Between now and the future – our mission and purpose

PharmaSUG 2022
Shanghai, China
- Spending trend in the medicine industry
- Innovations – AI, DV, VT/DCT, RWD/E…etc
- Transition of our roles – mission and challenges
Spending trend – Global spending growth on medicines

Constant dollar growth forecast (invoice)

- **Incremental COVID-19-related usage for treatments and vaccines**
- **Post-pandemic economic/budget pressures**
- **Vaccine spending declines with shift to boosters**

- **Demand impact during pandemic**
- **Post-pandemic volume rebound**

Spending trend – Global CAGRs on medicines (US&Bn)

Source: IQVIA Market Prognosis, Sep 2021; IQVIA Institute, Nov 2021
China spending trend – CAGRs on medicines

Source: IOVIA Market Prognosis, Sep 2021; IOVIA Institute Nov 2021
Profit % trend –
Global Healthcare profit pool

Global healthcare profit pool (2010)

Global healthcare profit pool (2020)

Note: Insurance US reflects total health plan premiums; CKO represents contract research, manufacturing and sales organizations
Sources: IMS; Datamonitor; Business Insights; Freedonia; annual reports; analyst reports; CMS; OECD; Bain analysis
Spending allocations on medicines

Global health care spending (USD billion)

- Global: $7,724 billion (30%)
- North America: $4,175 billion (19%)
- Western Europe: $2,279 billion (31%)
- Asia & Australasia: $2,427 billion (37%)
- Latin America: $437 billion (25%)
- Middle East & Africa: $279 billion (42%)
- Transition economies: $239 billion (35%)

Data from Deloitte.
Increasing reach
Depending on the market, this could mean increasing the number of health care facilities—such as the growing number of hospitals in China—or leveraging technology to increase health care access—such as Telehealth programs developed in Indonesia and India.

Financial pressure
As the cost of health care rises, consumers (including health plans, employers and patients) seek models, such as managed care, to control costs. This cost containment pressure has also sparked public and private partnerships to create managed-care models suitable for international markets.

Improving outcomes
At this stage, markets shift away from a fee-for-service model focused on volume of treatments, towards a payment model based on the outcomes of procedures. This leads to better overall outcomes for patients.

Preventative care
Focused on preventive action and remedies that address root causes instead of treating a disease, preventative care presents a new area of opportunity. Emerging technologies will help deliver next-generation therapies, such as gene editing and regenerative medicine.
# Key innovations in pharma industry

## Top 10 Pharma Industry Trends & Innovations in 2022

<table>
<thead>
<tr>
<th>Innovation</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Artificial Intelligence</td>
<td>21%</td>
</tr>
<tr>
<td>Big Data &amp; Analytics</td>
<td>15%</td>
</tr>
<tr>
<td>Precision Medicine</td>
<td>9%</td>
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<tr>
<td>Blockchain</td>
<td>9%</td>
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<tr>
<td>Extended Reality</td>
<td>7%</td>
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<tr>
<td>Flexible Production</td>
<td>13%</td>
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<tr>
<td>Additive Manufacturing</td>
<td>9%</td>
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<tr>
<td>Real World Data</td>
<td>6%</td>
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<tr>
<td>Digital Therapeutics</td>
<td>6%</td>
</tr>
<tr>
<td>Curative Therapies</td>
<td>5%</td>
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</tbody>
</table>
Drug Development – studying the patterns of various diseases, recognizing which drug compositions would be best suited, treating specific traits, designing and identifying new molecules to target-based drug validation and discoveries

Diagnosis – Machine Learning systems to collect, process, and analyze vast volumes of healthcare data

Remote Monitoring – wearables powered by AI algorithms that can remotely collect data & monitor patients suffering from life-threatening diseases and send alerts

Data Management – identifying most problematic areas of data collection on a trial, rule-based approach to highlight inconsistencies...etc
Latent Dirichlet Allocation (LDA) is an unsupervised clustering technique that is commonly used for text analysis. It’s a type of topic modeling in which words are represented as topics, and documents are represented as a collection of these word topic

LDA to achieve more focused edit checks or to automatically generate new queries, in order to reduce manual queries

Can be applied within the study or across studies

Rules-Based Approach can be further established
Innovations: Data Visualization

- Applied to: risk based monitoring, data management, data analysis, DMC, data exploring….etc
- Data type: clinical trial data, metrics data, audit trail data
- Basic demands: interactive, integrable, re-usable, real-time, accelerated timeline
- Other possibilities: interchangeable formats, pattern recognition, and machine learning?
Data Visualization example – Safety data review

<table>
<thead>
<tr>
<th>Category</th>
<th>Placebo (n=50)</th>
<th>Treatment A (n=50)</th>
<th>Treatment B (n=50)</th>
<th>Total (n=150)</th>
<th>AE Rate by group</th>
<th>Difference Between Groups</th>
</tr>
</thead>
<tbody>
<tr>
<td>+ Gastrointestinal disorders</td>
<td>26.0%</td>
<td>30.0%</td>
<td>34.0%</td>
<td>30.0%</td>
<td></td>
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<tr>
<td>+ Infections and infestations</td>
<td>22.0%</td>
<td>32.0%</td>
<td>18.0%</td>
<td>24.0%</td>
<td></td>
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<tr>
<td>+ Injury, poisoning and procedural complications</td>
<td>18.0%</td>
<td>24.0%</td>
<td>24.0%</td>
<td>22.0%</td>
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<tr>
<td>+ Renal and urinary disorders</td>
<td>2.0%</td>
<td>10.0%</td>
<td>22.0%</td>
<td>11.3%</td>
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<tr>
<td>+ Cardiac disorders</td>
<td>8.0%</td>
<td>10.0%</td>
<td>20.0%</td>
<td>12.7%</td>
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<tr>
<td>+ Nervous system disorders</td>
<td>14.0%</td>
<td>10.0%</td>
<td>18.0%</td>
<td>14.0%</td>
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<tr>
<td>+ Reproductive system and breast disorders</td>
<td>18.0%</td>
<td>4.0%</td>
<td>12.0%</td>
<td>11.3%</td>
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<tr>
<td>+ Investigations</td>
<td>16.0%</td>
<td>12.0%</td>
<td>6.0%</td>
<td>11.3%</td>
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<tr>
<td>+ Respiratory, thoracic and mediastinal disorders</td>
<td>12.0%</td>
<td>16.0%</td>
<td>12.0%</td>
<td>13.3%</td>
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<tr>
<td>+ Musculoskeletal and connective tissue disorders</td>
<td>14.0%</td>
<td>14.0%</td>
<td>8.0%</td>
<td>12.0%</td>
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<tr>
<td>+ Eye disorders</td>
<td>8.0%</td>
<td>6.0%</td>
<td>12.0%</td>
<td>8.7%</td>
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<tr>
<td>+ Skin and subcutaneous tissue disorders</td>
<td>6.0%</td>
<td>10.0%</td>
<td>6.0%</td>
<td>7.3%</td>
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<tr>
<td>+ General disorders and administration site conditions</td>
<td>10.0%</td>
<td>0.0%</td>
<td>4.0%</td>
<td>4.7%</td>
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</tr>
<tr>
<td>+ Metabolism and nutrition disorders</td>
<td>4.0%</td>
<td>8.0%</td>
<td>0.0%</td>
<td>0.0%</td>
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<tr>
<td>+ Blood and lymphatic system disorders</td>
<td>6.0%</td>
<td>8.0%</td>
<td>0.0%</td>
<td>4.7%</td>
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Innovations: virtual trials

- Tele-visits with doctors
- Home visit by care providers
- Hybrid model vs 100% remote model
- Expands the patient pool, faster recruitment
- Lower cost? Maybe, maybe not.
- Wearable devices = larger amount of data points = potential change in research endpoints = different data analysis approaches
- More diverse patient populations
Innovations summaries

• Replace repeat labor with machine learning
• Identify risk earlier than human would
• Collect data anytime/anywhere
• Streamlined data feeds, data processing in real time, even if data size grows exponentially
• Intuitive and interactive data formats, expandable analyses
• Data generates data, automatically.
• Improved convenience, improved treatment precision, reduced labor, reduced timeline, enhanced data, real-life data, optimized user experience, and reduced cost=improved efficiency
Our missions and challenges – the challenges

• ‘This is how we have always done it’…really?

• Who is going to take lead on data science innovation? Biostats & Programming? Data Management?

• Can current typical organization structures support the innovation effort?

• Where does the funding go to? Which platform to invest?

• How do we align on directions and collectively optimize the overall time & effort investment?

• Do we have all the talents we need within our industry?

• Do these innovations change the current process/practices in terms of process and decision makings?
• Be the leader but don’t have to be the leader
• Stay influential but ensure data science is a wider awareness across functions
• Develop with big-picture view in mind
• Streamline wherever that’s possible, delayering rather than adding another layer
• Innovations shall reduce learning curve, not increasing it. The aim is to achieve more with less

• Job security? Let’s worry about other more important elements….