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Perspective

Biologics vs. small molecules: Drug costs and patient access

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ABSTRACT

Significant advances in drug research and development are herein reviewed first to set the background for a critical consideration of the economic sustainability of biologics and small molecules, why biologic drugs are more expensive, and how drug cost often influences patient access to one drug class over the other. Also strongly emphasized is the need for the drug-making, especially the biopharmaceutical, industry to consider a reassignment of priorities so that more patients can enjoy the great benefits that come with blockbuster drugs, many of which are of biological origin but extremely expensive. A balance between the efficacy of wonder-performing drugs and the patient's financial ability to access them must be established to obliterate the crippling effect of the high costs of drugs on the poor majority of patients – those who cannot afford them. The overarching point broadly emphasized is that the actual success in drug discovery and development and in healthcare delivery should be measured not only by the magnitude of scientific breakthroughs but also by the level to which they are affordable to patients as determined by their costs. To enhance patients' access to drugs and new and/or improved healthcare technologies, more research attention must be paid to such cheaper alternatives as small molecules generics, biosimilars, and antibody-drug conjugates; government policies must be established to encourage the commercialization of biosimilars; and pharmaceutical companies must be charitable enough to run assistance programs for eligible financially handicap patients while seeking to make profits from the drug-making business.

1. Introduction

Man has had a long and excruciating experience with ill-health or disease ([1]). In the same vein has been the struggle for cures, a quest that will continue for as long as humanity coexists with pathogenic microorganisms and associated agents. There is no safer planet to run to. But thanks to the tremendous progress in science and technology, we can boldly attempt to face one of man's worst enemies—disease—with the enduring hope to conquer. This attempt has led to the discovery and development of disease-fighting "weapons" known as drugs, of which biologics and small molecules are major categories.

Biologics are medicines derived from living cells or through biological processes (2,3). They are relatively complex molecules usually consisting of proteins, carbohydrates, nucleic acids, cells or tissues for transplantation, or a complex composite of these substances (3). Examples include hormones, vaccines, blood products, allergenics, monoclonal antibodies, recombinant therapeutic proteins, gene and cellular therapies, growth factors, cytokines, insulin, among others (4,5). On the other hand, drugs made by chemical synthesis are called small molecules (6). Examples include aspirin, felbamate, varenicline, procaine, among many others (7). Most patented drugs in the market and their generics are small molecules (8).

Technically, biologics differ from small molecules based on size and manufacturing process (Table 1). While biologics are typically greater than 1 kDa in size, small molecules are relatively smaller, usually between 0.1 and 1 kDa (9). Biologics are notoriously sensitive to a given manufacturing process and the starting materials, as opposed to the retention of chemical identity typical of small molecules regardless of the synthetic method and materials used. The structural complexity of biologics makes characterization difficult; hence, clinical effects are hardly predictable in patients. On the contrary, small molecules possess relatively simple structures that do not trigger immune response, a very likely event associated with the action of biologics (6).

The foregoing is significant in defining drug cost, which is one major limiting factor that determines drug accessibility by consumers. Though much progress in healthcare has been made with biologics, end-user access to these innovative drugs is gradually being ignored or, at least, seldom prioritized. On this personal but justifiable perception lies the essence of this appraisal.

2. Some innovative breakthroughs

More than ever, contemporary drug discovery and development has become more daunting and sophisticated as patients' medical needs grow. However, recent progress in molecular sciences and cutting-edge technology have provided researchers access to the molecular realm of disease mechanisms (11). Though the pharmaceutical sector has experienced decades of significant stagnancy in obtaining FDA (Food and Drug Administration) approvals (12), research efforts have continued, and a few notable breakthroughs have been achieved in recent times.

2.1. Biologics

Biotechnology has been applied as an innovative tool in medicine (13), paving way for the exciting drugs called biologics. Rather than using non-living vessels, medicines are now produced in living cells, which can be grown in vitro (14).

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Table 1
Major differences between biologics and small molecules (10)

Biologics	Small molecules
Produced by living cell cultures	Produced by chemical processes
High molecular weight	Low molecular weight
Complex, heterogeneous structure	Well-defined structure
Strongly process-dependent	Mostly process-independent
Not entirely characterizable	Completely characterizable
Unstable	Stable
Immunogenic	Nonimmunogenic

Protein engineering has enabled the discovery of a treatment for late-stage melanoma in 2015. Talimogene laherparepvec (TVEC), the antimelanoma agent, is a product of genetic modification of the herpes virus, which has been engineered to attack only malignant cells and trigger the immune system to fight off cancer (15).

In 2016, Garamella et al. (16) developed a bio-based synthetic tool for the batch and semicontinuous synthesis of proteins in milligram quantities using cytoplasmic extract from *E. coli*. The system has been equipped for cell-free execution of DNA programs so that it is potentially applicable to biologics production, which is conventionally achieved in vivo. This is important as it promises to surmount the challenge of irreproducibility encountered in biologics manufacturing using living cells. Another cell-free but industrial scale biosynthetic tool was also developed in 2017. Here, the *E. coli* extract is lyophilized to afford a high-yield system that finds potential use in both biopharmaceuticals production and high-throughput protein synthesis (17).

The biopharmaceutical industry has also seen novel treatment strategies being discovered and developed recently. Among the most innovative is tailor-made (personalized) medicine. For instance, CAR T (Chimeric Antigen Receptor Thymus) cell therapy allows for customized patient treatment in which the isolated cells of a patient are genetically modified to CAR T-cells, which are then cultured (See Fig. 1). The multiplied CAR T-cells are returned to the patient's body where they attack cancerous cells (18). Though this novel therapy is not free of some safety-related challenges (19,20), research has been ongoing to make it much safer (21), which is why it is still undergoing clinical trial (22).

2.2. Small molecules

Apparently, biologics have recently made more exciting strides in healthcare development. However, small molecules are still in the picture of innovative drug research and development. As of 2012, the number of small molecules in the Chemical Universe Database totaled 166 billion (24).

Currently, a key area of small molecules research is the identification and development of molecular entities capable of targeting RNA, which plays so many biological roles including the regulation of polymerase reaction, multilevel progression, viral infectivity (25) and gene expression (26) and storage (27). Small molecules that interfere with RNA's ability to execute these functions will be therapeutically relevant in fighting diseases associated with these processes. One of the earliest of these is the aminoglycoside class of drugs, which includes streptomycin (28), neomycin (29), kanamycin (30), and gentamicin (31). Recent research efforts have revealed new aminoglycosides as potential therapeutic candidates for fighting gram-negative bacteria, which have persistently defied the potency of many drugs, including older aminoglycosides (32). The most notable of

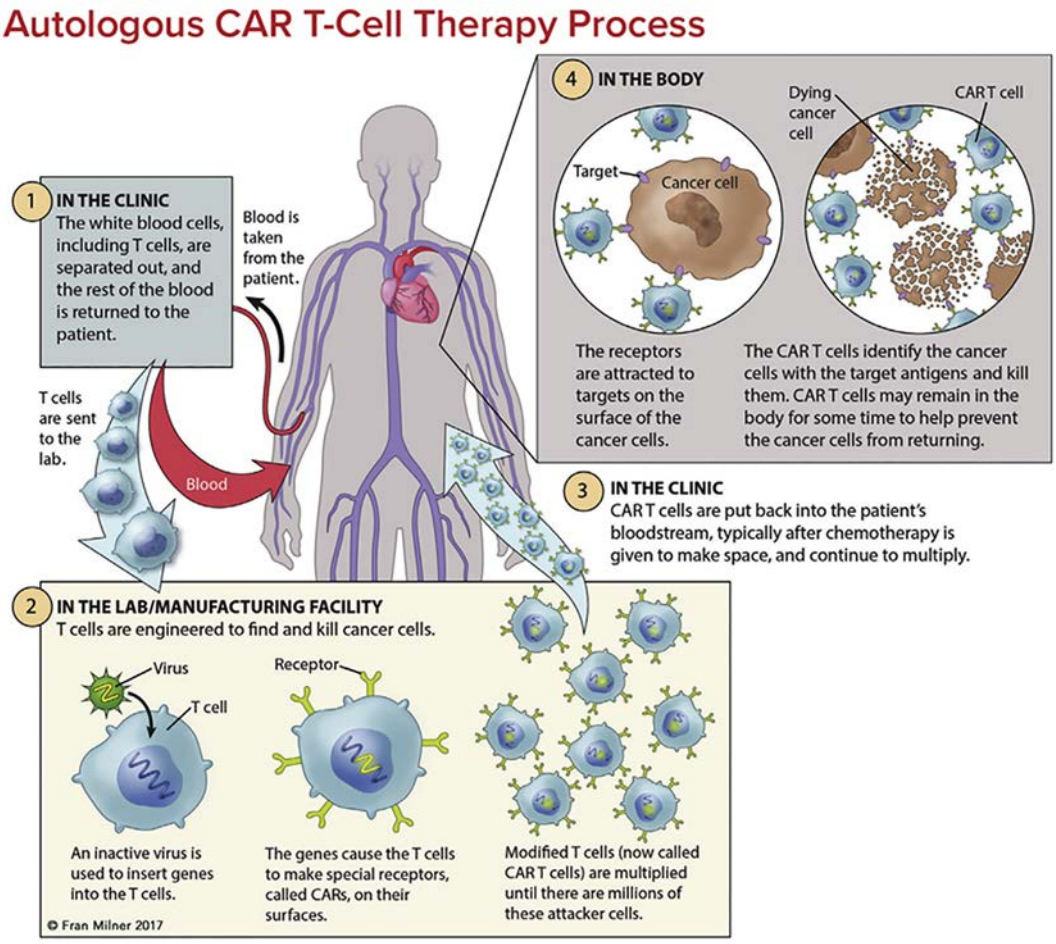

Figure 1. CAR T-cell therapy (23). © Fran Milner 2017

these novel aminoglycosides is plazomicin (33), which has proven to be nonnephrotoxic in both human and animal studies (34).

Drug discovery has experienced a recent revolution thanks to Nuevolution, a biopharmaceutical company that was able to create a library of 40 trillion unique small molecules by attaching DNA strands to each (See Fig. 2). "DNA-encoded libraries are revolutionary," says Roger Kornberg, a biochemist and 2006 Chemistry Nobel laureate. Indeed, this is pivotal to facilitating the search for new drug candidates (35). Ahna et al. (36) have reported in 2017 the discovery of a small molecule capable of modulating β_2-adrenergic receptor, a G-protein-coupled receptor (GPCR). This feat was achieved with the help of DNA-encoded small-molecule libraries. Because GPCRs mediate human responses to hormones and neurotransmitters and can, hence, be excellent therapeutic targets (37), the discovery of this small molecule is a significant stride in drug research and development. Yet another DNA-encoded library hit is the discovery of a novel series of benzoxazepinone inhibitor, whose high potency, kinase selectivity, and robust pharmacokinetic profile made it an excellent lead with the potential to become a clinical candidate for the treatment of multiple inflammatory diseases (38). With further research effort, Harris et al. (2017) were able to access the clinical candidate, which is currently undergoing phase IIa clinical investigations for ulcerative colitis, psoriasis, and rheumatoid arthritis (39).

The significance of the DNA bar-coding technological breakthrough becomes even more obvious when the cost of conventional high-throughput screening is considered. Typically, $400 million to $2 billion is spent just to traditionally create and investigate a 1 million-compound library. However, with DNA-based approach, the same aim can be achieved for 800 million compounds costing about $150,000. Thus, the financial burden of this cardinal process on small pharmaceutical companies and start-ups is lessened unprecedentedly (35).

Worthy of note is the therapeutic potential shown by small molecules in the ongoing fight against the corona virus (Covid-19) pandemic. It is no news that this viral attack has left the world gyrating in search of a vaccine and cure. Relentless research efforts targeting small molecules have led to significant progress in man's struggle to overcome this common enemy.

In 2020, a small molecule known as niclosamide has shown potential for clinical application in Covid-19 treatment. It has been approved by the FDA as an anthelminthic drug effective against many other viral infections and cancer (40). This inexpensive drug is currently undergoing clinical trials for ulcerative colitis, prostate carcinoma, and colorectal cancer (41).

The beauty of small molecules in drug science comes to bear when researchers manipulate them by chemical transformations to produce more potent, less toxic analogues. This has clearly been demonstrated with immunosuppressant drugs – small molecules used to suppress the immune system during organ transplant so that neither rejection nor deterioration of the transplanted organ occurs. Research has yielded better drugs from preexisting immunosuppressants with improved pharmacological profiles. A few of these drugs include ISAtx-247 (a calcineurin inhibitor), FTY-720 (an apoptosis stimulator), Alemtuzumab (a CD52 antagonist), and Abatacept (a CD28 antagonist) (42), which are more specific in action and less toxic (43).

Recent small molecule research has also reinforced the fight against cancer. In 2019, Cheng et al. (44) reported a novel small molecule (PAWI-2) with growth-inhibitory activity against tumors. This potential drug was also found to enhance the therapeutic effects of enzalutamide, another small molecule currently used in the clinical treatment of prostate cancer. In the same year was the discovery of novel drug-like small molecules capable of reversing biological dysfunctions associated with Parkinson's disease. Though these do not yet constitute a cure for the dreaded disease, they present a gateway for scientific breakthrough in the development of drug candidates for the disease and its kind (45). Prospectively, the healthcare sector anticipates the revolutionary impact of innovative cell and gene therapies for treating several inherited conditions, including sickle cell anemia. Moreover, annual FDA approvals for 10–20 of these products are expected by 2025 (46).

Furthermore, a new class of highly potent drugs, called antibody-drug conjugates (ADCs) (See Fig. 3), has demonstrated the synergy between biologics and small molecules (47,48). These drugs comprise an antibody chemically linked to a cytotoxic small molecule (47). The antibody transfers and optimally releases the antitumor small molecule at the cancerous target site, achieving therapeutic function without affecting healthy cells (49). This class of drugs is simply a classic meeting point of chemotherapy and immunotherapy in healthcare (50).

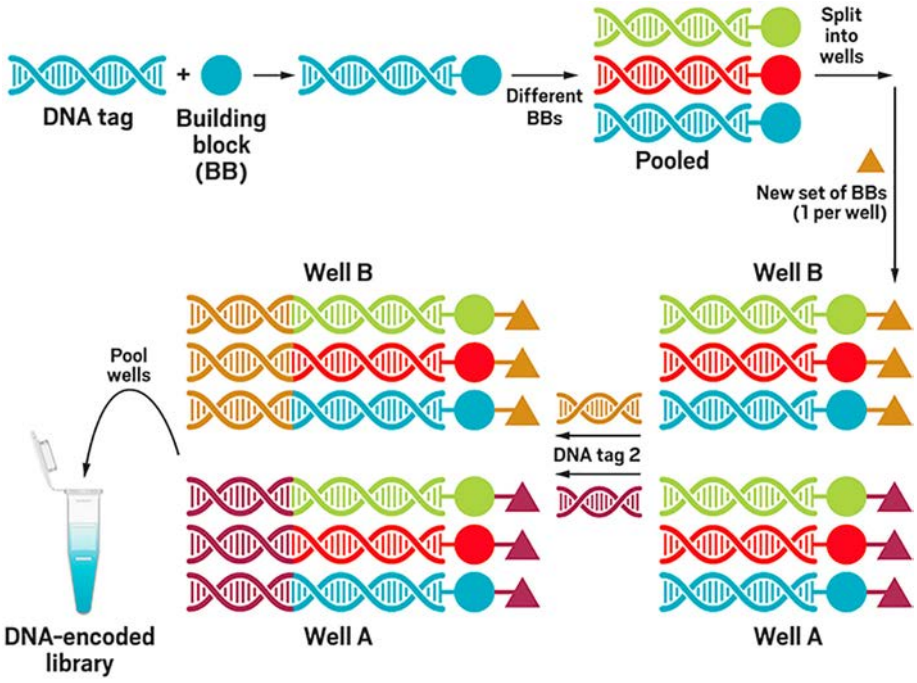

Figure 2. Building a DNA-encoded library (35). Credit: c&en

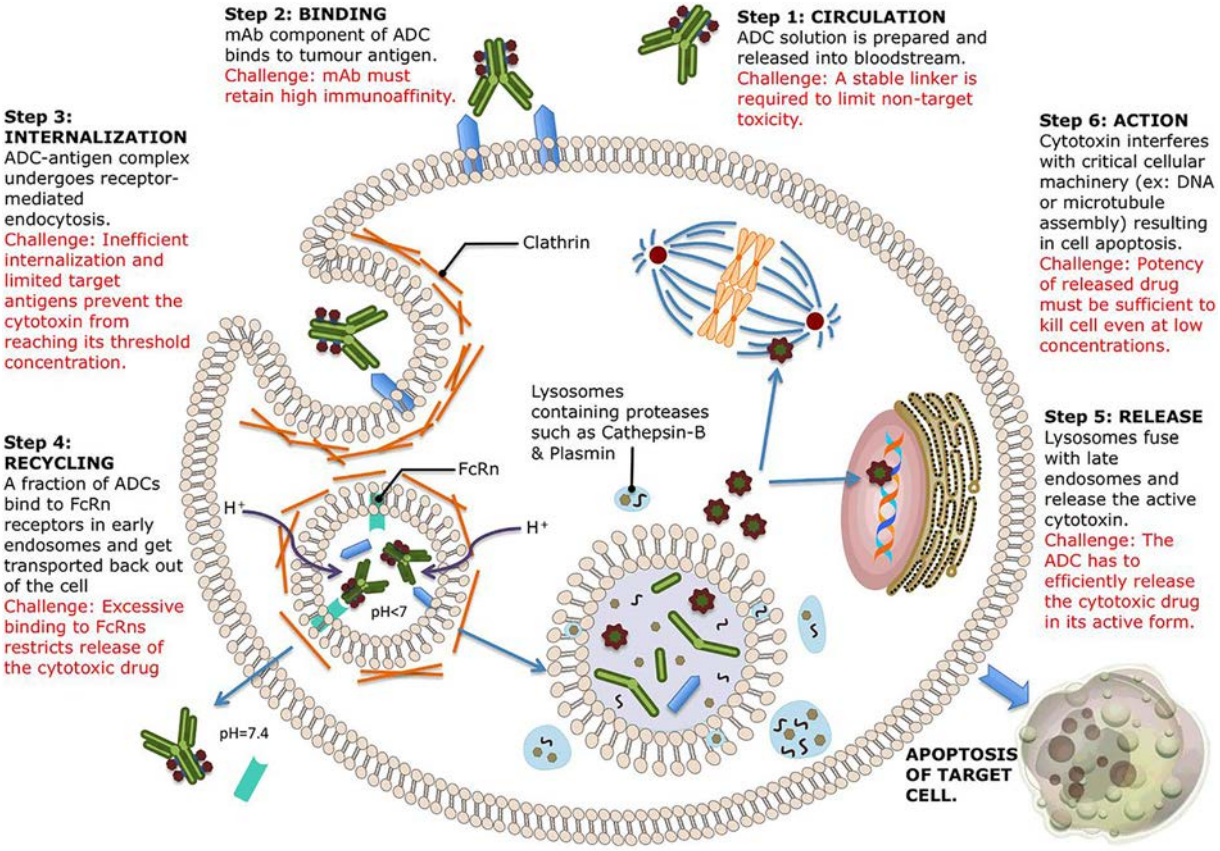

Figure 3. Action mechanism of ADC (51). © Christina Peters and Stuart Brown 2015

Of course, condensing all recent advances in drug research and development to fit in here is nearly impossible. However, the foregoing is instrumental in pointing out milestones in innovative drug research.

3. Current market trends

A consideration of the current commercial trends for both biologics and small molecules is imperative to understanding the economic differences between these drug types. Although these disparities were not significant as of 2013 (52), further years have seen so much accomplishment in drug R&D that the economic divergence of biologics and small molecules has now become obvious.

First, biologics have been "blamed" for the high rise in drug prices (53). In 2017, only 2% of US prescriptions comprised biologics, yet this small percentage accounted for 37% of net drug spending (See Fig. 4). Also, since 2014, 93% of net drug spending at a global level emanated from biologics (53,54). In 2015, these drugs accounted for 35% of Colombia's drug market (55).)

Nevertheless, in today's drug market, small molecules constitute as much as 90% of global sales (8). Yet, in the United States and other countries, the rate of purchase of biologics is increasing alarmingly (56) by those who can afford them. Averagely, daily dose of a biologic costs 22 times more than that of a small molecule (57).

In 2006, there was a 20% ($40.3 million) increase in biologics sales out of a little above 8% increase in total sales of pharmaceutical products (58). The following year saw a 12.5% increase in biologics growth rate, which was approximately twice the rate increase observed overall the pharmaceutical market (59).

However, small molecule market is significantly growing. In 2019, an 8.11% growth rate was estimated. Small molecules are increasingly being applied for the treatment of chronic diseases, and this explains the growth in their demand. They are still predominant in the pharmaceutical market, though they have been more affected by policy implementation than biologics, which are relatively new in healthcare (60).

4. The "why" behind the wide gap in cost

To every effect, there is a cause. Hence, there are factors that account for the high cost difference between biologics and small molecules.

First, there are more competitors in the market of small molecules, which have been around much longer than biologics. Consequently, small molecules costs keep decreasing with increasing development of generics by a growing number of competitors. This is not the case with biologics, and the reason lies in the complexity of their science (61).

While it is relatively easier to produce by chemical transformations small molecules as effective as the reference small molecule, producing generic versions, called biosimilars, of biologics is extremely difficult due to their complex structures. In addition, the insufficient insight of manufacturers into the biological process that yields biologics makes it even more difficult for prospective competitors to produce biosimilars (2,61), which are less expensive versions of biologics (62). An analysis of ten pharmaceutical companies by Boston Consulting Group revealed the average production cost per pack was ca. $5 for small molecules and ca. $60 for biologics (63). What a huge difference ($55)!

For instance, only five ingredients are required to produce aspirin (64). Insulin manufacture, on the other hand, requires genetic modifications in living microorganisms. This complex manufacturing typical of all biologics production, in addition to its nondisclosure in patents, makes their characterization by prospective competitors a near-impossible task (61).

Unlike small molecules, biologics are usually administered directly to the patient in a hospital or outpatient facility because they are not in pill form and, hence, cannot be distributed by retail (52). The requirement for

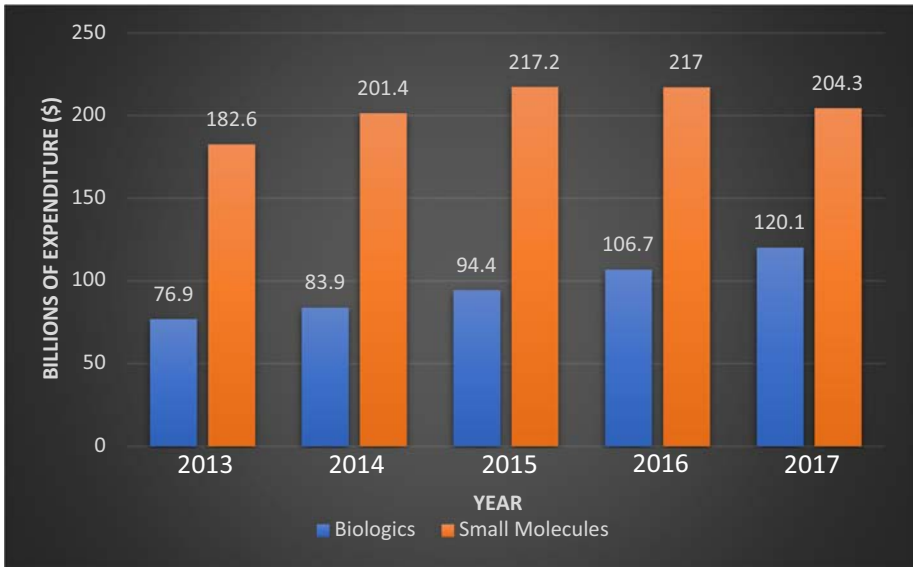

Figure 4. US net drug spending on biologics and small molecules from 2013 to 2017 (53).

medical personnel to oversee patient treatment incurs extra costs (65). In some countries, biologics escape price regulation as they are dispensed in hospitals (66). Contrarily, small molecules are usually available in pharmacies. Thus, biologics prices skyrocket as they are not regulated (52).

Moreover, for biologics, getting FDA approval is almost a miracle. The annual number of FDA-approved biologics has always been far less than that of approved small molecules. From 1982 through to 2013, only 91 biologics were approved in contrast with 777 approved small molecules (67). Amazingly, despite the pre-eminence of biologics, the biopharmaceutical industry has apparently had no progress with FDA approvals relative to small molecules industry (See Fig. 5) (9).

Though "biologically similar" to the brand biologics, biosimilars are not strictly generic versions of biologics. They are not replicas of biologics as they differ in active ingredients (62) despite having same therapeutic function (68). The first biosimilar, Zarxio, was approved by the FDA on March 6, 2015, followed by Pfizer Inflectra on April 5, 2015 (62). Indeed, biosimilars are late in the drug market, but timely to enhance consumers' access to biologics' benefits.

However, biosimilars' commercial success is indirectly hindered by critics who insist they should remain nominally distinct from preexisting biologics brands to facilitate their identification by doctors and pharmacists. On the other hand, biosimilar producers demand the contrary so that their products are considered as safe and efficacious as biologics (69). Obviously, biosimilars cannot favorably compete if medical personnel consider their use a relative risk, especially due to the recency of their emergence in healthcare. Also, brand loyalty favors biologics even more, suppressing biosimilars' success in the commercial space (62).

5. Cost implications for consumers

5.1. The dilemma of the "poor majority"

Unfortunately, most patients are relatively poor. Contextually, the poor represent those who cannot afford biologics while the rich represent those who can. Drug cost has stratified consumers into the rich and poor categories. Though both categories are prone to the burden of high biologics cost, the poor are much more. Being extremely expensive, biologics are not easily accessible to poor patients. This is more obvious in low- and middle-income countries. For example, a vial of Adalimumab (Humira) costs about US$1000, which is a near-equivalent of the average annual wage in a low-income country. The public health budget of many such countries

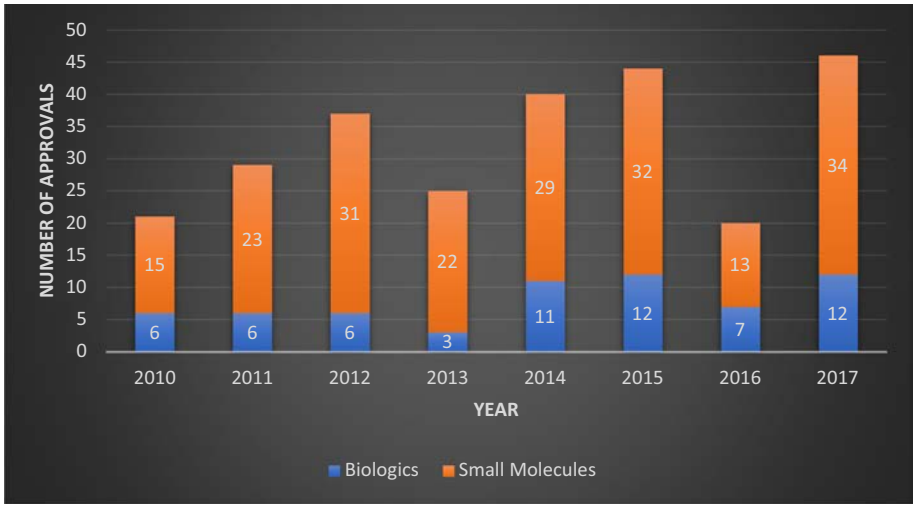

Figure 5. FDA approvals for biologics and small molecules from 2010 to 2017 (9).

introducing biologics has suffered heavily from their high cost (2). In Brazil, more than 50% of expenditure on medicines goes to biologics (55).

In short, Gary Owens (70) says it better: "Some of the therapies range from $10,000 to $40,000 a year, and if patients do not have adequate coverage, they may find that access to them is limited." This explains why small molecules draw the largest customer population. The poor majority naturally resort to the cheaper small molecules to "manage" conditions that are curable by the more expensive and unaffordable biologics; often, a cheaper drug is not as effective (71).

It is unfortunate that following man's applaudable success in the intellectual struggle for a cure is man's pathetic nonaccess to the cure. Has a cure been found if its high cost makes it inaccessible to majority? If indeed the majority is to be prioritized, then it will make little or no difference finding cures which are simultaneously, though unintentionally, rendered inaccessible by the barriers of huge costs. Indeed, medication and treatment have always constituted a burden rather than a relief to many in need of healthcare [72].

5.2. Adalimumab vs. Baricitinib – comparative case study on rheumatoid Arthritis treatment

Though biologics are known to be often more effective than small molecules at combating certain diseases that have remained defiant to the latter drug class, common grounds based on therapeutic application still exist between the two. The treatment of rheumatoid arthritis achieved by both Adalimumab and Baricitinib is one of such common grounds. Adalimumab (trade name: Humira) is a biologic while Baricitinib (trade name: Olumiant) is a small molecule.

Rheumatoid arthritis is a chronic medical condition, which occurs when the immune system mistakes the *synovium* – lining of the joints – for foreign invaders and therefore attacks it, giving rise to joint inflammation and pain (73). Generally, arthritis is so prevalent among adults. From 2013 to 2015, 22.7% (54.4 million) of the US adult population had been diagnosed of arthritis (74). Indeed, the market for antirheumatoid arthritis drugs is prodigious.

5.2.1. Efficacy and safety

It is noteworthy that Abbvie's Adalimumab, approved in 2002 by the FDA (75), has been the "world's best-selling drug" because of its high efficacy and, concomitantly, the overwhelming benefit it offers to sufferers of rheumatoid arthritis who can afford it (76). The drug could be used alone, or with methotrexate, and this has been established in two phase III clinical trials (77). According to the results, 46% of 544 rheumatoid arthritis patients improved by ACR20 (American College of Rheumatology 20% improvement) standard upon administration of the biological drug.

Notwithstanding the pre-eminence of Adalimumab in treating rheumatoid arthritis, Baricitinib has also been shown to be an effective agent against the disease. In a 128-week phase IIb study by Keystone et al. (78), ACR20 response was attained by oral administration of Baricitinib in amounts of 4 mg and 8 mg. However, despite the 8-mg dose being more effective, the drug is currently confined to the 4-mg dose due to safety issues associated with the higher dose (79). In fact, having established that clinical improvement was attainable with a daily 4-mg dose for 12 weeks, Genovese et al. (80) have reported that skin cancers and fatal stroke are potential risks associated with the use of higher-than-4-mg doses of Baricitinib. Consequently, the drug, which narrowly escaped FDA's disapproval, is subject to undergoing a long-term safety trial (79).

Small molecules have always been more prone to safety challenges than biologics. Of the 777 small molecules approved from 1982 through to 2013, 26 were subsequently withdrawn based on safety while only 2 of the 91 approved biologics faced the same fate in the same period [67]. Obviously, the safety setback with the higher dose of Baricitinib, as well as the lower efficacy of the smaller dose, offers a competitive advantage to Adalimumab in the commercial space. This can be clearly seen in their costs, which in turn impact on their accessibility levels.

5.2.2. Cost and accessibility

Due to the high efficacy of Adalimumab, its cost has only continued to rise. In fact, the price escalation of this biologic has been biannual, with a zenith of $18.9 billion in sales in 2017 and a projected figure of $15.2 billion through to 2024. This alone portrays the global commercial dominance of Adalimumab in the drug market (76). Unfortunately, for "poor" patients and eagerly waiting potential competitors, after patent expiration in 2016, this drug won many more patents and, once more, monopolized rheumatoid arthritis treatment, as well as the treatments of psoriasis and Crohn's disease. This high commercial monopoly has precipitated an unprecedented increase in price. For instance, the annual cost of the injectable biologic has been more than $72,000 on prescription drug websites and would, predictively, remain so until at least 2023 (75).

On the other hand, Baricitinib had been launched at an annual wholesale cost of $25,000 by Lilly, its manufacturer. This relatively low price, which is 60% less than $60,000, the list price of Adalimumab, was set as a means to survive the commercial competition against the famous biologic (79), giving room for more of the "poor majority" of rheumatoid arthritis patients to purchase the small molecule. But then, while this might be good news to the financially handicapped patients, every patient wants the best treatment; and as far as it concerns rheumatoid arthritis, there is yet to be a better drug than the biological Adalimumab regardless of its already high, yet incessantly burgeoning price.

So, on the one hand is a blockbuster Adalimumab with unparalleled therapeutic benefits fully accessible to the financially capable rheumatoid arthritis patients, who alone enjoy the benefits even if they constitute the smaller percentage of the entire relevant patient population. Most sadly, on the other hand is the larger percentage of the concerned patients who cannot afford to access the pre-eminent biologic. If anything, they could only settle for Baricitinib, a small molecule that is relatively not as effective as the unaffordable Adalimumab. In essence, while the biologic's market grows from the patronage of a few "rich" patients, the small molecule's commercial growth largely depends on the "poor" majority. Thus, as demonstrated by Abbvie's Adalimumab and Lilly's Baricitinib, the biologic manufacturer only keeps increasing their commercial wealth at the expense of a wider scope of impact in terms of access by the general patient population, while the small molecule manufacturer tends to impact more patients, this being the original goal or not, by a lower drug price, most often in order to survive in the drug business. Clearly, manufacturers of both drug types, especially those of biologics, must commit, or recommit, to prioritizing the potential impact on patient population that their drugs could achieve.

6. Making more money or reaching more people?

Clearly, the better the drug, the more money for the pharmaceutical industry. Therefore, biologics producers are at the apex of the money-making game, regardless of the difficulty to get FDA approvals. Since better drugs potentially make their producers richer due to higher cost, these drugs would be less accessible by the patient population. There will always be a few who can afford them, but the number decreases with increasing cost of medicines like biologics. Then it becomes obvious that more money is made from a few at the expense of reaching more people. If health were a mere want, then the high drug cost would be fair; after all, we do business to make money, and biologics R&D is expensive in the first place (81). But health recovery is as much a dire need to the sick as oxygen to the suffocating man. Therefore, while drug producers seek to make more money, reaching more patients should be highly prioritized and this should be reflected in a moderate drug pricing. The outrageously high costs of biologics constitute a bane to most patients as they cannot benefit from these often-better drugs, whose heavy price tags often crush the euphoric hope of the sick for a cure (82).

How can this inverse relationship between drug cost and consumer access be improved upon to increase drug accessibility? For biologics, biosimilars would have been a good solution. Unfortunately, they are nearly as expensive as biologics (71). In fact, their future is vague. The reason is FDA requires these "pseudo-generics" of biologics to undergo the

same approval process, unlike small molecules generics, which only need to be shown to have the therapeutic functionality of their brands (83). Also, biosimilars are not as "trusted" as biologics in healthcare. Currently, despite a global dozen of approved biosimilars, none is on the US drug market (71).

Co-pay assistance programs have been helpful to patients (84). Despite having maximum financial assistance limits, exceeding which the patient would be thenceforth responsible for their medication (82), establishing more of such charitable bodies will alleviate the financial burden of accessing biologics. Herein, therefore is a callout for the assistance of the poor majority suffering from diseases whose available cures they cannot access. Biopharmaceutical companies especially would be empathetic if they start running these assistance programs alongside their business. This will accentuate the priority, if any, they place on reaching more people.

Also, policy changes could favour biosimilars. Alberta, for instance, has expanded its initiative on cheaper drug versions, including biosimilars, to boost the sustainability profile of its drug programs (85). Biologics high costs have always negated the push toward healthcare sustainability, negatively impacting even governments (2,55). So, if governments can play a significant role in achieving this sustainability, why not?

Research on ADCs should be intensified since these alternatives are not entirely "bio-based." As of 2008, only one ADC, Mylotarg, had been approved by FDA. Because ADCs are new in drug research (86), there is much to discover so that cheaper alternatives to biologics become accessible.

7. Conclusion

Obviously, small molecules are more accessible than biologics due to disparities in their science, production strategies, and existing government policies. This dilemma has forced most patients to helplessly choose small molecules over the more costly biologics, which often hold the cures for their diseases. Also, this wide cost difference implies small molecules are economically more sustainable than biologics.

If their high costs persist, biologics will remain relatively inaccessible. More research advances must be made with ADCs, biosimilars, and small molecules. Also, governments should change or make policies to foster biosimilars survival in the drug market.

Lastly, more assistance programs should be established. Since the cures for the most ravaging diseases have been monopolized so often by biologics, these drugs will always be needed even by those who cannot afford them. However, with financial assistance from charitable individuals and/or groups, more patients will have access to biologics.

The overarching point is drug accessibility is as important as efficacy and profit-making.

CRediT author statement

Favour Danladi Makurvet: All work, including manuscript revision, was done by the named author.

Declaration of competing interest

The author declares that there are no conflicts of interest.

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