Comparison of Electronic Data Capture with Paper Data Collection – Is There Really an Advantage?

a report by
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Pharmaceutical Research and Development – The Profitability Gap

Although the pharmaceutical industry still shows healthy profitability rates of an average of 16%,[1] it can be said that the 'golden days' are over. The market still grows, but at a decreasing rate.[2] Development costs are growing at a higher speed than sales,[3] with returns remaining steady since 1981 at only 2% to 3% above the cost of capital.[4] To cite Drews and Ryser: "The predicted output figures are not sufficient to sustain the pharmaceutical industry as it stands today."[7] Costs of developing a new drug are meanwhile exceeding US$800 million, with an average of 11 years from creation to market.[5] Among other industries, the research-based pharmaceutical industry ranks highest in spending money on research and development (R&D) when revenues and R&D investments are compared.[6]

To a certain extent, the pharmaceutical industry is faced with similar problems than other industries many years before. The remedy to this growing gap is – generally speaking – cutting costs or, more specifically, to reduce development costs.

The Electronic Data Capture Proposal

If R&D spending in the pharmaceutical industry is to rise in congruence with projected industry sales, pharmaceutical companies will need to achieve substantial increases in R&D productivity, with a need to reduce the cost of drug development by 20% to over 40%.[3]With clinical research being one of the most expensive and critical areas of drug development, there seems to be a potential for electronic data capture (EDC). Its capacity to reduce clinical research costs is estimated to be up to 20%.[3] In this article, we want to analyse if EDC can be a substantial part of this effort in productivity increase.

The EDC Market

The pharmaceutical market seems to have an interest in this technology. In 2001, software and services related to clinical trial processes reflected a worth of US$874 million worldwide, and is estimated to reach almost double (US$1.49 billion) by 2004.[8]

The Value of EDC

The ever-repeated claim of EDC supporters is its ability to decrease clinical trial costs and – even more important – time to market through accelerated development. It is interesting to see that the adoption of this technology goes with a relatively slow speed. This reluctance may be based on negative impressions, partially based on poor design and performance of early EDC systems and/or the fact that many pilot EDC trials showed a lack of true scalability. If this statement has been true in the past sometimes, it certainly has to be recalled with the advent of modern EDC systems giving significant improvements to their users as well as business value to the market.

Well-designed EDC systems give – amongst many other qualities – improvements in clinical research compared with paper data collection (see *Table 1*).

1. *The 2002 Fortune 500 Industry Rankings, "How the Fortune 1000 Stack Up In Their Industries",* Fortune, *April 2002, http://www.fortune.com/lists/F500/indsnap_41.html*
2. *M Napier and R Lee (October 2000),* A New Edge for Pharma: The eBusiness Guide to Managing Innovation, Risk, and Speed, *Deloitte and Touche, Chicago.*
3. *Pricewaterhouse Coopers (1998),* Pharma 2005: An Industrial Revolution in R&D.
4. Examining the Relationship Between Pharmaceutical Pricing and Innovation, *Arthur D Little, May 2002.*
5. *J Moser, "Links Between Drug Company Profitability and Investments in Research: A Fact Sheet", Galen Institute, July 2002, http://www.galen.org/news/070202.html*
6. *"The Myth of 'Rising Drug Prices' Exposed", PhRMA Backgrounder, March 2002, http://www.phrma.org/publications/documents/backgrounders/2002-03-06.333.phtml*
7. *J Drews and S Ryser, "Innovation Deficit in the Pharmaceutical Industry",* Drug Inf. J., *Vol. 30 (1996), pp. 97–107.*
8. *Silico Research, "Clinical trials and the internet",* e-R&D-Insights, *June 2001.*

These – and many other – virtues of EDC have been heard many times before, but there are not only qualitative improvements that EDC has to offer. In a business set-up, the quantitative aspect is much more important, of course. Work has already been carried out in order to quantify the advantages of EDC.

Efficiency of EDC versus Paper Data Collection

To our knowledge, Banik[9] has been the first to publish metrics evaluating EDC versus paper data collection. His analysis is based on a five-country, 19-site trial (N = 226). In this context especially, the findings on EDC efficacy deserve interest. A summary of the latter is shown in *Table 2* (see also *Figure 1*).

Criteria for Remote Study Monitoring

Another valuable analysis is the publication of Proeve,[10] where he defines criteria for the evaluation of possible candidates for remote study monitoring (RSM). In this case, data has been derived from a development programme (Phase II/III trials), with the RSM part enrolling some 5,000 patients in 36 countries. His results are depicted in *Table 3*.

Comparison of Data Quality

A recent publication[11] shows a rather differentiated view on data quality, comparing paper-based data collection with EDC. As the figures in *Table 4* show, the benefits achieved in actual EDC developments have been remarkable (see also *Figure 2*). Results for this analysis were generated out of 10 Phase III studies (N = 6,700 subjects).

EDC versus Paper – Cost Comparison

The most detailed and precise work regarding cost comparison between EDC and the 'classic' paper-based approach comes from Green.[12] Analysis data in this publication was derived from four different clinical trials:

1. Phase I trial (one site), N = 24 – CRF size: 75 pages;
2. Phase II trial (five sites), N = 90, four years follow-up – CRF size: 148 pages;
3. Phase III trial (30 sites), N = 450, trial duration: 54 months – e-CRF size: 150 pages; and
4. Phase IIIb trial (192 sites), N = 7,700, trial duration: 18 months – CRF size: 30 pages.

Table 1: A Selection of EDC-based Improvements in Clinical Research

EDC Characteristic	Improvement Over Paper Data Collection
Elimination of double data entry	Time and cost savings
Edit checks to eliminate errors	Reduction of queries
Creation of electronic documents (e-CRFs)	Elimination of printing, binding and shipping costs, reduction of space at trial sites
e-Monitoring	Time saving, reduction of travel costs

Table 2: Efficiency of EDC versus Paper

Parameter	EDC Efficiency Over Paper
Clinical trial duration	↓30%
Time to locked database	↓43%
Number of queries	↓86%

Table 3: Major Criteria for Selecting Good Candidates for RSM

Criterion	Not Recommended	Depends on Situation	Good Candidate
Number of patients per site	<6	6–10	>10
Number of visits	Few	Several	Many
Number of data points	Few	Several	Many
Number of investigators	1	2–20	>20
Number of regions involved	>2	2	1
Interim analyses	0	1	>1
Study complexity	Easy	Intermediate	Difficult
Standardisation	Not at all	Partial	Full
Strategic project	No	Low priority	High priority
Phase	IV & PMS	I	II & III
Study duration (months)	<6	6–12	>12
Number of studies per project	1	2–5	>5
Time available for study set-up (months)	<2	2–3	>3

Figure 1: Comparison of Efficiency of EDC versus Paper Data Collection (N = 226)

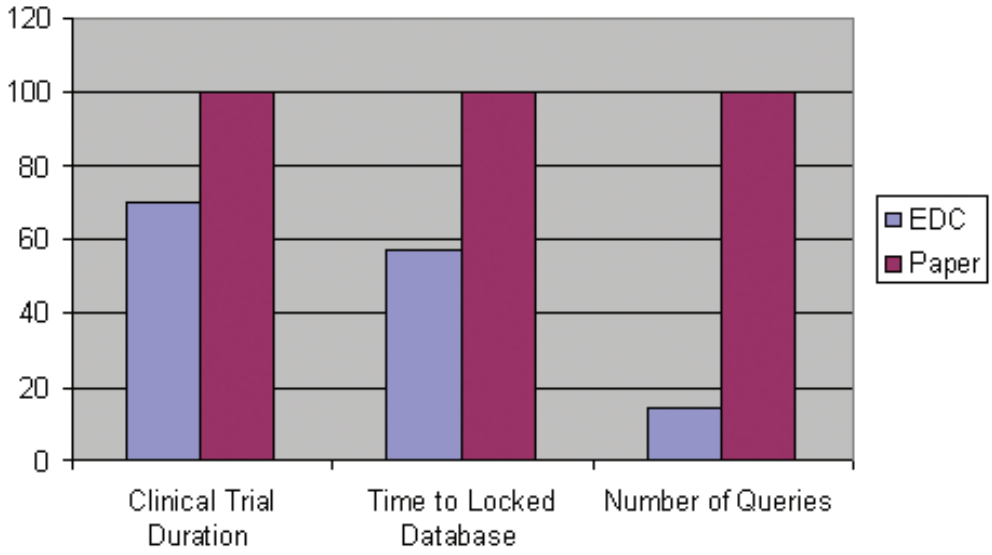


Table 4: Comparison of EDC versus Paper Data Collection Data Quality

	EDC	Paper
Percentage of enrolled subjects that are invalid	7.5%	15%
Cost of raising and resolving a query	US$10	US$60
Number of queries/subject	0.25–1	5–20
Percentage of data requiring correction	0.05–0.1%	1–2%
Percentage of queries caused by missing data	0%	48%
Percentage of queries caused by inconsistent data	5%	35%
Percentage of queries caused by out-of-range data	0.1%	8%
Percentage of queries requesting clarification	0%	6%
Percentage of queries due to invalid data	0.05%	0.1%

Figure 2: Data Quality Comparison – EDC versus Paper Data Collection (10 phase III studies; N = 6,700).

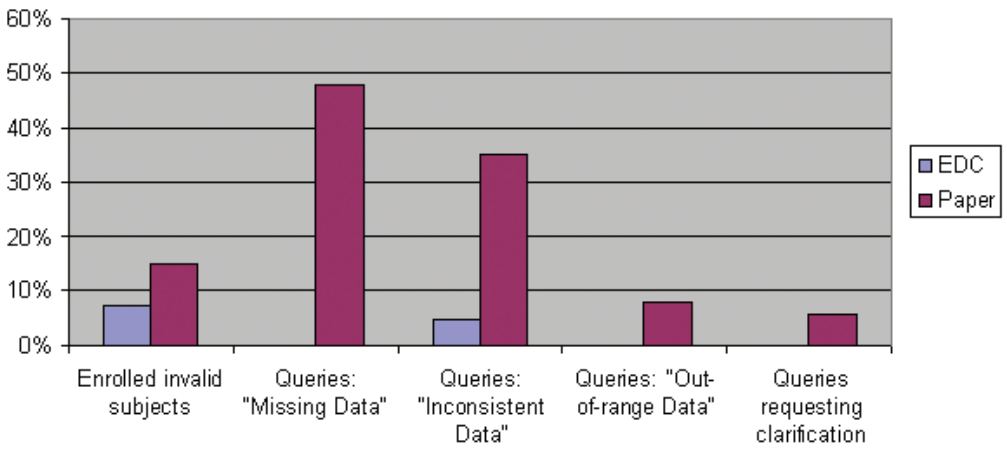
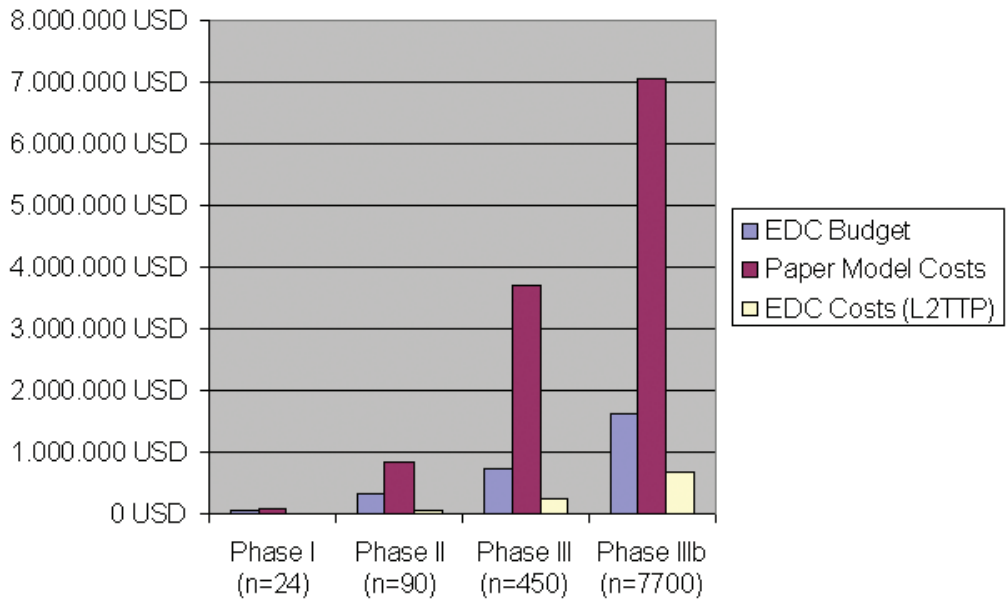


Table 5: Cost Comparisons for Actual EDC Budgets, Estimated Paper Model Costs and Technology Transfer and Enterprise Relationship Pricing

Clinical Trial	Actual EDC Budget	Estimated Paper Model Costs	EDC Costs Under Technology Transfer and Enterprise Pricing
Phase I	US$59,640	US$68,440	US$6,500
Phase II	US$319,776	US$851,468	US$47,952
Phase III	US$745,986	US$3,714,000	US$243,000
Phase IIIb	US$1,643,000	US$7,051,125	US$693,000

Figure 3: Cost Comparisons of EDC Budgets of Four Clinical Trials (N = 24, 90, 450, 7,700) with Corresponding Paper Model and EDC L2TTP (Level 2 Technology Transfer and Enterprise Relationship Pricing) Costs



Global results of this publication are depicted in *Table 5* (see also *Figure 3*). In comparing costs, Green gathered the following data in his work:

- actual approved EDC budgets in each clinical study;
- estimated costs for a paper model implementation from four panel experts; and
- EDC costs applied under a Level 2 technology transfer and enterprise relationship pricing model. (Green defined Level 2 technology transfer as a process by which a client internalises the use of EDC software allowing for the independent design of e-CRFs, data management reports and data exports, as opposed to outsourcing these activities to the software vendor.)

Conclusion

All the aforementioned analyses have one thing in common: they underline the value of EDC as a cost and time-saving instrument in modern clinical research. Regardless of method and trial, EDC could fulfil in all examined parameters its promises, realising cost savings of up to a factor of 5.8 in comparison with paper data capture.[12]

There exists a multitude of reasons for the relatively slow adoption of this new technology, for example inertia of a conservative, heavily regulated market, service providers feeling uneasy of adopting a new method capable of transforming their entire business model, the extreme frequency of change both in hardware and software products, etc. However, the message is clear: EDC will acquire a clear majority of the market for data capture and data processing in clinical research in the near future.

Even those who are sceptical about too optimistic expectations regarding EDC can save precious time to market and reduce financial commitments in development. EDC will contribute to this goal, which is inevitable in today's cost-sensitive environment.

With increasing experience and availability of more objective data on EDC, it will become more and more difficult, perhaps impossible, to cast away a technology that is capable of delivering significant business value to the client in reducing overall costs and accelerating development time. It is our conviction that EDC will sooner or later be the standard in clinical research data capture. ■

9. *N Banik, "Evaluation of EDC versus Paper in a Multinational Asthma Trial", Presented at the DIA European Data Management Meeting, Berlin, October 1998.*
10. *J Proeve, "Challenges and Solutions for the use of remote study monitoring in a transcontinental project",* Drug Inf. J., *Vol. 34 (2000), pp. 121–127.*
11. *C Spink, "Electronic Data Capture (EDC) as a means for e-clinical trial success", IBM Global Services, Pharmaceutical Clinical Development, March 2002.*
12. *J A Green, "The EDC Value proposition to the pharmaceutical industry. A Detailed Comparison of EDC Versus Paper Model Costs For Four Different Clinical Research Projects (Phase I –IIIb)", Datatrak International, Inc., July 2001.*