INTRODUCTION
Over a billion people are now users of Facebook, the most popular social networking site today [2]. This astonishing statistic highlights growth and increasing importance of social media (SM), a term that embraces websites and applications that enable users to create and share content or to participate in social networking. Unsurprisingly, SM has become a staple of daily life for many patients, caregivers, and health care professionals; for instance, offering access to a vast range of information, support, advice, and opinion, as well as, enabling rapid communication and dissemination. Therefore, there is a need for the pharmaceutical industry and its collaborators to understand the potential of this unique resource to support, challenge, and advance or undermine their aims and activities. With such issues in mind, we reviewed the published literature to explore how far the healthcare community has embraced opportunities presented by SM, and evidence on whether or not SM has helped individuals or patient communities.

TRENDS IN THE USE OF SM IN HEALTH CARE
Considerable research on interactive internet and mobile technology has been conducted in the last 10 years. These studies have covered topics such as the use of SM to create awareness, increase knowledge, or change attitudes in patients, parents, caregivers and health care professionals; its use to change the way in which patients and health care professionals interact; and whether the use of SM by doctors and/or patients could damage professional/patient relationships. Various other contexts have also been studied including, for example, social support through SM websites.

A particularly promising area for the pharmaceutical sector, is the adaptation of mainstream SM or the development of new SM resources with the aim of identifying, supporting, and educating patients and caregivers and, ultimately, improving health outcomes. This has been explored in several ways, including, for example, the establishment of specific health-related forums such as PatientsLikeMe, SmartPatients, and Facebook pages developed to target a patient subpopulation, or the use of bespoke SM resources such as online discussion forums for participants within a clinical trial of an online educational tool. SM has also been used successfully to target or recruit research participants in many disease areas. Specifically, SM has often been used to recruit people typically considered hard to reach, such as those with or at risk of sexually transmitted or other infections, and substance misusers. Another common target are populations considered hard to reach, such as those with or at risk of sexually transmitted or other infections, and substance misusers. Another common target are populations which might struggle to attend more formal health care settings, such as parents, pregnant women, or those with neurological or mental health problems. The analysis of SM content has also been a popular research topic. Such material is a rich source of data on patients and health care professionals, particularly through providing ready-made, freely-available, real-world information on the lives of SM users with a given disease or problem, and for studying attitudes and behaviors relating to taboo subjects.

SM AND KNOWLEDGE OF DISEASE
Research to date on the use of SM-based interventions to assess effects on patients’ knowledge of disease areas has generally produced favorable results. Most recent studies on this topic seem to have been conducted in patients with mood disorders or diabetes. SM has shown particular promise in both of these groups, with improvements in knowledge being reported in almost all published studies [3-5]. Data also suggest that people with other less prevalent diseases may benefit from the use of similar interventions. For instance, improvements in patients’ knowledge of their disease have been reported in studies investigating patients with inflammatory bowel disease, epilepsy [6], joint problems [7,8], cancers [9], sexually transmitted diseases [9], fibromyalgia [10], amyotrophic lateral sclerosis [10], and multiple sclerosis [10]. Of course, the level of improvement in patients’ knowledge depends on how well-educated they were about their disease before using the SM resource, and the quality of the information they receive. As well as understanding their illnesses more, users of SM have stated that an increase in patients’ or carers’ knowledge of a disease can help patients manage their problems more effectively and inform their interactions with their health care providers.

SM AND KNOWLEDGE OF/ADHERENCE TO TREATMENT
SM sites and discussion forums have been shown to increase knowledge of treatment options in adolescents with diabetes and their parents, and patients with osteoarthritis, rheumatoid arthritis, and human immunodeficiency virus (HIV) infection. There is no clear consensus, however, on its usefulness in improving treatment-related behavior. Some studies found very positive results, for example, belonging to an online forum/group such as PatientsLikeMe resulted in a reduction in engaging in risky behaviors, and increased awareness of the need for continuous antiretroviral therapy in HIV-infected patients [10]. Other studies reported more varied findings. For example, when patients with osteoarthritis or rheumatoid arthritis were offered a Facebook-based educational intervention in one study, there was an increase in their knowledge of at least eight self-help treatments that could alleviate symptoms associated with the joint problems. Despite this greater knowledge, however, users of the site reported significantly increasing their participation in only two of these eight types of therapy; yoga and aquatic therapy [7]. A similarly mixed pattern of results was seen in a study in which adolescents with type 1 diabetes who used an unmonitored social media and peer support website designed to improve treatment behavior. The participants reported less family conflict, and their parents stated that the adolescents had fewer perceived barriers to treatment and improved adherence to insulin therapy compared with a control group. Although there was a reduction in symptoms of diabetes in the intervention group, however, there was no difference in how well their diabetes was controlled [11].

Interestingly, we found no research on the use of SM to improve knowledge of, and/or adherence to, pharmacological treatment in patients with mental health problems.

SM AND CHANGE IN CLINICAL OUTCOMES
The research on clinical outcomes of SM has focused on specific interventions that have been developed with therapeutic intent, rather than on the use of SM in general. These studies offer an unclear overall picture of whether “therapeutic” SM leads to improved clinical outcomes. Various publications on the use of online cognitive behavioral therapy (CBT) interventions with additional SM support such as online discussion forums, consistently reported that users had reduced depression, anxiety, or social phobia scores compared with people who were waiting for treatment [12-16]. Also, other studies found health benefits from use of targeted SM in patients with epilepsy [6] and HIV [10]. Similarly, patients with cancer were shown to benefit psychologically from SM support groups.

Other studies found an inconsistent impact of SM-based interventions on diabetic control, such as levels of glycosylated hemoglobin (HbA1c). For example, one study investigating the effect of a Facebook- or Skype-based intervention in type 1 diabetes found an associated improvement in clinical outcomes [17], while other studies using a discussion forum [11] or mobile phone app [18] to educate and support patients with diabetes either found no change or inconsistent changes [18], respectively.
In the cases where SM has been shown to improve disease knowledge, treatment-related behavior, or clinical outcomes, it is worth considering whether the increasing role of SM in everyday life may point to a shift in patient preferences from traditional methods of understanding health care-related information and improving clinical outcomes, to a dependency on social networks when trying to achieve these goals. If so, these changes can therefore not be ignored as there is a possibility that improved clinical outcomes may not be achievable without greater professional engagement with SM.

The evidence of benefit from “non-therapeutic” SM, especially where this involves content that has been created without health care provider input, is even less clear. A detailed review of the literature on the impact of SM use in the general population was beyond the scope of our review. We found two studies of direct relevance to this topic. In one, use of SM was found not to be associated with increased likelihood of developing depression in university students [19]. In the other, increased use of SM was the main predictor of the development of eating disorders in adolescent girls in Fiji [20].

LIMITATIONS OF SM
SM has revolutionized peer-to-peer communication and is important to users. Key challenges remain, however, in using it as a new weapon in the battle against disease.

Currently, there is only weak evidence that health-related SM can improve a wider range of clinical outcomes. SM is a key gateway to hard-to-reach populations, and can provide access to other real-world disease communities that are more likely than other patients to respond to online surveys. Such groups can be used to test the effect of SM-related health promotion, disease education, and initiatives to improve adherence.

Additionally, some people (both users and non-users) have expressed concerns that participation in SM may have negative effects on patients. For example, patients with more severe or traumatic experiences may withdraw from needed support if they see that their outcomes are worse than other members of the community, or, at the other extreme, those with mild disease may be frightened by hearing about the suffering of others who are more severely affected. Also, there are concerns that some users may end up changing their medication based on advice from other patients, without proper clinical guidance. In addition, most SM users in the health-related research we identified were middle-aged women. So, we still don’t know much about effects of these media in other populations.

Patients, caregivers, and health care professionals have all expressed worries about privacy and sharing of health information on SM sites, given the general principle that personal health care data should ideally be kept confidential. Patients may voluntarily share personal information in a disease-based forum, without knowing who else can access that information. Even when disclosure is not intended, the relatively low level of security provided for SM sites is likely to be less than in dedicated electronic patient record databases, meaning that some SM tools that allow supporters to access the patient’s laboratory results to help them manage their disease may be hacked or accessed accidentally by others.

CONCLUSIONS
The use of SM is escalating, and this is increasingly being targeted by those interested in health outcomes as a way of providing information and support to patients and caregivers. Results of studies on the impact of SM on knowledge, attitudes, and behavior of patients have been generally positive, although there is a risk that publication bias may have prevented negative studies from being published. There is some evidence that “therapeutic” SM use can lead to health benefits – particularly from non-pharmacological interventions like CBT and improved adherence to medication in, for example, HIV or diabetes. SM has potential to be a beneficial tool in health promotion and disease management, and its use in clinical research is burgeoning. In a world where a shift in the balance between support for patients and sale of specific products by pharmaceutical companies seems to be occurring, SM is a particularly valuable tool that should have a more formalized role in health care than is currently the case.

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REFERENCES