INTRODUCTION

To study rare but clinically important categories of patient behaviour represents a methodological challenge for the researcher in clinical communication research. The patient’s more or less explicit or ambiguous expression of emotion is a frequently studied example of relatively rare communication categories. The interest in patients’ expression of emotion is partly motivated by data indicating that emotional expression in the medical consultation is important for health outcomes (Stewart 1995).

There are a number of labels of emotionally charged utterances from patients in clinical communication research, for instance emotional cues (Butow et al., 2002), concerns (Roter, 1989), or empathic opportunities (Suchman et al., 1997). Patients’ emotional cues are typically found to be embedded in the dialogue concerning the medical information (Butow et al. 2002). Patients seldom verbalize their concerns and emotions directly and spontaneously (Suchmann et al. 1997).

The study of emotional cues and concerns raises a number of interesting research questions. What are the precipitating events leading up to a patient’s expression of concern? May expressions of concern be predicted by patient variables (such as patient gender or the degree of psychological distress), by physician variables (physician gender) or by variables related to the pattern of communication? How do physicians respond to patients’ cues and concerns?

These questions can hardly be answered by way of conventional consultation research methods, in which categories of communication behaviour are counted at the consultation level. Such analyses may tell us if there is a co-occurrence of behaviours of interest at the consultation level, for instance if there tend to be many examples of specific physician behaviours in consultations with many utterances of emotional concerns. However, these analyses do not reveal information about their closeness or distance to the cues in the dialogue. In this paper we will demonstrate how sequential analysis may be applied to study the dynamics of rare utterance categories, in this case patients’ emotional cues, in the physician-patient dialogue (Bakeman & Quera, 1995; Bakeman & Gottman, 1997).

We will illustrate the use of sequence analysis in a small data set of 39 consultations. In order to exemplify sequence analysis we will explore the empirically based assumptions that physician communication differs according to the gender of the physician (Roter et al., 2002).
METHODS

Participants and coding

Thirty-five follow up consultations with cancer patients at an oncology outpatient clinic were studied, 23 patients with female and 12 patients with male physicians. Demographic data on the sample are reported elsewhere (Eide et al., in press).

The consultations were coded with the Roter Interaction Analysis System (RIAS) (Roter 1977; 1989). All utterances made by the patient and the physician during the consultation were coded into fourteen categories classified as “socio-emotional” and 25 categories classified as task-focused (“instrumental”) utterances, mainly in terms of open and closed questions, information transfer, and counselling. “Silence” was coded whenever either patient or physician was not speaking during the consultation. The inter-rater reliability of the coding was satisfying and is reported elsewhere (Eide et al. submitted for publication a; in press).

The patient categories of main interest in this study were the RIAS categories of “concern” and “asks for reassurance”. “Shows concern or worry” is defined in RIAS as: “a statement or nonverbal expression indicating that a condition or event is serious, worrisome, distressing or deserving special attention (such as comforting or other special consideration) and is of particular concern right now during the medical interview” (Roter, 1989). “Asks for reassurance” is defined as “a question of concern that expresses the need or desire to be reassured or encouraged. Voice tone, intonation and emotional content may be of significance when distinguishing questions that ask for reassurance from other questions” (Roter, 1989). These two categories were combined for use in the sequential analysis, labelled “concern”.

Among physician categories Gives reassurance / shows optimism (named reassurance in the rest of the text) should be specifically mentioned. The category is defined in RIAS as “statements indicating optimism, encouragement, relief of worry or reassurance, reflecting how the person feels right now. The category also includes prognostic statements that are related to physical or emotional consequences” (Roter, 1989).

To avoid empty cells we aggregated the remaining variables following a cluster division described by Hall et al. (1993). We consider this way of clustering particularly suitable for the coding of psychosocial communication in such a highly biomedical context as oncology (Sandvik et al. 2002). This clustering is described elsewhere (Eide et al. submitted for publication a, b).

The computer software The Observer Base Package and Observer Video Analysis were used as tools for coding the consultations (Noldus Information Technology 1996; 1997; Noldus et al. 2000).

Sequence analysis

In our sequence analysis we applied the Sequential Data Interchange Standard (SDIS), which defines a standard format for sequential data, developed by Bakeman & Quera (1995). The OTS (an Observer to SDIS conversion program) was used to transform the data from the Observer to a format that was suitable for sequence analysis in SDIS (Bakeman & Quera, 2000; Quera & Bakeman, 2000). To perform the sequence analysis, we applied the Generalized Sequential Querier (GSEQ), a computer program developed by Bakeman & Quera (1995), to analyse sequential patterns between patient concern and physician communication elements.

In sequence analysis according to SDIS, the unit of analysis is the association between a given behaviour and an adjacent target behaviour. The association between behaviours may be analysed at different time lags. Positive lag 1 indicates the association between a given behaviour (utterance) and the immediately following target behaviour; lag 2 indicates the association between the given behaviour and the second following behaviour, etc. Target behaviours preceding given behaviour can be investigated in the same way, expressed as negative lags.

Lag analysis is based on the associations between coded events, in our study single utterances by patient and physician. An alternative is timed event sequences, in which the given behaviour is associated with target behaviours occurring within specified time windows after (or before) it. Moreover, chain analysis may be applied in order to identify specific combinations of doctor-patient interaction (Bakeman & Quera, 1995). Neither of these approaches was applied in the present paper.

Measure of global sequential association

In order to test the degree of global sequential association between physician and patient behaviour (i.e. whether the sequence of utterances in the respective categories between patients and physicians in general occurred by chance or not), we produced tables with all the behavioural categories of one group (patients or physicians) along the y-axis (given behaviours), and the behavioural categories of the other group along the x-axis (targets behaviours). The Chi-square statistic for each lag table was calculated. A significant chi-square value for the whole table indicates that the association between the variables is not determined by chance, and that a given category of utte-
rances is followed (positive lag) or preceded (negative lag) more often by some categories and less often by others. Having established a global sequential association between physician and patient behaviour, it is meaningful to look further into which specific pairs of categories are associated, and the strength of these associations (Bakeman & Quera, 1995).

How many lags that are meaningful to explore will depend on a significant chi-square for the whole table and that there are behaviours at the respective lags that are significantly more or less associated with each other than expected by chance. In this study 4 lags were chosen.

In this study, 16 such tables were produced, all with physician behaviours as given behaviours, at Lag 1, 2, 3 and 4 (4 alternatives), with target behaviours both before (negative lags) and after (positive lags) the given behaviour (2 alternatives) for male and female physicians (2 alternatives; thus 4 x 2 x 2 = 16 tables).

Associations between specific categories: lag analysis

To determine the strength of the individual associations between the given category chosen for special attention (patient concern) and specific target categories of utterances, adjusted residuals were calculated. Adjusted residuals are standardized raw residuals (based on the difference between the observed and expected frequency) and may be inspected to determine whether a specific target behaviour occurs significantly more or less often than expected after each given behaviour, and which given behaviour tends to occur significantly more or less often before each target behaviour. An adjusted residual above 1.96 or below –1.96 is considered significant at the 5% level (Bakeman & Quera, 1995). A value above 1.96 means the behaviour occurred significantly more often, and a value below –1.96 less often, than expected by chance.

By using adjusted residuals it is not possible to make cross-table comparisons, since adjusted residuals are dependent on the sample size. Therefore Yule’s Q was also computed. Yule’s Q is a test specific to 2x2 tables that can be used to determine the strength of an association, similarly to the correlation coefficient (Bakeman, 2000). The range is from +1 for a perfect positive relationship to –1 for a perfect negative relationship. Unlike adjusted residuals, Qs are not dependent on sample size, and can therefore be used for making cross-table comparisons of the strength of the comparisons when the numbers of observations in the tables being compared differ.

RESULTS

Frequencies of the given behaviour (patient “concern”)

There was a mean of 4.8 (SD: 6.0) “concerns” per consultation, 3.9 (SD: 4.6) in consultations with a female and 6.4 (SD: 7.9) in consultations with a male physician. Frequencies of other categories are not reported here.

Assessment of global sequential association: an example

We will use one of the 16 tables produced as an example of assessment of global sequential association. We have chosen findings from first positive lag with patient behaviour as the given behaviour and male physician behaviour as target behaviour. In other words: we start with patient (given) behaviours and study what categories of physician (target) behaviour follows immediately (1st lag) afterwards (positive lag) when the doctor is male.

At lag 1, several behaviours did not concur, i.e. there were some empty cells in the given x target behaviour matrix. We chose to re-run the analysis based only on the behaviours that actually did concur, without any empty cells. All target categories following the given behaviour (patient “concern”) in 1st lag were included.

The results of these analyses are displayed in table 1. This table is actually a representation of five separate tables from the GSEQ output, i.e. one table for each of the target categories. The table displays frequencies of concurrence and expected frequency outside of the parentheses in each separate cell.

In the chi-square analysis for the whole table, there was a highly significant deviation from a chance distribution of frequencies in the 30 cells (six patient categories x five physician categories). The chi square for the table at lag 1 for the male physicians were 159.0655, df = 20, p < 0.0000001.

The other 15 tables also had highly significant chi-square values.

Associations between specific categories: lag analysis

Table I displays all associations at lag 1. The strength and statistical significance of the individual associations is expressed as adjusted residuals with p-values in the parentheses and Yule’s Q in brackets.

In this paper we are interested in the relationship between patient concern and physician behaviour. As we see from the table, for male physicians “reassurance” is the only target behaviour that has a highly significant positive association with the chosen given (patient) behaviour.
If our main research aim, for instance, had been to explore communication patterns concerning patient utterances on psychosocial topics, we see that the most significant physician behaviour associated with this patient behaviour at lag 1 consists of facilitating utterances.

Categories that precede and follow patient “concerns”

In table II we have chosen as the given patient behaviour “concern” and present all significantly associated physician behaviours before (negative) and after (positive).

Table I. – First positive lags, with several patient communication categories as given behaviour and male physician’s communication categories as target behaviours (following the given behaviour).

<table>
<thead>
<tr>
<th>Target</th>
<th>Given</th>
<th>Physician</th>
<th>Reassurance</th>
<th>Medical information</th>
<th>Psychosocial topics</th>
<th>Facilitating behaviour</th>
<th>Silence</th>
<th>Totals</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Concern</td>
<td>4 / 1.1</td>
<td>2 / 4.7</td>
<td>1 / 1.2</td>
<td>12 / 7.6</td>
<td>6 / 10.3</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Reassurance</td>
<td>2 / 0.7</td>
<td>0 / 3.0</td>
<td>1 / 0.7</td>
<td>8 / 4.9</td>
<td>5 / 6.6</td>
<td>16</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Psychosocial topics</td>
<td>0 / 2.9</td>
<td>2 / 11.9</td>
<td>(-1.79, p = .0736)</td>
<td>(4.17, p &lt; .0001)</td>
<td>(0.05, p = .9694)</td>
<td>111</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Facilitating behaviour</td>
<td>13 / 9.3</td>
<td>43 / 38.3</td>
<td>4 / 9.5</td>
<td>28 / 61.7</td>
<td>114 / 83.3</td>
<td>63</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Medical</td>
<td>0 / 5.1</td>
<td>5 / 21.1</td>
<td>4 / 5.2</td>
<td>68 / 33.9</td>
<td>34 / 45.7</td>
<td>202</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Information</td>
<td>(-2.43, p = .0153)</td>
<td>(-0.48, p = .0001)</td>
<td>(-0.56, p = .5734)</td>
<td>(-2.37, p &lt; .001)</td>
<td>(-2.38, p = .0175)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Silence</td>
<td>37 / 36.8</td>
<td>179 / 151.9</td>
<td>45 / 37.5</td>
<td>215 / 244.6</td>
<td>325 / 330.1</td>
<td>801</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.05, p = .9694)</td>
<td>(4.17, p &lt; .0001)</td>
<td>(2.15, p = .0317)</td>
<td>(-3.89, p &lt; .0001)</td>
<td>(-0.63, p = .5289)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>[Q = 0.01]</td>
<td>[Q = 0.34]</td>
<td>[Q = 0.34]</td>
<td>[Q = 0.24]</td>
<td>[Q = 0.04]</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Totals</td>
<td>56 231</td>
<td>57</td>
<td>372</td>
<td>502</td>
<td>1218</td>
<td></td>
</tr>
</tbody>
</table>

Notation in cells:
Observed lag frequencies / Expected frequency
(Adjusted residuals, p-value for adjusted residuals, two-tailed)
[Yules Q]

Table II. – Significantly associated communication behaviours before and after the patient’s conveyance of “concern” in consultations with female and male physicians.

<table>
<thead>
<tr>
<th>Female Physicians</th>
<th>Lag -4</th>
<th>Lag -3</th>
<th>Lag -2</th>
<th>Lag -1</th>
<th>Lag 1</th>
<th>Lag 2</th>
<th>Lag 3</th>
<th>Lag 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reassurance</td>
<td>4 / 1.5</td>
<td>No specific</td>
<td>4 / 1.1</td>
<td>Facilitation</td>
<td>No specific</td>
<td>7 / 1.8</td>
<td>7 / 1.1</td>
<td>7 / 1.1</td>
</tr>
<tr>
<td>[2.17]</td>
<td>[2.00]</td>
<td>[2.75]</td>
<td>[1.77]</td>
<td>[1.51]</td>
<td>[1.47]</td>
<td>[0.66]</td>
<td>[0.66]</td>
<td>[0.66]</td>
</tr>
<tr>
<td>Silience</td>
<td>17 / 6.8</td>
<td>Facilitation</td>
<td>17 / 6.8</td>
<td>1 / 1.2</td>
<td>Facilitation</td>
<td>17 / 6.8</td>
<td>1 / 1.2</td>
<td>1 / 1.2</td>
</tr>
<tr>
<td>[65]</td>
<td>[65]</td>
<td>[65]</td>
<td>[65]</td>
<td>[65]</td>
<td>[65]</td>
<td>[65]</td>
<td>[65]</td>
<td>[65]</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Male physicians</th>
<th>Lag -4</th>
<th>Lag -3</th>
<th>Lag -2</th>
<th>Lag -1</th>
<th>Lag 1</th>
<th>Lag 2</th>
<th>Lag 3</th>
<th>Lag 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reassurance</td>
<td>3 / 1.2</td>
<td>No specific</td>
<td>4 / 1.1</td>
<td>Facilitation</td>
<td>No specific</td>
<td>7 / 1.8</td>
<td>7 / 1.1</td>
<td>7 / 1.1</td>
</tr>
<tr>
<td>[2.71]</td>
<td>[2.71]</td>
<td>[2.71]</td>
<td>[2.71]</td>
<td>[2.71]</td>
<td>[2.71]</td>
<td>[2.71]</td>
<td>[2.71]</td>
<td>[2.71]</td>
</tr>
</tbody>
</table>

Notation in cells:
Observed lag frequencies / Expected frequency
(Adjusted residuals)
[Yules Q]
ve lags) at all four lags. Each of the cells in table 2 represents one of the 32 global associations tables (exemplified by table I), but we report data only from one given behaviour category, “concern” (one row in the global associations table), and present only those associations which are significant. We could have presented one table such as table II for all patient categories (six tables) and vice-versa with physician behaviours as given behaviours (five tables).

Significant associations were found at several lags preceding the utterance of concern and at two of four lags following concern differentially displayed for female and male physicians.

For both female and male physicians the significantly associated behaviours before the patient expression of concern were reassurance, facilitation behaviour (RIAS-categories) and silence, but the behaviours were displayed at different lags. After the utterance of concern reassurance and facilitating behaviour were applied, also here displayed at different lags for male and female physicians respectively.

**DISCUSSION**

In this paper we have, to our knowledge for the first time, applied sequence analysis with SDIS to data collected according to the RIAS method. We have shown how sequence analysis may be utilized to determine what physician behaviours are associated with patients’ expressions of concern. We have given an example of lag analysis of coded events in four negative (before the given behaviour) and positive (after the given behaviour) lags. A more detailed analysis could include time event analysis and chain analysis, briefly referred to in the Methods section.

This approach to sequence analysis is particularly useful in the analysis of relatively infrequently occurring behaviours. In our study there was an average of 4.8 expressions of concern per consultation. We have been able to show which physician behaviours occur before and after each concern. It is particularly interesting to observe the role of reassuring remarks from the physicians. Reassurances are sometimes described as blocking behaviour (Maguire & Faulkner 1988; Maguire et al. 1996), whereas our research group in an analysis of the same sample as in the present paper has found a positive association between reassurance and patient satisfaction, at least among male patients (Eide et al., submitted for publication a). May be that reassurances in the context of a routine follow-up visit in oncology may work well to elicit concerns, whereas such expressions in other context may serve to block patient emotions.

The differences between male and female physicians in the present study are contrary to expectations based on empirical research (Roter et al., 2002). It should, however, be taken into account that there were only two physicians of each gender in the sample. Moreover, we have not controlled for the fact that each physician performed several consultations each. Thus the observed differences may well be due to individual differences in communication style, not to gender as such. Our point in this paper was, however, not to give substantial evidence of gender differences, but to use the data set to illustrate the application of SDIS based sequence analysis. Sequence analysis appears to be a clinically meaningful and statistically sound method for analysing rare patient utterances and associated physician behaviour.

**REFERENCES**


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