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# When Are Medical Apps Medical? Off-Label Use and the Food and Drug Administration

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### Abstract

People have a love/hate relationship with rapidly changing healthcare technology. While consumer demand for medical apps continues to grow as rapidly as does supply (there are over 100,000 health, wellness and medical applications, or 'apps' on the market), healthcare professionals and safety experts worry about the impact of these apps on the health consumer. In response to the rapidly growing mobile healthcare sector, the Food and Drug Administration has put forth guidelines to regulate 'mobile medical apps' (MMAs), those health-related apps that are (self) designated as medical devices. In this article, I argue that this decision, to only regulate apps that bill themselves as medical devices, will create a market for 'off-label' app use. Further, I will talk about the oft used analogy between off-label apps and off-label pharmaceuticals, showing that off-labeling apps will provide patients none of the benefits that come with a physician prescribing a drug off-label, while exposing the mobile healthcare consumer to significant risks that go significantly beyond those that we know of (and must accept) from prescription drugs. Recognizing that the Food and Drug Administration is not going to be able to significantly change its policies on oversight, I will suggest specific actions to at least mitigate some of the risks associated with off-label app use.

### Keywords

Medical apps, Food and Drug Administration, mobile healthcare, off-label, conflict of interest

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## Introduction

Healthcare providers have known for many years that an ounce of prevention is worth a pound of cure. In recent years, this (somewhat tired) phrase has translated into concrete changes in medical practice. Healthcare professionals have been moving away from solely treating illnesses when they appear and are instead focusing more on the early detection of disease, on better maintenance of chronic health conditions and on changes to lifestyle (i.e. smoking cessation, dieting and increased fitness), hoping to avoid costly procedures and chronic problems 'down the road'. Recognizing the cost-saving potential of early detection, many of these health improvement trends have become incentives built into both the Affordable Care Act and private insurance company policies.

On the consumer side, medical technology companies have jumped onto the preventative care bandwagon, selling products to enable consumers to self-diagnose, thereby believing that they are in charge of their own health. In fact, as of 2013, there were 43,689 medical (as opposed to the broader 'wellness' category) smartphone applications available at Apple's app store.[1] The app-fueled empowerment of the health consumer comes with costs, as concerns with medical apps over safety,[2] efficacy and accuracy,[3] privacy[4] and conflict of interest[5] have resulted in a demand by both the USA and the European Union (EU) for proper oversight of these medical adjuncts. The question (or one question) according to Daniel Rhon, editor of *Medical App*, is how to reconcile the need for new information with the need for safety: 'A critical aspect of this process is the right balance between regulation and freedom to innovate. Too far in one direction can result in issues

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of patient protection, but too far in the other direction will stifle development and innovation'.[6]

This desire to balance safety with innovation had led the USA's Food and Drug Administration (FDA) to suggest a sliding scale approach to the oversight of medical apps. In *JAMA 2014,* Powell, Landman and Bates argue that the FDA will focus on apps to the degree that they act as medical devices: 'In general, apps that provide precise treatment recommendations and diagnostic information will receive more regulatory attention'.[7] The FDA's approach, which seems quite sensible (as there are clear differences between apps that provide diet tips and those making diagnostic decisions for patients), requires the FDA to find a way to draw a line between medical device apps and wellness apps. The FDA's final guidelines, designed to allow for innovation while protecting the public, attempt to thread this needle. However, their method for identifying medical apps is based on one highly problematic premise, that an app developer will disclose whether it intends its app to be used for medical (as opposed to educational or entertainment) purposes. In other words, the FDA will only evaluate apps that market themselves as medical devices, while apps that declare themselves to be in other categories may go straight to market. Although it is impossible (and unwise) to argue that all apps labeling themselves as a resource are doing so to hide from scrutiny, there is good reason to believe that some would and, unfortunately, there do not appear to be provisions for the FDA to otherwise investigate whether or not to assert that an app is medical after it has given itself another label, or under any other circumstance.

Apparently, the FDA is not alone in having limited resources when it comes to targeting medical apps. Although there are some differences between the situation in the USA and Europe, the USA's current position on medical apps is similar to the one being refined in Europe. According to its 2014 Green Paper on mobile health,[8] the EU's Medical Devices Directive (MDD) calls some medical apps *en vitro* diagnostic equipment and views others as medical devices, with still others not belonging in either category. Putting aside differences in categorization and terminology between the USA and Europe, differences that have more to do with finding the proper 'home' for medical apps in existing regulatory structures for each government, (interesting, but falling outside the scope of this paper) the MDD, like the FDA, has made the decision to leave the question of whether an app should be considered a 'medical app' up to the manufacturer.

Of course, it is entirely rational to focus more on those apps that act more like medical devices and less on other wellness apps, as nobody believes that the FDA should spend considerable time and money on

an alarm clock just because it boasts its ability to help people monitor their circadian rhythm. However, there is a real difference between this reasonable approach and further restricting the FDA by focusing on the app developer's intended use. The FDA's decision has in reality left both app makers and app consumers to their own devices (so to speak) when trying to navigate the regulatory landscape. According to medical educators Lewis and Wyatt:

> The lack of clarity regarding when a medical app becomes a formal medical device means that many developers may not recognize that their app requires formal regulation. As a result, the vast majority of medical apps remain without any form of regulation or safety check, and some of these may present a patient safety or other risk.[9]

Although it is difficult to pinpoint the amount of risk present in any particular app, the danger here lies in the presence of a gap in safety standards that allows unchecked apps to be used as pieces of medical equipment.

The danger in this case is that any app can be used by anyone, regardless of its label. Specifically, an app marketed for education or entertainment could be used as a medical device, regardless of its original purpose.

When a healthcare provider or consumer deems that an app marketed as having a non-medical purpose is now to be used for medical diagnosis or treatment, that person or group is doing so 'off-label'. Off-label use could include apps that, regardless of origin, medical schools require students to use for diagnostic work. Similarly, doctors could tell patients to use particular apps to monitor their health.[10] Finally, health consumers, lacking a doctor's ability to distinguish medical information from nonsense, might download certain apps in order to stay or become healthy. As further proof of the inadequacies of app labeling, even in cases where apps are clearly marked as jokes, a cursory read of their reviews shows in numerous angry end-users, claiming that the apps they downloaded did not cause their phone's camera flash to clear up their skin, improve their eyesight or cure their skin cancer, while others say that they cannot believe that blowing at the screen (as another app requires) did not accurately result in the app displaying their blood alcohol content.[11]

Although it might seem easy to blame this situation on off-labeling in general, there are other examples of FDA-controlled industries using off-labeling with more success. Specifically, both pharmaceuticals and medical devices have to go through FDA testing in order to be used in the USA. These approvals are specific, with a given drug being used at a particular dosage (and administered in a certain way) to a clearly defined

population to treat a particular condition. When that drug is prescribed by a doctor in other contexts (at a different dosage, with a different delivery system, for a different population or as a treatment for a different condition), the doctor who writes the prescription for that approved pharmaceutical or piece of medical technology for a non-FDA approved purpose is using that medication 'off-label'.

There are good reasons for doctors to prescribe drugs or use medical devices off-label, despite the well-known risks associated with these practices.[12] As such, it might seem that, analogously, app off-labeling might be something for the public to welcome (employing similar cautions). However, this article will show that there are dangers for app off-labeling that are both serious and unique to app development and marketing and the dangers of this system outweigh the potential utility of using any particular unregulated app. To address these issues, the FDA (or any group taking up the regulatory challenge) will need to focus more on whether apps have medical applications (and less on app intent). Additionally, this article will argue for the need for post app-store oversight of a wider range of apps than are currently on the FDA's 'medical app' list. As these changes would be impossible to make, given the veil of secrecy surrounding medical app production, a third 'demand' will be for the FDA to require that app information be more readily available to the public. To this end, this paper will do the following: summarize the app regulatory system recently put in place by the FDA; compare that system to the FDA's pharmaceutical and medical device regulatory apparatus; show the implications of off-labeling within both regulatory systems. The paper will conclude with specific recommendations that would allow for better oversight of apps both pre and post-listing in the app-store marketplace.

## Regulation of medical apps

The nearly universal rush for health metrics, by governments, by the health insurance industry, by pharmaceutical companies and by health consumers themselves has resulted in a flood of mobile healthcare (mHealth) hardware and software, created for and marketed to both health professionals and the general public. The 100,000 plus medical, health and wellness apps on the market perform a wide variety of functions within this niche, ranging from collating existing information to proposing specific types of treatments (not to mention apps that only pretend to be medical and that are designed for entertainment purposes).

While a handheld medical dictionary is (probably) innocuous, other types of apps, without regulation or oversight (other than by the app-store), might act in ways that could cause health consumers to make app-based decisions, cause consumers to believe that their health is being accurately monitored by their mobile devices or have a significant impact on their actual health. As a result, medical apps have become a real source of concern to the medical (and larger scientific) community, as well as to consumer protection groups. Alerted to this problem, the US Department of Health and Human Services put together a panel to study this problem with the goal of putting together a regulatory apparatus for medial apps under the FDA's existing oversight authority.

Hoping to reconcile the need for safety with the explosive nature of app development (and understanding the groups interested in both of these goals), HHS Secretary Kathleen Sebelius introduced the FDA's response: 'This proposed strategy is designed to promote innovation and provide technology to consumers and health care providers while maintaining patient safety'.[13] The FDA's strategy is to find a place for medical apps within its existing regulatory structure and the best fit is to see medical apps as medical devices. To the FDA, a medical device is as follows:

> an instrument, apparatus, implement, machine, contrivance, implant, *in vitro* reagent or other similar or related article, including a component part or accessory which is:
>
> ○ recognized in the official National Formulary, or the US Pharmacopoeia, or any supplement to them;
> ○ intended for use in the diagnosis of disease or other conditions, or in the cure, mitigation, treatment or prevention of disease, in man or other animals;
> ○ intended to affect the structure or any function of the body of man or other animals and which does not achieve its primary intended purposes through chemical action within or on the body of man or other animals and which is not dependent upon being metabolized for the achievement of any of its primary intended purposes.[14]

The FDA policy on medical apps is as follows:

> If a product is **labeled, promoted or used** in a manner that meets the following definition in section 201(h) of the Federal Food Drug & Cosmetic (FD&C) Act it will be regulated by the Food and Drug Administration (FDA) as a medical device and is subject to pre-marketing and post-marketing regulatory controls.[15]

Although some have made arguments about the FDA's decision to limit its scrutiny based on their narrow definition of a medical device,[16] my concern is instead with the preamble (as I call it) to the definition, where the FDA limits itself to regulating only those app makers who themselves define their products as medical devices. [17] According to the preamble: 'Whether a smart device or app is classified as a medical device depends on its intended use described by the manufacturer. If the **intended** use matches certain criteria, the manufacturer has to ensure that all appropriate regulations are observed'.[18] This decision to only pursue apps that declare themselves to be medical devices will allow the vast majority of health-related apps to go to market without regulation. For instance, Deborah Lupton found an app used in medical schools called WAGMobile:

> The developer of the app directed at educating second-year medical students, WAGMobile is a generalist app development company that provides apps for clients in numerous categories. It does not provide any details of how the content is generated, and indeed offers a disclaimer at the bottom of the app description that notes: ''Please do not take any action based on the content of this app''; an odd caution given that the material is marketed at accomplishing training for medical students.[19]

If, in the best case scenario, apps made for various purposes are being brought into medical practice (regardless of the intent of the manufacturer) and if, in a worst case scenario, an environment exists where app makers could choose to avoid scrutiny by labeling themselves as 'entertainment' or 'reference material', the current landscape of app regulation has left the public open to significant private and public health issues. This danger is a direct result of the subject of this paper, the off-labeling of apps.

## The path to off-labeling

Both health consumers and providers have a real interest in having access to quality health apps and both groups have an incredibly tough time finding apps that they can trust. Faisal Ali of the University of Manchester's Dermatology Center argues that the aforementioned issues surrounding smartphones should cause us to abandon smartphones as mobile health devices altogether:

> Mobile health care (mHealth), the practice of medicine supported by mobile technologies, is advocated as a means to improve patient care. However, the mHealth market is presently saturated with a surfeit

of largely unregulated mHealth apps. Knowledge of which apps may be helpful to a particular patient's care and ease of use (or lack thereof) may dissuade clinicians from engaging with mHealth.[20]

The source of researchers and scholars' frustration comes, on the one hand, from not being able to look under the hood of medical apps. App makers need not include any information on whether their apps were created under the guidance of health professionals and they do not provide data on whether their apps are accurate in their data gathering or interpretation. In *Evidence Based Medicine* Bujink, Visser and Marshall report that: 'Most medical apps lack authenticity details; authors, manufacturers and distributors are not listed and references are unavailable or out-of-date'.[21] Clinical researchers Lewis and Wyatt say that those who want answers are forced to do this research themselves. This means that there are few studies, and that they are based on specific apps or medical problems, making results difficult to generalize. Even given these restrictions, researchers have found real problems and have gone to the trouble of publishing them in clinical and professional journals:

> Despite this, several studies have highlighted a number of medical apps that can compromise patient safety and are potentially dangerous in clinical use. For example, certain apps designed for opioid dosage conversion or melanoma detection demonstrate dangerously poor accuracy, while a number of other medical apps do not follow evidence-based guidelines. Such risks have led to recent calls for increased regulation before further use and adoption of some apps in clinical practice. One issue highlighted by a small number of studies is that many app developers have little or no formal medical training and do not involve clinicians in the development process and may therefore be unaware of patient safety issues raised by inappropriate app content or functioning. Another issue is the sheer volume and exponential growth of medical apps, meaning it is practically impossible to assess each and every medical app.[22]

If, as the authors conclude, gaps in expertise, coupled with a high volume of (and a high demand for) these new medical adjuncts, are at fault here, this means that larger studies need to be pursued before medical apps should play a real role in improving healthcare.

Of course, there is pushback on these criticisms from people connected to the app industry. For example, researchers Visser and Korevaar argue that medical knowledge need not have any impact on app performance: 'To our best knowledge, there is no published evidence that apps developed in collaboration with

health professionals are actually superior to apps developed without health professionals involved in the app development'.[23] Others believe that the best way to regulate apps is to let the market sort itself out. According to the FDA's Bakul Patel: 'The whole mobile application world has its own ecosystem...Mobile apps live and die and it's all user- or consumer-driven. The end-of-life cycle is so short compared to any other products we see'.[24]

To those who might wish to apply a more traditional approach to medical device oversight to medical apps, critics like Drs Chan and Misra point out rightly *in JAMA* that current methods used to police medical devices are inadequate to handle medical apps:

> The challenge in both certification and clinical evidence is that traditional methods have not adapted to the fast paced nature of technology. Traditional randomized clinical trials are expensive, lengthy endeavors, which mHealth researchers have often lamented. Researchers aiming to systematically evaluate apps have found that the applications they were evaluating were being updated as frequently as every 3 weeks. A clinical trial that began the institutional review board approval process in October 2011 using the just-released iPhone 4S would be using outdated technology less than 1 year later because the iPhone 5 was released in September 2012.[25]

Recognizing the FDA's backlog, some private groups have taken it upon themselves to provide certifications for medical apps. For instance, the non-profit Health On the Net Foundation claims to be able to rate and certify medical apps as both safe and effective: "However, the Health On the Net Foundation's HONcode takes 12 to 18 months to review a website".[25] This time lag is significant, as apps can appear and disappear within a few weeks.

Given the rapid pace of medical app development, the FDA's decision to focus only on apps that are 'really really' medical makes sense. Even with the current structure, the FDA is overwhelmed, with a significant backlog of apps to investigate (as noted above). Unfortunately, the FDA's additional decision to effectively cede its authority to app makers, by only reviewing those medical apps whose developers are confident enough in their product to so label them, results in the current worry, the consequences of off-labeling.

## *The analogy: Pharmaceutical and medical device companies and app makers*

Medical apps are not the first (or only) medical tool that can be used off-label. Both medical devices and prescription and over-the-counter (OTC)

pharmaceuticals are regularly used off-label, with doctors routinely prescribing them for purposes completely unrelated to their original approval. 'In many countries, doctors are free to prescribe off-label and do so frequently, although in some countries restrictions are placed on off-label prescribing; for example, by health insurance companies and individual institutions'.[26] Of course, the use of off-label prescriptions and medical devices is not problem-free, but there are significant benefits attached to their use. In addition to allowing medications and medical technology to be used in populations generally deemed too small (or vulnerable) for large scale randomized control trials,[27] off-labeling allows a physician to try new treatments when others have failed and do not need special approval for use by a physician so long as her/his intent is 'the practice of medicine'. While off-labeled drugs and medical devices do not have to go through all of the targeted scrutiny of an approved use, they have all been approved by the FDA as being (at least) safe in their original context.[28] That being said, there are risks when medications and medical devices are used off-label, with potential impacts on patient health, on innovation, and on drug and technology costs. For medications:

> It undercuts expectations that drug safety and efficacy have been fully evaluated. When newer, more expensive drugs are used off-label, it increases health care costs. It undermines the incentives for manufacturers to perform rigorous studies — and instead subtly encourages them to game the system by seeking approval for secondary indications for which clinical trials are less complicated and less expensive. And off-label use may discourage evidence-based practice.[29]

In addition, in both medical and 'risk' literature, there are a number of ongoing discussions on problems revolving around the role of the FDA in regard to pharmaceuticals and medical devices (for approved and off-label use). These range from critiques of the guiding principles behind the FDA's focus on safety over efficacy,[30] to questions about implementation and post-approval review,[31] to ways that manufacturers have either ignored bans on marketing for off-label uses of meds and medical devices[32] or to ways they have shifted their aggressive in-office marketing of their wares from doctors to nurses and other office staff.[33]

The point of this paper is not to argue against the use of pharmaceuticals and medical devices off-label. There are significant concerns that need to be addressed by a physician exercising this option and any off-labeling scenario places an additional onus of responsibility on the physician. Accordingly, the FDA cautions: 'If physicians use a product for an indication

not in the approved labeling, they have the responsibility to be well informed about the product, and to base its use on firm scientific rationale and sound medical evidence'.[34] If the physician is able to meet these standards, and armed with the knowledge that the drug has already gone through safety screening in another context, s/he is medically (and legally) cleared to administer that product. Regardless of liability, however, administering a medication in a new way could easily lead to new risks. Added to this is the fact that, sometimes, a medicine that has cleared FDA hurdles ends up doing significant harm years after it has been approved. These issues have led groups to argue that the FDA's focus on pre-approval limits its ability to monitor the safety and effectiveness of medical devices[35] and drugs.[36] Professor, medical doctor and attorney Jennifer Bard, in the *Indiana Health Review*, argues:

> Having outlined the many ways that these failures of post-market oversight had caused harm, [this article] recommended that the FDA take a 'lifecycle approach' to its task of making sure that the drugs prescribed to the public were both safe and effective.[37]

The concerns of Bard and others in the legal and medical community resulted in Congress extending the FDA's ability to require manufacturers to conduct their own research studies to assess the safety and efficacy of the drugs they sell, not just before seeking FDA approval, but afterwards as well.[38] As a result, medical professionals know that when they recommend or prescribe OTC[39] or prescription medicines or medical devices off-label, they do so based on well-known safeguards and risks and drug and medical device companies know that they have an ongoing responsibility to produce safe and effective products.

The problem being introduced in this paper is not with the analogue (medications and medical devices), but with the analogy itself. Medical apps carry all of the risks mentioned above for OTC and prescription drugs and medical devices (risks that might be considered either acceptable or at least familiar). But, additionally, apps undergo none of the measures that might make them as safe as the aforementioned medications or devices.

One way to frame this new threat is to contrast medical app use with the widespread acceptance of other quasi-medical items.[40] When a doctor suggests that a person suffering from a sore throat drink herbal tea or that the best thing for the flu is a big bowl of chicken soup, the medical professional has every reason to believe that this 'prescription' will, at worst, do no harm. This is because the FDA has already made sure that the foods we get in the store meet safety standards. So, even if these therapies do not actually help, at least

they will not hurt. Additionally, the FDA requires that herbal remedies contain warning statements (in some cases, 'black box' warning) to alert consumers as to their possible dangers. Granting that so many people ignore warnings that the FDA has forced tobacco companies to have huge and rather gruesome pictures on boxes of cigarettes to make the warnings harder to miss, medical apps do not even give medical consumers this simple warning. US consumers are under the impression that their government would never allow a company to sell something that it knows would hurt people. As a result, when consumers purchase an app to improve their health, whether they do so on their own or under their doctor or their health insurance provider's guidance, they have a reasonable expectation that the app will, like that cup of soup, do no harm.

## Kicking a dead analogy: Oversight of meds and apps in three easy steps

When the government decided to regulate medical apps, it decided to designate them as 'medical devices', putting them under the authority of the FDA. Although this was probably the best choice available to those in favor of regulation, this decision allowed for the creation of a dangerous analogy, connecting the idea of off-labeling of apps to the off-labeling of other medical devices and pharmaceuticals. In fact, while the off-labeling of meds and medical devices has its problems, the real benefits to populations who would not otherwise have access to these medications and devices more than balances the risk equation. The problem with off-labeling medical apps is that it shares all of the problems with using pharmaceuticals and medical devices off-label with none of the safeguards. Working with and against the aforementioned analogy, this author will offer three suggestions to help make safer (or at least mitigate harm from) off-labeled apps.

*Suggestion 1: Post approval (or post certification) study.* While pharmaceuticals and medical devices may not be approved for a particular population, they all have to go through extensive safety testing in laboratory and then clinical trials,[41] testing that is totally absent from app development. In fact, as mentioned above, many apps do not have clear ties to medical professionals. As such (and arguing against the argument above by Visser and Korevaar) without oversight by people used to working with patients, app developers might not even consider such testing when bringing their wares to market. While nobody worries about the accuracy of the physics behind Angry Birds, having a poorly calibrated or inaccurate glucose monitor, stethoscope or electrocardiogram app could result in serious harm.

Further, the FDA notes that, despite its extensive regulatory system, harmful drugs have occasionally made it to the market.[42] Indeed, concerns about this problem were the impetus for Congress extending the FDA's ability to require manufacturers to conduct their own research studies to assess the safety and efficacy of the drugs they sell, not just before seeking FDA approval but afterwards as well. Noting the special issues surrounding off-label use of pharmaceuticals, some experts have suggested an increased focus on post-market research and regulation:

> The FDA might consider undertaking a range of new activities in regulating off-label use, including systematically collecting postmarketing data to quantify the harms and benefits of common off-label uses; synthesizing evidence regarding off-label uses and disseminating its reports; scrutinizing marketing efforts to restrict materials on off-label uses that don't have strong support; increasing the use of active drugs as comparators in postmarketing clinical trials; and requiring information about anticipated off-label uses to be presented at the time of a drug's review for initial approval.[43]

Similarly, recognizing that there is no way to exhaustively test biologics and medical devices for every possible post-market use, some medical researchers have argued the need for post approval study and regulation:

> Regardless of study design, the approval or clearance process cannot identify every possible safety concern. Postmarketing safety surveillance partially addresses this knowledge gap by providing information based on real-world use of medical products in heterogeneous populations and detecting adverse events that were not observed in the clinical trials—possibly because they occur infrequently in any population (e.g., aplastic anemia) or because individuals in whom such events are most likely to occur were not enrolled in the trials (e.g., spontaneous abortion, because pregnant women were excluded).[44]

Given convincing arguments for the FDA to do post-market research on drugs and medical devices, presumably already deemed safe, the FDA should amend its medical app approval process to similarly evaluate medical apps by the way that they are used (as opposed to the way that they are marketed) after they have gone on the market (as there is no 'approval' process for apps, the best analogue is to evaluate them after they have been listed on an app store). While imperfect, at least the FDA would have the ability to study apps that are clearly being used for medical purposes, instead of being hamstrung (as their current mandate would suggest they are), unable to act to protect the public from a demonstrably dangerous app.

*Suggestion 2: External review.* One especially relevant critique of having the FDA expand its review of apps is that the FDA is already backlogged (as noted above) with the relatively few apps it is currently charged to review. While the FDA could meet some of those needs by forcing app makers (as they do with drug and medical device makers) to take on some of the responsibility for testing and reporting, this action would be both insufficient and, at times, problematic for app makers For one thing, forcing app makers to pay for post-marketing studies would be insufficient in that the FDA would be asking a group to police itself. Just as there is a real risk (as described above) of a medical app company calling its app 'entertainment' to avoid scrutiny, asking an app company to evaluate its own software would give rise to similar temptations. Stories of companies underreporting problematic data[45] or of those companies dropping people from studies or otherwise manipulating data in order to meet FDA scrutiny[46] are well known in the world of pharmaceuticals and the FDA is either powerless (or penniless) to bring its regulatory power to bear in every instance of fraud, even when it can find it. Additionally, forcing app makers to, like drug companies, take on the time and expense of self-reporting would take the analogy between meds and apps too far. Drug makers and medical device makers are (for the most part) huge companies. As such, they have a lot of capital that they can use to bring their products to market. Forcing them to take on some of the regulatory burden will cut into their profits, but it will not bankrupt their companies (except, this author supposes, if none of their products can stand up to even their scrutiny). App makers, in some cases, are not large, cash rich, corporations. Many of the most popular apps out on the market were developed by individuals or by small teams of people[47] and, further, many of these apps are free (whether ad sponsored or not) or very inexpensive. Although app development can result in a large payoff, (especially when whose apps get bought out by large companies like Facebook or Google), few if any of these developers would have been able to bring an app to market if they had been forced to pay for extensive post-market reporting. This would have been a total innovation killer, exactly the result that the FDA wanted to avoid.

One way for the medical app community to avoid the imperfect (and inapplicable) model used by the FDA when it comes to drugs and other medical devices might be look to the private sector for post-marketing

information. This could be done by an academic approach, commissioning more peer-reviewed studies of particular sorts of apps or by a 'Consumer Reports' approach, generating reviews from companies interested in app safety and reliability.

On the academic side, medical researchers have been evaluating apps for some time now, without any help or guidance from outside sources. That being said, the academic approach has been stymied to a large extent by researchers being unable to get information about the apps under study. Without knowing about the app (i.e. the background of the app-making process, possible conflicts of interest in the creators), researchers report (as discussed above) that their ability to draw conclusions about apps remains limited. Other impediments to app research have more to do with the academic's home than the app's creators. For instance, researchers have a limited amount of time; time that they might need to spend on their primary research. When academics have to budget their time in ways to ensure their academic appointments, they may not be able to devote the time and resources necessary to fight the good fight. Additionally, there are a limited number of journals interested in publishing articles on medical apps and, to make things even worse, apps quickly appear, disappear and change, which might mean that the app you wrote about in your publication may not exist (or be recognizable) by the time a journal article gets published. This (again) can dissuade researchers from spending their time studying medical apps, regardless of the researcher's interest. That being said, researchers have published on app efficacy and those sorts of publications are invaluable to those in the medical community who want information on apps coming out in their fields.

On the corporate side, a number of companies have devoted themselves to rating medical apps, leading some to imagine that this sort of 'market based' system might be able to fill in the gaps present in the academic model. However, even these companies have not been able to keep up with the massive influx of medical apps. Additionally, medical app review companies have their own limitations. For instance, there are real questions about the economic viability of private companies that offer to credential medical apps.[48] Given that each company hopes to become the gold standard in the industry for app credentialing, each review company has created its own proprietary algorithm to rate submissions, leading the healthcare professional or consumer little way to compare between rating agencies. By keeping their comparison methods a secret, these companies (perhaps unwittingly) have made it difficult for there to be any outside review of that rating agency's standards (a sort of 'who watches the Watchmen' effect). One of the strengths of academic work is that is open to peer review, a process that can find and help eradicate errors in the original researcher's work. Here, the proprietary nature of a competitive business culture can lead to errors with serious consequences:

> This became apparent at the end of 2013, when Happtique, a mobile health solutions company and subsidiary of the Greater New York Hospital Associations for-profit arm GNYHA Ventures, suspended its mobile health app certification program after serious security issues had been found in apps Happtique had previously certified as secure.[49]

Although both of these approaches are not without problems, both have real potential to fill in the gap left by the FDA's current program of medical app review. That being said, any review, whether by the FDA or by outside groups, can only occur if data about medical apps are available. This problem, highlighted above in reference to the academic community, but certainly equally an issue for app review companies, can be resolved by demanding that information be made available by the app makers, which is this paper's final suggestion.

*Suggestion 3: Transparency.* One of the most often cited complaints by those scrutinizing medical apps is that they are inscrutable. As noted above, it is impossible to find out whether a medical app was created or tested by people working as medical clinicians or researchers. Absent (or in addition to) actual oversight of all medical apps, the FDA should use its powers to demand a standardized 'label' for all health and wellness apps. Citing limitations of both commercial certifications and peer-review, another alternative has been suggested,[50] placing the onus on app manufacturers to provide standardized information, e.g. app-synopses and checklists to the user, information that would be available on both the manufacturer's website and at the appropriate point of sale (i.e. app store). The information being provided could be used to educate consumers on the benefits of a particular app, on its efficacy in laboratory or real-world tests, on its makers and backers and on the information that it can provide to (and on the information that it can collect from) the prospective consumer or healthcare provider. Additionally, this information could be used to lay the groundwork for better external studies of medical apps (as called for above), which would lead to a better-informed medical community.

> All in all, the provided information can also be used for an unofficial but collaborative evaluation process of all interested parties, for example, patients, doctors, but also competitors; this may also be an additional

building block on the path toward informed patients in the information age.[51]

While giving competitors (and consumers) easier comparative data might not be in the best interests of medical app developers, this information is crucial if medical professionals are going to be able to make good judgments when they 'prescribe' certain apps to their patients. As mentioned above, in addition, asking patients to connect their fitness trackers to healthcare portal apps and to medical health records, doctors rely on medical apps during their training,[52] use them in their practices and suggest them to their patients. There is a possibility, and to Lewis and Wyatt, a real potential, for apps to cause injury to patients when they misuse (or at times trust) a particular app to monitor or treat symptoms:

> Perhaps the biggest threat to patient safety from medical apps is likely to result from inadequate education and knowledge of health care professionals and patients about their risks. We think in the vast majority of cases, it is probably the actions of a user resulting from a specific app that leads to harm, rather than the app itself.[53]

The difference between health and harm is education and medical providers (at least) need to have the ability to give medical apps a quick check up.[54] Again following the analogy, doctors and pharmacists offer medical guidance to people using medications and medical devices, both in the doctor's office and at the point of sale. Apps should similarly come with clear information so that doctors can make good decisions on their use, comfortable that their prescriptions are being properly followed.

## Conclusion

Balancing innovation with safety is always difficult and, in an environment of rapid change, low profit margins for app developers and an overburdened regulatory agency, there are good reasons to argue against forcing every inventor and invention to be subject to the sort of outside scrutiny that we rightly demand for medical devices. Additionally, given the FDA's inability to keep up with the stream of apps either on the market or coming out soon, the decision to do pre-approval regulation based on self-reporting is apparently a necessary evil.

That being said, given the outbreak of apps and given the need for the FDA to use triage to handle the volume and urgency of this problem without crushing an industry that all agree can improve both quality

and access of care to the public, I offer three suggestions to push app regulation forward. Following the analogy between meds and medical devices and medical apps, there needs to be some sort of post-approval scrutiny put in place by the FDA for those apps that are being used for medical purposes (in addition to its pre-screening of apps that declare themselves to be medical). Next, and against the aforementioned analogy, there should be an increased push (which could include increased incentives) for the external review of health apps by both medical professionals and private companies. This mixed model of response could both protect the FDA from having to stretch its scant resources, it could spawn new growth in both academic and business circles and it would promote more innovation by app makers. Finally, and perhaps most importantly, the FDA must demand some sort of standardized, publically accessible labeling by the medical app industry. This information is critical for any sort of serious review of a medical device. Just as it would be laughable for any other medical device or pharmaceutical maker to think that they could hide these data and hope to bring their product to market, we should expect the same transparency from medical (and for all wellness) apps. This transparency should be recognized by all as a necessary (though not sufficient) precondition for app review, whether by the FDA or by extra-governmental means.

None of these suggestions will provide a panacea. In fact, most of the proposals that I have bundled together have been offered before singly. The failure of any one approach to catch on shows that each has its own hurdles to overcome. However, to use another analogy from the medical industry, when we cannot find a cure, compounding may allow for a treatment regimen whose sum is greater than its parts. As a worst case scenario, this paper argues that managing symptoms and monitoring the patient is preferable to ignoring the illness with hopes that it will go away on its own.

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