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Electronic Patient Reported Outcomes (ePRO): Single vs. Multiple Questions Per Screen

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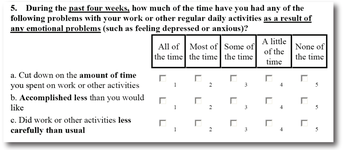
Migrating from Paper to Electronic

When an instrument has been migrated from a validated paper version to ePRO, it is necessary to review the changes and assess their implications for data equivalence.

One common change, particularly when developing for a small device such as a handheld computer, is to present one question per page, whereas paper originals generally have a number of questions per page.

Proximity Effects

Paper questionnaires often present items in groups. Sometimes these groups are logical, for example when items all refer to a particular domain. Sometimes the grouping is arbitrary, as when a set of questions is grouped because they all have the same response options. Here is an example from the SF-36:



5. **During the past four weeks, how much of the time have you had any of the following problems with your work or other regular daily activities as a result of any emotional problems (such as feeling depressed or anxious)?**

	All of the time	Most of the time	Some of the time	A little of the time	None of the time
a. Cut down on the **amount of time** you spent on work or other activities	1	2	3	4	5
b. **Accomplished less** than you would like	1	2	3	4	5
c. Did work or other activities **less carefully than usual**	1	2	3	4	5

Correlations between responses to questions in a group tend to be higher than when the same questions are presented singly. In many situations this correlation is spurious: making each question self-contained should if anything improve the veracity of the data. In general, though, these effects are small.

Data from a web study (Couper et al. 2001) found trends towards a grouping correlation, but this was small and not statistically significant.

This appears to be the only study carried out explicitly to address this issue. Other useful information comes from equivalence studies comparing paper instruments with grouped questions and ePRO instruments with single questions per screen.

Equivalence Studies in the Literature

Gwaltney et al. (2008) have reported a meta-analysis of published studies that compared electronic and paper collection of PRO data. Their review was limited by the fact that many studies do not provide much information about the electronic application, so it is not always explicitly stated whether single or multiple question layouts have been used. However it may be safely assumed that implementations on a handheld computer will use single questions. Larger devices could use either single or multiple questions per screen.

Gwaltney and co-authors compared the equivalence data for PDAs and for larger screen devices. The average correlation (ICC) between PDA scores and paper was 0.91, while the average correlation between larger screen devices and paper was 0.90. Thus their analysis suggests that using single questions per screen has little or no effect on the data obtained.

Case Study: EQ-5D in Rheumatoid Arthritis

A study carried out in 43 patients with rheumatoid arthritis (Tiplady et al. 2010) has evaluated equivalence of PDA versions of a number of scales with the paper originals. We have examined the results from the EQ-5D. This has five questions, each related to one domain of function. In the paper version, these five questions are presented on a single page. The PDA version presented one question per page.

We compared the correlations between questions using Cronbach's alpha. The values were as follows:

Mode	Alpha
Paper	0.72
ePRO	0.73

The correlations were virtually the same, indicating that mode of presentation had no discernible influence on the correlations between responses to the five questions. Thus in this case presentation of single or multiple questions has no impact on the data obtained.

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Usability by Patients

When questions are presented singly, the patient navigates from one question to the following question by tapping a "next" button each time. If multiple questions are presented on a single screen, as is possible with larger devices, the patient has to tap "Next" only once for a group of questions. This could make the multiple Question layout easier for the patient to use.

On the other hand, if the questionnaire involves branching logic, this is likely to be simpler if questions are presented singly.

Usability Data

We have not found any studies in the literature that directly compare electronic devices using single and multiple question layouts. A number of studies have compared PDA implementations (using single questions) with paper (using multiple questions). Two types of data are available, the opinions and preferences of the patients who complete the instruments, and the time they take to do so.

It has repeatedly been shown that respondents find electronic questionnaires easy to use, and often prefer them to paper. (Drummond et al., 1995 ; Kvien et al. 2005; Heiberg et al. 2007). In the Rheumatoid Arthritis study (see left) of the 43 patients in the study, 23 (53%) preferred electronic, while only 6 (14%) preferred paper. The remainder expressed no preference.

The data from time to completion is not consistent – some studies suggest that PDA electronic takes longer than paper (vanDenKerkhof et al. 2005; Kvien et al. 2005), while others suggest similar completion times (Heiberg et al. 2007; Tiplady et al., 2010). Interpretation of these data are complicated by the fact that time is taken not only be the user, but by the application – thus some applications mat take time after a "next" button is pressed before the next screen appears. Nonetheless two conclusions can be draw n – (1) that single questions do not necessarily take longer than multiple questions, and (2) that any increase in completion time is not sufficient to have a major effect on usability.

References

Couper et al. (2001) Public Opinion Quarterly, 65: 230
Drummond et al. (1995) Quality of Life Research, 4:21
Gwaltney CJ et al. (2008) Value in Health, 11:322
Heiberg et al. (2007) Arthritis Rheum., 57:454
Kvien et al. (2005) Annals of the Rheumatic Diseases., 64:1480
Tiplady et al. (2010) The Patient, 3:1
VanDenKerkhof (2005) Anesthesia and Analgesia, 101:1075

Conclusion

These results show that presentation of questions singly on the screen of a small ePRO device such as a PDA has little or no effect on the data collected, or on the ease of use for patients.