by the patient) login to an application (app), this data is displayed on a dashboard and can be viewed, along with a patient's daily rating of her mood and her subjective experience of rest.

Why develop this technology? What is its purpose? What is its promise? There is a high prevalence of low adherence to treatment among adolescents with chronic health conditions.[2,3] Mental health disorders affect approximately 25% of children and adolescents worldwide,[4] and early intervention is essential in improving outcomes for this group. Adolescent-onset schizophrenia is less common than adult-onset schizophrenia and phenotypically more severe.[5] This severity entails comparatively greater compromise of social and occupational function. The purpose and promise of DHFSs is to promote better adherence to medications among adolescents, thus translating into better outcomes for these patients.

Ethical issues raised by this case are discussed here within the framework of a risk-benefit analysis. The benefits involve the promise. The question of risks, however, is primary in the ethical analysis of this DHFS, particularly given that its benefit as an adherence tool is not established. The basis for Food and Drug Administration (FDA) approval relied on the safety and usability of the device and the bioequivalence of the active ingredient, aripiprazole, whose efficacy was previously established.[6]

Promise of Benefit

Poor adherence to medications among adolescents with any chronic health condition is associated with poor outcomes, including increased complications, increased mortality, and increased utilization of health services.[7] In contrast, getting care early improves outcomes.[8] Part of that treatment includes use of antipsychotics.

Adolescents have adopted communication technology as a part of their everyday lives. The technology required in implementing the DHFS—an app—would not be unfamiliar to them.[9] In addition, participants in the initial studies of aripiprazole with sensor reported the system was relatively easy to use.[10] A survey published in the *JMIR Mental Health* in 2015 found that young adults, ages 18-35, with first-episode psychosis were comfortable with receiving information digitally and more than half had a positive view of receiving reminders to take medication by text or email.[11] Combined with DHFS's ease of use and the prevalence of and familiarity with communication technology, this receptiveness to reminders could confer on DHFS a unique advantage in improving self-management skills in adolescents such as BR. Unfortunately, there is currently a dearth of evidence that these apps improve adherence to prescribed medications.[12]

BR is, at first glance, a perfect candidate for a DHFS. His stated reason for noncompliance is forgetting, and forgetfulness in adolescents is a known barrier to

adherence.[4,9] The idea of an applied technology that could improve adherence in this population is compelling.

In terms of the patient-physician relationship, there is potential for benefit as well. A DHFS might offer a tangible way of discussing nonadherence, as the physician and patient could review mood, sleep, and activity as it relates to the medication. It is a tool that might, in real time, shed light on the reason for the patient's nonadherence—be it simply forgetting or related to side effects such as sedation, fatigue, nausea, or general ineffectiveness of the medication. It might enhance an interactive relationship between BR and his psychiatrist as they in concert make decisions about medication or behavior based on the additional information provided by the DHFS. It could also help the illness seem less mysterious and more manageable.[3,13]

A DHFS might also relieve the anxiety of parents. It doesn't take much imagination to suspect that one source of stress in the household is BR's nonadherence. Assuming his parents are notified by text or email by the app that BR ingested his medication, the system might relieve their anxiety and BR's as well. It could put an end to daily inquiries into his medication compliance by his parents. It might become part of a positive reinforcement system rather than a negative one if, for example, BR is praised for adherence rather than repeatedly questioned in fear or expectation of nonadherence.

Risks

BR, however, is hesitant. He would like to keep taking the medication of his own accord without the aid of a DHFS. In this case, there is a conflict between the autonomy of the patient on the one hand and the parents' need to care for and protect their child. This conflict is consequential. Empirical research has demonstrated that, by 14 years of age, adolescents' cognitive capabilities and decisional competence are comparable to adults'.[14] BR is 16 and developmentally should be well on his way to a substantial understanding of personal responsibility as a measure of independence and emotional maturity.[15]

Psychiatrists are obliged to recognize the individual patient's dignity, autonomy, and capacity for self-determination regardless of age.[9] Does this adolescent have decision-making capacity? Does he understand the risks and benefits of accepting or declining treatment and the potential outcomes of alternative treatments, and is he able to provide a voluntary noncoerced decision? Based on the case vignette, BR expresses knowledge of his illness, an understanding of the necessity of medication given his illness, and an awareness of the positive effect of medication on his well-being. In fact, he wishes to keep taking the medication. Given this apparent decision-making capacity and his age, BR's assent to employ the DHFS is necessary if not sufficient for consent. (Unless emancipated, a minor must have consent from the parents to receive treatment.[14]) Assent to the DHFS has the potential to produce better patient

participation and compliance with treatment and to improve communication between physician and patient.

Although the psychiatrist and patient would both benefit from the patient's assent, if BR feels spied on, or forced or manipulated into accepting the DHFS by his parents and the physician despite his voiced objection, a confrontational triad might ensue with resentment and anger infiltrating all relationships, thus destroying a foundation of trust and foreboding therapeutic relationships in need of repair. If the DHFS system worsens the patient's paranoia, it could actively insert distrust and suspicion into these relationships as well. (Of note, one study thus far did not find that the system worsened adult patients' psychosis.[10]) Such a scenario is unlikely to improve the substantial familial stress mentioned in the case study.

The patient's stage of development presents another set of difficulties. BR is a budding adult with a serious chronic illness, and he might view the DHFS as reducing his status to that of an irresponsible child whose word is disregarded in favor of technological confirmation. In addition, using, refusing, or failing the system could lay the groundwork for shaming, a known harm.[16] Related to shame is another known concern among teenagers: cyberbullying. A study assessing the attitudes and concerns of young people (ages 15 and 16) pertaining to the employment of mental health apps found that their concerns included loss of confidentiality and cyberbullying.[17]

The FDA is well aware of privacy issues as they pertain to new digital technologies in the medical field.

> Medical devices, like other computer systems, can be vulnerable to security breaches, potentially impacting the safety and effectiveness of the device. This vulnerability increases as medical devices are increasingly connected to the Internet, hospital networks, and to other medical devices. All medical devices carry a certain amount of risk. The FDA allows devices to be marketed when there is a reasonable assurance that the benefits to patients outweigh the risks. While the increased use of wireless technology and software in medical devices also increases the risks of potential cybersecurity threats, these same features also improve health care and increase the ability of health care providers to treat patients.[18]

Is it prudent to offer a patient a device that stores another source of personal data in the digital cloud—a device that is walking around with the patient? Aripiprazole with sensor addresses security by encrypting the Bluetooth signal between the chip and the patch, excluding the chip's connecting directly to the internet, and excluding any GPS capability. It also has an automatic timeout function protecting the app from needless exposure. The app requires that the patient specifically authorize any shared information in order to protect his or her privacy, and that authorization could be revoked at any time.[6] But bullies with malignant intent can certainly spy on a smart phone, and the protection of confidentiality here requires individual diligence on the part of the patient regarding his or her phone.

A Decision

Given the facts of the case above, how should Dr S proceed in the context of BR's wariness and his parents' demands? Is this DHFS the most necessary and least harmful intervention? Again, the technology was not approved based on studies of its effectiveness as an adherence tool, nor is it marketed as such.[1] For this reason, the bar for implementation is set high. The promise of better compliance is a known good and could translate into decreased stress at home, better communication between BR and his psychiatrist, and improved control of symptoms with likely improved outcomes. Risks of harm as described above include undermining of BR's autonomy, further conflicts between BR and his parents and his psychiatrist exacerbated by distrust, possible data breaches, possible shaming, and possible exposure to unknown harms by peers. The psychiatrist, therefore, must weigh these risks and benefits and convey them, in detail, to the patient and his family. Dr S knows that parents are essential to adherence to medications in adolescents, as is their supportive relationship at home with parents who are well versed in the illness and accepting of its presence.[8] Dr S must make BR aware that everyone's goal is to help him direct himself toward a future he chooses, a future made more tangible with good medication compliance. In so doing, the psychiatrist can help divorce punishment from treatment options. Dr S must also make it known to the parents that fully informed assent by BR is required in order to protect his dignity, his autonomy, and his capacity for self-determination. The use of a DHFS should be and must be as a tool, not as a bat. Whether other interventions were implemented is not clear given the case description. Interventions such as supportive psychotherapy; watch, phone, or computer reminders; and peer support groups involve much less risk to patient privacy and must be explored with BR and his family prior to the use of a DHFS with the high risk-to-benefit ratio described. A collaborative relationship wherein all agree on a treatment course based on relevant risks and benefits has a much greater chance of success and utility.[12] Adolescent-onset schizophrenia is, at this time, a chronic illness that requires a great deal of resources and mental health interventions, a motivated patient, and support from parents. Enlisting BR in his treatment is essential, and obtaining his assent is crucial no matter the final decision.

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Editor's Note
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