Title: Meeting The Unmet Medical Needs

Essay:

Introduction

The 21st Century began on a promising note for the world following the breakthrough in the human genome. Finally, we have the map to heal humanity! This atmosphere of optimism was reechoed through Peter Goodfellow, a former senior vice-president of discovery for GSK, when he said, “We’d like to create a drug for every target in the human genome”1. Imagine a world where we have medicines for almost every disease. A world where addressing diseases is the least of our problems. This consequentially would lead to a better quality of life since significant resources would be mobilized against other global challenges. However, while there have been remarkable efforts to treat various diseases, this goal is far from realized considering the imbalance between the overwhelming burden of disease and available medicines.

Unmet Medical Needs

Diseases have been with us throughout history and have inspired many innovative medicines over the years. Undoubtedly, the recent event of the COVID-19 pandemic is a strong reminder of how helpless humanity becomes without medicines for diseases. According to the MalaCards database, there are over 26,000 recorded diseases based on the parts of the body and per global classification, over 18,000 distinct diseases 2. Ideally, these should have appropriate and effective therapeutic interventions, yet thousands of diseases, unfortunately, have no treatment.

Unmet medical need is defined according to the United States Food and Drugs Administration as a condition whose treatment or diagnosis is not addressed adequately by available therapy3. These include immediate and longer-term health concerns and encompass serious conditions without available medicines and those with treatment options which need better alternatives. The challenge of unmet medical needs spans a range of disease areas including rare diseases, neglected tropical diseases and other infections, cancers, cardiovascular and neurological conditions. While these areas have attracted some attention over the years, available therapeutic interventions are inadequate to fully meet these challenges.

Ultimately, the absence and inadequacy of medicines result in a global health crisis. Unmet medical needs are an underappreciated cause of death and poverty, having a direct and indirect bearing on most of the Sustainable Development Goals (SDGs). A 2019 report revealed that about 90% of global mortality of 55 million were caused by health-related conditions4. The presence of medications to effectively manage these conditions would have significantly saved many and added to their quality of life. Surely, the absence of medicines to meet these needs is a relevant concern, and even scarier for the future if not addressed. It is apparent, therefore, to intensify efforts to discover medicines for such conditions.

Lives Are Saved In The Laboratory

On 11th January 1922, Leonard Thompson lay down with no glimpse of hope. Like many other kids who had perished earlier, an inevitable death was imminent. This story excitingly changed
after he received a new injection, one which would later be called insulin. Shortly, the room of despair was filled with hope and smiles and “for the first time in history, type 1 diabetes was not a death sentence”\(^5\). The tides turned for Leonard and millions of people only because some scientists put in this effort. To the sick, clinicians are the heroes and hospitals are places of salvation. Yet this is just a part of the story as there are many unseen players. Scientists can be likened to the technical staff of a sports team. Although not seen by the audience, they are the brains behind the performance of the athletes. Medications are powerful tools for clinicians, but their existence can only be attributed to scientists working at all levels of drug discovery and development. To this end, it is deserving to claim that lives are saved in the laboratory.

An undisputed solution to addressing the absence of effective medicines for conditions lies in the discovery of newer and better medicines. This process, however, is extremely enormous with many unsuccessful attempts at various stages at the expense of massive resources. It takes millions to billions of US Dollars and 10 to 15 years to get medicine to the market from the initial discovery efforts\(^6\). Yet this is the surest way to find remedies to the unmet conditions. Of great importance are the initial and basic discovery efforts as this dictates the tone and fate of drug candidates through the development process.

Academic institutions and research centers have long been the source of most basic drug discovery efforts. There may have been attempts to develop drugs for unmet conditions, yet with a success rate of 10% in clinical development \(^7\), the journey of bringing a drug to the patient is very challenging and unpredictable. Regardless, a strong foundation in basic drug discovery is undoubtedly a way of achieving future success, even in currently unmet medical conditions. Active and adequate investment in academic and basic research institutions by Governments and private organizations has a great role in addressing these challenges. Continuous and adequate financial commitment to this research field would ensure the expansion of current facilities and inputs, translating into better outputs. This would also encourage innovation in medications for rare diseases, neglected tropical diseases and other unmet conditions. In addition, adequate investment would ensure the creation of innovative programs to train more scientists. This would increase the technical workforce to secure the future of drug discovery and address many unsolved puzzles.

Another way of addressing unmet medical needs is the involvement of basic and academic institutions in the drug development process. Historically, academic scientists identify targets, characterize pathways, design drugs, and eventually hand them or collaborate with pharmaceutical companies for subsequent development processes. In addition, their findings are published in journals for public consumption, including the industry. The academic environment allows room for innovation and addressing unmet needs unlike the industry, which is mostly commercially driven. A study on 252 new drugs between 1998 to 2007 reported that 24% (60) originated from universities (and later transferred to either biotechnology or pharmaceutical industries). 123 of the total drugs addressed unmet medical needs of which the universities contributed 30% (37). Hence more than half of the university-derived drugs addressed unmet needs. Also, 118 out of the total drugs were considered scientifically innovative and novel, to which the universities contributed 31% (36)\(^8\). This is a shred of compelling evidence to change the narrative of feeding the industry and directly partake in advanced drug development efforts. The industry is often compelled to decide and prioritize projects based on commercial influences. Academic institutions have the freedom and time to prioritize projects which address unmet medical needs, even in small populations and areas of little commercial value.
Another way forward is productive collaborations between basic drug discovery scientists and other disciplines to enhance the productivity and success of drugs. The traditional approach to discovering medicines is quickly evolving, with modern technologies having a pivotal role. The use of computational programs and artificial intelligence for effective hit finding, lead optimization, and predicting drug properties promises to increase the success rate of the discovery and development process. This will accelerate the journey from the bench to the bedside. Nonetheless, these demand careful and deliberate attempts. Collaborating with technology-based setups and institutions to harness this process is an effective way to give humanity a chance at better medicines.

**Groundbreaking Must Be Affordable**

The quest to address scientific challenges has yielded innovative and creative ways of thinking, resulting in trailblazers. These ideas and technologies have successfully been applied to the discovery of medicines. While this is good news for the global healthcare system, they are often extremely expensive for the average person. But how is it groundbreaking when the patient cannot afford it? What is the relevance if the patients who inspired the development of those medicines continue to suffer from the disease? Indeed, groundbreaking must be affordable!

The complexity of the drug discovery journey, the risk involved and its resource-intensive nature mostly direct investors and players into areas of possible financial return. These do not only replenish the investment but keep them financially stable for subsequent campaigns. All these add up to influence the cost of new medications. The cases of outrageous prices are mostly seen with rare diseases, a disease area with heavily unmet medical needs. Rare diseases, also called orphan diseases, affect a small portion of the population. In the European Union (EU), this is objectively put as 5 in 10,000 people. Most of these have genetic origins and mostly affect children, resulting in a significant burden on their families. Currently, the EU reports over 6000 different rare diseases in an estimated 30 million people living in Europe. Amidst these, there are only about 230 medicines for rare diseases.

Medicines for rare diseases often require complex, groundbreaking, and costly strategies due to their largely genetic nature. Despite interventions and incentives from regulatory authorities, these drugs are often expensive. A collaborative call for flexibility in patents and the promotion of open science for rare diseases is needed to address this challenge. A system where findings are made accessible and transparent to the scientific community would orchestrate productive collaborations with reduced financial burden. As demonstrated in the COVID-19 pandemic, regulatory authorities and stakeholders can adjust policies and adopt open science to the benefit of patients. This must be implemented in cases of rare and other neglected conditions, to facilitate the discovery of effective yet affordable medicines.

**The Next Pandemic Is Already Here**

Albeit our efforts to contain our current health challenges, a safer future is not assured unless we prepare our world for one. All was well and normal until a viral outbreak in December 2019 took over the world within a few months, exposing major flaws in global healthcare. This event cost the world lots of lives, mainly because there was no available remedy for the disease. Could something worse than this occur again? And how prepared are we for such a mishapening? Surprisingly, such pandemics could be more common than we think. A recent study showed that one has a 38% probability of experiencing a pandemic with the magnitude of COVID-19 in the lifetime, implying that serious pandemics are relatively likely.
Much attention has been drawn to many zoonotic diseases, an area with huge unmet needs. Honestly, it is worth the scare because about half of the millions of infections from animals could spill over to humans. While the fear of the unknown like “disease x” is real, we should never underestimate the known. We anticipate many deadly pathogens, yet we do not have medicines for those we face currently. Viral infections like Ebola, Lassa fever, and Zika virus amongst others do not have adequate medicines available. These are like a time bomb which could easily get out of control and addressing them would certainly give a level of security to humanity. The case of antimicrobial resistance constitutes another urgent global threat, which some experts see as a pending pandemic. Imagine the infections we once had full control over, taking a stronger form to hunt us again. While the solutions are multifactorial, the discovery of newer and stronger drugs is key to addressing this crisis. Disappointingly, it is reported that none of the antimicrobials currently in clinical development address this concern enough\textsuperscript{11}. This unmet medical area demands more innovative discovery efforts to shield humanity against preventable death.

**Future Outlook**

The landscape and description of unmet medical needs in the future depend on our efforts today. A key contributor to this issue has been the non-existence of effective medications for some diseases, as those currently available mostly do not tackle the root cause. These medicines mostly alleviate patients of their symptoms and do not add major benefits to the course of the disease. Innovative medicines, which modify the course of diseases and stand the test of time are a better direction to target. Also, implementing sustainable drug discovery practices is necessary for the future. It does no good to create medical needs for the future while addressing current ones. The discovery and development of drugs create a huge amount of pharmaceutical waste, a highly unsustainable way to meet our needs. These pharmaceutical wastes end up in the environment and find their way into the body to contribute to drug resistance and new diseases to further augment the burden of unmet medical needs.

Unmet medical needs threaten life everywhere and demand a radical, innovative and committed strategy to address them. The discovery of new and more effective medicines, though challenging, is a lasting way of solving this urgent health challenge. This, however, should be done with a sustainable approach, to avoid compromising and creating future problems.
Reference List / Bibliography / Sources:


Word Count (essay text only): (2087/2100)