

FROM THE ANALYST'S COUCH

Pharmaceutical forecasting: throwing darts?

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The pharmaceutical industry is constantly looking to its future, aiming to address unmet needs today through yet-to-be-developed medicines and technologies. Importantly, the future that is envisioned is one that is often years — if not more than a decade — on the horizon owing to the long cycle time for drug innovation.

Furthermore, given the vicissitudes of the external environment, the uncertainty of drug development and the unpredictable actions of competitors, weaving an array of scientific, clinical, regulatory and commercial data into a numerical representation of value for a drug is a substantial challenge. However, such forecasting is a crucial activity that affects many decisions inside a pharmaceutical company: for example, designing a clinical programme; deploying sales force resources; making decisions on geographic resource allocation; or acquiring a company or licensing assets. Additionally, drug forecasts are one of the most important inputs into investors' decisions to buy or sell shares of a company.

Given the importance of forecasting, we set out to investigate three questions. First, how good have drug forecasts been historically? And, more specifically, how good have estimates from sell-side analysts been at predicting the future? Second, what type of error has typically been implicated in the misses? Third, is there any type of drug that has been historically more easy or difficult to forecast?

To answer these questions, we looked at a discrete period of drug launches (2002–2011) to assess the forecast accuracy of sell-side analysts' estimates and to measure two different types of forecast error among consensus estimates. First, we investigated the variance: what is the typical magnitude of the inaccuracy between analysts' estimates of peak drug sales and actual peak drug sales? And second, what is the typical direction of the inaccuracy (that is, is there a consistent under- or overestimate by the analysts?)

Our data set consists of more than 1,700 individual analyst forecasts on 260 launched drugs (see [Supplementary information S1](#) (box) for the detailed methodology). We chose

to use consensus forecasts as the data source for our analysis for two reasons. First, the data are the most complete source available to look at forecasts longitudinally and across a broad set of drugs. Second, many pharmaceutical companies and investors rely on sell-side forecasts as the starting point to inform their own forecasts. Although the consensus does not necessarily mirror internal company or buy-side forecasts, it is often a starting point or comparator and not generally that different from other forecasts in our experience.

Analysis outcomes and discussion

Two major findings emerged from our analysis.

First, most consensus forecasts were wrong, often substantially. And although consensus forecasts improved over time as

more information became available, accuracy remained an issue even several years post-launch. More than 60% of the consensus forecasts in our data set were either over or under by more than 40% of the actual peak revenues (FIG. 1a). Although the overall median of the data set was within 4%, the distribution is wide for both under- and overestimated forecasts. Furthermore, a significant number of consensus forecasts were overly optimistic by more than 160% of the actual peak revenues of the product.

Tracking individual drugs over time, one would expect that once a drug is approved and on the market, the forecasting accuracy would improve as more data and information become available. When a drug is in clinical development, not much is known about how the drug will perform commercially because

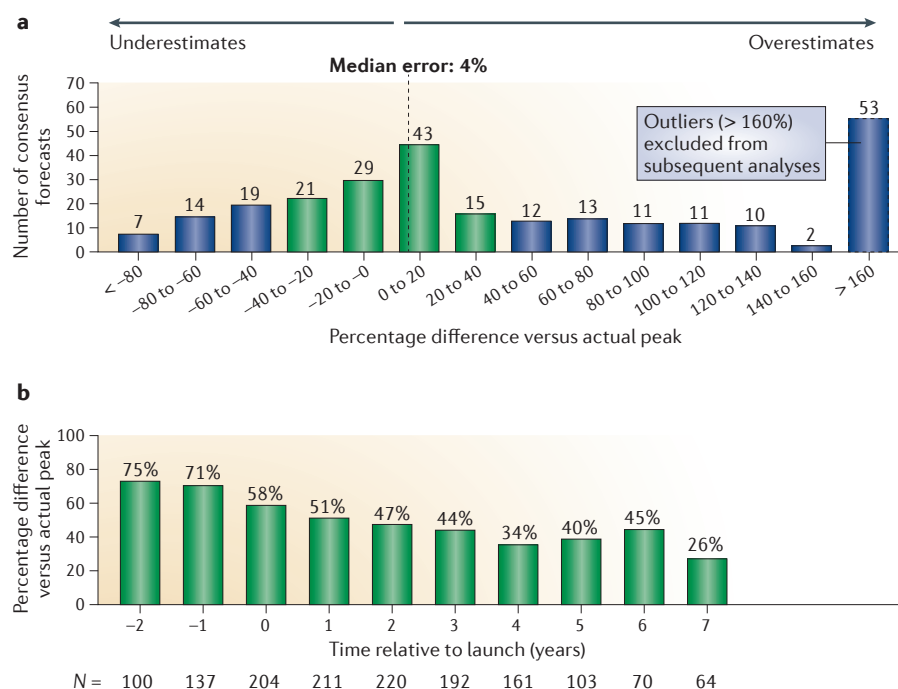


Figure 1 | Inaccuracy in pharmaceutical forecasting. **a** | The majority of consensus analyst forecasts are off by more than 40%. The graph shows the percentage difference in estimated versus actual peak sales (calculated as the consensus estimate of peak sales minus the actual peak sales divided by the actual peak sales) for 260 drugs forecasted in the year before launch. **b** | Variance in consensus estimate versus actual peak sales. Although forecast error decreases over time, it remains as high as 45% even 6 years after launch. See [Supplementary information S1](#) (box) for details.

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- ▶ there are many uncertainties that are hard to foresee: for example, the pivotal trial has not yet been completed; the regulators have not yet weighed in; and clinicians have not yet had a chance to use the drug.

Indeed, our analysis shows that there is a trend towards better forecasts once a drug is approved; however, there still appears to be a systemic variance in the forecasts, even years after the drug has been launched (FIG. 1b). The variance in peak sales estimates was still 45% versus actual peak sales 6 years after the drug has launched, reflecting continued uncertainty even as new information becomes available.

Second, there are differences in forecast accuracy for different segments of the market. Large pharmaceutical companies generally have higher quality and a wider sell-side coverage than smaller companies, and our data seem to reflect this difference. Although the average bias among estimates for drugs from large pharmaceutical companies is low, forecasts for drugs from small companies tend to overestimate peak sales by more than 30% (FIG. 2a). The bias for large pharmaceutical companies averages

out between a severe underestimate applied before launch and a more moderate bias after launch (data not shown). The variance, however, is high for both sets of forecasts, which suggests that any one selected forecast is likely to be wrong.

For the period we assessed, central nervous system (CNS) and cardiovascular drugs were most commonly overestimated, whereas oncology drugs were most commonly underestimated (FIG. 2b). In the period we evaluated, the sales of many successful oncology drugs expanded through new indications that were approved after launch, and it is likely that forecasts underestimated this growth potential.

Perhaps surprisingly, analyst forecasts for 'follow-on' therapies are no more accurate than predecessor 'first-in-class' therapies, despite a greater understanding of the disease pathway, market adoption, usage patterns and so on (data not shown).

Implications

Although the conclusion that most forecasts are poor is not surprising in our view, the magnitude and extent of the error

in forecasting is striking and troubling as it suggests a large-scale and systemic misallocation of capital and destruction of value in the industry. It also suggests that there is a substantial opportunity for companies and investors who develop a competitive advantage in forecasting.

The unanswered question in this analysis is what companies and investors ought to be doing to forecast better. We do not offer a complete answer here, but we have thoughts based on our analysis.

Beware the wisdom of the crowd. The 'consensus' consists of well-compensated, focused professionals who have many years of experience, and we have shown that the consensus is often wrong. There should be no comfort in having one's own forecast being close to the consensus, particularly when millions or billions of dollars are on the line in an investment decision or acquisition situation.

Broaden the aperture on what the future could look like, and rapidly adapt to new information. Much of the divergence between a forecast and what actually happens is due to the emergence of a scenario that no one foresaw: a new competitor, unfavourable clinical data or a more restrictive regulatory environment. Companies need to fight their own inertia and the tendency to make only incremental shifts in forecasting and resourcing.

Try to improve. It appears that some companies and analysts may be better at forecasting than others (see Supplementary information S1 (box)). We suspect there is no magic bullet to improving the accuracy of forecasts, but the first step is conducting a self-assessment and recognizing that there may be a capability issue that needs to be addressed.

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Competing financial interests

The authors declare no competing financial interests.

SUPPLEMENTARY INFORMATION

See online article: S1 (box)

ALL LINKS ARE ACTIVE IN THE ONLINE PDF

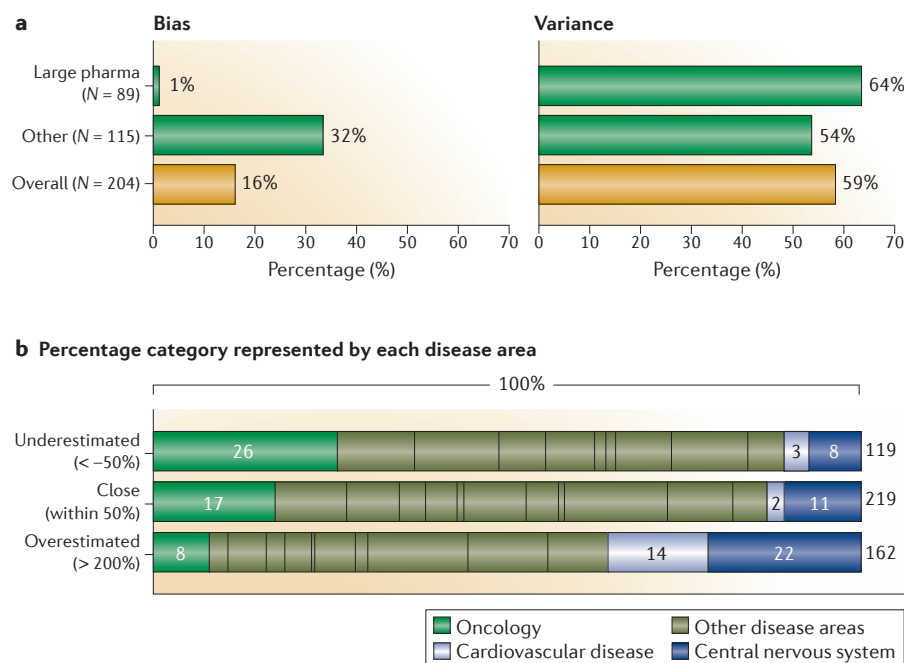


Figure 2 | Forecast accuracy across various segments of drugs. **a** | Forecast accuracy versus company type, first year post-launch. The average bias for the forecasts for large pharmaceutical companies is lower than for other companies. **b** | Forecast accuracy versus disease area. Revenues for oncology drugs were more likely to be under-estimated, whereas revenues for cardiovascular and central nervous system drugs were more likely to be overestimated. See supplementary information S1 (box) for details.