The use of MDS and HCA enabled pharmacists to reveal their roles which reflect on country of practice and cultural differences when improving patients' adherence to asthma medication

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Abstract: Pharmacists are health care professionals who have a lot more to offer to the public rather than just selling pills. Pharmacists live a dichotomy role: health care consultants versus shop keepers. The aim of this research was to assess how pharmacists intervene improving patient adherence to asthma medication and to see how pharmacists perceived themselves. The research was conducted by means of a multiple choice questionnaire that was completed by 551 pharmacists. The replies were analysed using Ordinal Multidimensional Scaling and Cluster Analysis, with the routine PROXSCAL. Pharmacists revealed their roles in terms of four dimensions: a community health orientation, theoretical-applied drug orientation, the degree of involvement with the patient and the role of the pharmacist as a consultant. These dimensions have different salience in each one of the countries.
Keywords: pharmacy, country, asthma, adherence multidimensional scaling.

1 Introduction

In Europe, over 30 million people have asthma. The total annual cost of asthma was estimated in 2003 to be €17.7 billion (£15 billion) in Europe (Loddenkemper et al 2003)[1]. The pharmacist is usually the last health professional in contact with such patients giving advice, and will often be the first point of contact in the detection of adverse drug reactions (ADRs). One of the key tasks set for community pharmacists is to improve patients' knowledge of their disease, and to give advice on the use of medicines in order to increase the effectiveness of therapy. However, although there is a common role to all pharmacists, there appears not to be a cross-country study of cultural differences in pharmacy management. We report here on a study aimed at filling this void. The aim of the study was to investigate the activities of community pharmacist in relation to asthma medication. The research instrument was an on-line survey of community pharmacists in Italy, Switzerland, and the UK. In total, 551 pharmacists replied to the survey. Answers to survey questions were coded in the form of keywords, and analysed by means of multivariate statistical techniques, in particular Multidimensional Scaling (MDS), and Cluster Analysis. MDS was chosen because it allows the visualisation of the results, while keeping a solid mathematical basis. After this section we report on the way in which the questionnaire was designed. This is followed by a technical section in which, after giving summary statistics, we explain how the MDS model was implemented and interpreted. The paper ends with a discussion of the results.

2 Terminologies

There are two technical terms relating to pharmacy practice that need to be first defined: adherence and compliance. Adherence is the extent to which the patient's behaviour matches agreed recommendation from the prescriber. Compliance is the extent to which a patient's behaviour matches the prescriber's recommendations (NCCSDO, 2005)[2]. The difference between the two terms relies on the fact that compliance denotes a relationship where the doctor decide on the appropriate treatment (authoritarian role) and the patient follows the doctor's order (passive role), while adherence emphasizes the concept of an agreement between doctor and patient.

3 Aims

The aim of the research was to explore community pharmacist's role (activity) in relation to encouraging adherence to prescribed medication for patients with asthma, and how these roles are culture and country dependent.

4 The research instrument (questionnaire)

The questionnaire had 11 questions, the first asked about the country in which the practice was situated, as one of the aims of the research was to explore international differences in pharmacy practice. Question 2 was aimed at evaluating what pharmacists understood as adherence, and to exploring whether they understood the difference between compliance and adherence. Questions 5 and 9 tried to establish how pharmacists identified patients that were non-adherent with their asthma medications and the most common reasons why patients did not take their asthma medications properly. Question 4 was set to establish whether pharmacists gave advice on the correct inhaler technique only to new patients, only to established patients, both or neither. Question 6 was aimed at providing information on what tools pharmacists have at their disposal to improve and encourage patients' correct use of their asthma medication. Questions 7 and 10 explored pharmacists' perceived level of involvement in improving patients' use of medicines. Questions 3 and 8 looked at pharmacists' level of confidence in giving advice on inhaler techniques and at their perceptions on the result of such advice. The last question, Question 11, was aimed to understanding, which were for pharmacists, the three most positive outcomes of improving patient's adherence. The questionnaire was distributed in November 2009, and responses were collected until the end of March 2010. It was designed with three language options: English, French and Italian. It was sent through Qualtrics® system to UK Swiss and Italian pharmacists. The MUR (Medicine Use Review) database held by the Medway School of Pharmacy (UK) was used to distribute the questionnaire in the UK. In Italy and Switzerland the survey was e-mailed through the pharmaceutical associations of Pordenone (Friuli Venezia Giulia Region, Italy) and Canton Ticino in Switzerland. One reminder was sent to UK pharmacists but no reminders were sent to Swiss and Italian chemists. Of the 6611 emails that were sent to UK pharmacists, 370 replied giving a response rate of 5.6%. In Switzerland, 38 pharmacists answered the survey giving a response rate of 10% and in Italy 103 replied giving a response rate of 27%. Country of origin could not be established in 40 questionnaires.

5 Data analysis

Responses to questions were coded into the package SPSS version 19. Each respondent was treated as a case. A set of keywords was derived from the replies to the questions. All keywords were coded with the values zero or one; one, if the respondent had replied positively to the question, and zero otherwise. When a question had several possible answers, a keyword was allocated to each option. The data set was a matrix of 551 questionnaires by 58 keywords. All entries in this matrix were either zero or one. Missing country values were coded as zero.

5.1 Multidimensional scaling

The data set of pharmacies by keywords was analysed by means of Ordinal Multidimensional Scaling (MDS) with the routine PROXSCAL, although standard menus could not be used, and a routine was coded using the syntax facility. Our interest was not in comparing pharmacists, but in finding out if there were patterns in the way the questions were answered by pharmacists. We were particularly interested in finding out which questions were relevant to particular countries and not to others. MDS is a multivariate statistical technique that starts by calculating a measure of similarity between the entities of interest, the keywords. The measure of similarity used was proposed by Russell and Rao (Yin and Yasuda, 2005)[3]. The Russell and Rao measure assesses the "proximity" between two keywords by counting the number of times that respondents had replied "yes" to both keywords. This procedure is similar to Mar Molinero and Xie (2007)[4]. A table of similarities (proximities) between pairs of keywords was obtained in this way. The next step was to plot the keywords in the space in such a way that when the measure of similarity between two keywords is high, the keywords are located next to each other in the space. When the similarity between two keywords is low, they are located far apart in the space. The space in which the keywords are located may have more than two dimensions, and it is necessary to work with projections on sets of two dimensions. When working with more than two dimensions, it is necessary to complement MDS with other statistical techniques in order to interpret the results. The quality of the statistical representation varies with the number of dimensions of the space in which the keywords are located. The higher the number of dimensions the better the quality of fit. There are various ways of assessing goodness of fit. Stress1 was chosen as the measure of quality of fit. Stress1 is based on the proportion of unexplained variance. We used the ordinal approach to build the configuration, untying tied observations, (Coxon, 1982)[5]. The value of Stress1 was calculated for six dimensions: D6 (Stress 1= 0.109), D5 (Stress 1 = 0.124), D4 (Stress 1 = 0.139), D3 (Stress 1 = 0.173), D2 (Stress 1 = 0.224), and D1 (Stress 1= 0.331). As the number of dimensions increases, the value of Stress1 decreases. The values of Stress 1 in D5 and D6 did not improve massively and for this reason rather than estimate the model again in four dimensions, we used the first four dimensions of the six dimensional representations. The projection of

the six dimensional map in D1 and 2 can be seen in Figure 1, and the projection of the six dimensional map in D3 and 4 is reproduced in Figure 2.
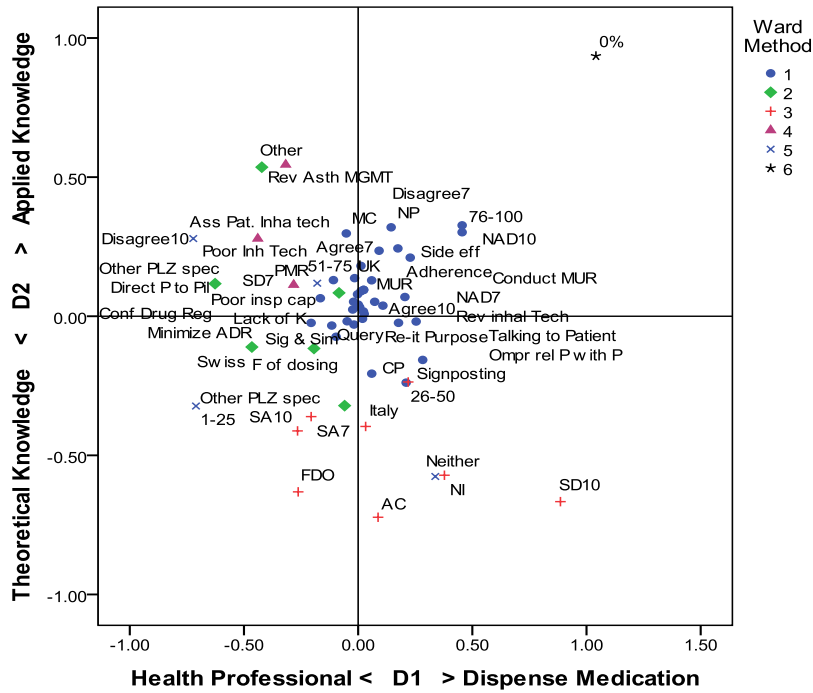
Figure 1. Representation in Dimensions 1 and 2 with Ward cluster membership
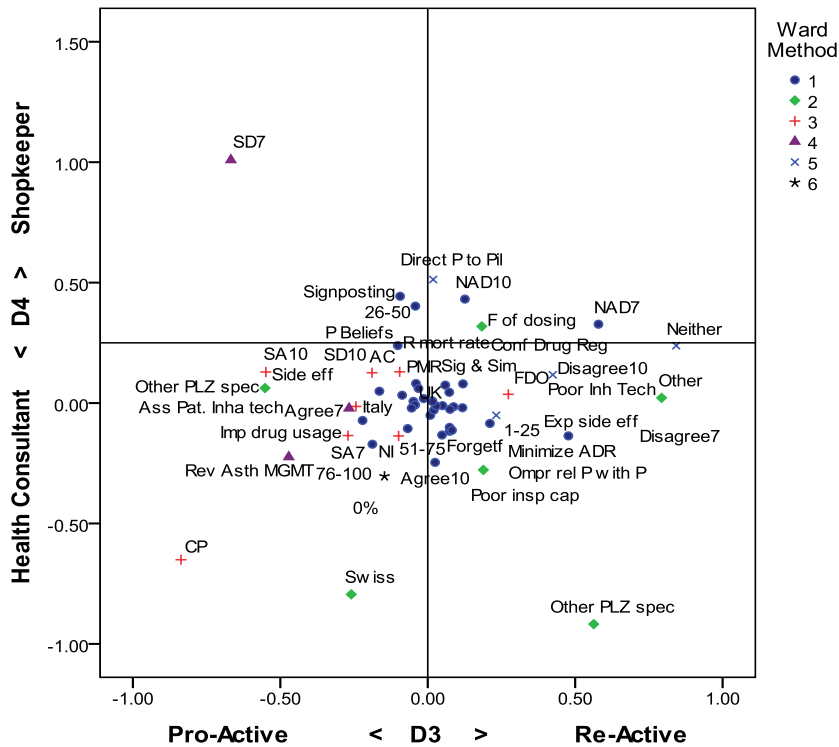

Figure 2. Representation in Dimensions 3 and 4 with Ward cluster membership

It is now possible to attach meaning to the dimensions in the plot. We will start with D1. On the far left hand side of Figure 1 we find that pharmacists find out if patients are not using the medicine properly reviewing asthma management plan, checking PMR (patient medication record), looking for "Sign and

Symptoms"; they intervene assessing patient inspiration capability and minimizing adverse drug reaction. From the centre to the left side of the D1 axis we found pharmacists that strongly agree and agree to the fact that is the responsibility of the pharmacist to ensure that the patient takes the medicine properly; and that the pharmacist thinks that a positive outcome of improving patient adherence is to "minimise adverse drug reaction" as well. At the right hand side of Figure 1 we find a disagreement with the view that the pharmacist has to consider patient's adherence more often; and, for example, that when the pharmacist discovers that the patient is not taking the medicine correctly, takes the action of "signposting to another health care professional"; that pharmacists neither agree nor disagree regarding to the fact that it is their "responsibility to ensure patients use their medication properly" and neither agree nor disagree that they "need to consider patient adherence more often". This dimension appears to be discriminating between pharmacists that see their role as community health professionals, and pharmacists that see themselves as just in charge of dispensing medicines as prescribed by the medical doctor. Using similar considerations we interpreted D2 as pharmacists mainly looking at drug from the theoretical point of view (bottom) which means a general knowledge of drug such as frequency of dosing, to a pharmacists looking at drug under the application point of view (patients' implication) identifying specific issues such as assessing patient inhalation technique, poor inspiration capability. D2 is associated with a higher drug orientation form theoretical knowledge (negative side of the axis) to applied knowledge (positive side of the axis) about drugs. It appears also very clear the link between MUR and UK pharmacists which reinforce the concept of the applied knowledge as well. The presence of the keyword "PMR" (patient medication history) is reinforcing the concept of the knowledge which is applied in a real situation. UK and Swiss pharmacists have PMR in place, but Italian pharmacists are not allowed to keep PMR due data protection regulation. Dimension 3 was found to be related to the degree of pharmacists' involvement in the management of the disease: on the negative side of this axis, the pharmacists are actively involved (Pro-Active), assessing and reviewing which means taking the initiative; on the right hand side, the pharmacists tend to state why poor adherence can occur (Re-Active). Dimension 4 appears to be related to the extent to the role of the pharmacist as a health consultant, the lower end of this dimension being associated with a higher involvement in health advice: health consultant. The opposite end is showing pharmacists who do not tend to get engaged with patients (shopkeeper behaviour). The MDS analysis has revealed that pharmacists see their role in four dimensions: as community health professionals – prescription dispenser; as people with theoretical-applied knowledge; in terms of their relationship with the patient; and as health consultants. We can see in Figures 1 and 3 that the keyword "Swiss" is located towards the left hand side of D1, and just below the middle of D2, towards the left of D3, and towards the negative side of D4. This would indicate that Swiss pharmacists can be described as community health oriented (D1), with a slightly heavier component of theoretical knowledge, with pro-active attitude involved in the management of the patient (D3), perceiving themselves health consultant. The keyword "UK" is in the middle of D1, towards the positive side of D2, it is also in the middle of D3 and just at the beginning of the negative value of Dimension. This could be explained by the fact that UK pharmacists perceived themselves across two systems: being involved in the management of the patient and dispensing prescriptions where the weight of the two components seems to be balanced. The presence of UK in the positive area o D2 underpins the focus of UK pharmacists on the applied knowledge. They still are in the negative part of D4, but they perceived themselves less health care consultant compared to their Swiss colleagues. With regards to the Italian pharmacists they appeared to be salient in D1 and very close to the middle of this dimension but slightly skewed to the right. The location of Italian pharmacists in D2 is clear: the theoretical knowledge is predominant versus the applied knowledge. D3 shows the same level of involvement in patient management such as the Swiss; D4 placed them slightly below the UK but far from the Swiss meaning that they did not perceive themselves having a consultant role such as their Swiss colleagues.

5.2 Cluster Analysis

Having attached meaning to the dimensions, and having used these meanings in order to explore the health management culture of pharmacists in the three countries from which information was obtained, it is also relevant to establish if there are questions, or groups of questions, that are answered in the same way by pharmacists. We are particularly interested in knowing which positive answers to questions serve to differentiate pharmacists in the three countries. To assess the proximity of the points in the space we used Cluster Analysis. Distances between keywords in the six dimensional spaces were calculated from the coordinates in the MDS configuration using the Euclidean metric. We used Hierarchical Cluster Analysis with the method suggested by Ward, since it maximises the homogeneity within clusters and the heterogeneity between clusters. The output of the analysis is a dendrogram and it is a matter of judgement to decide how many clusters are relevant. One is looking for "long branches" in the diagram,

since these reveal the heterogeneity of the clusters. As the branches become shorter the clusters increase in homogeneity, but also in number. In the end we settled for six clusters. Cluster 6 and Cluster 5 stand out as discordant from the rest. They both relate to single variables, and summarise responses from very few pharmacists. There will not be any further discussion on these two clusters. Cluster 1 group together very many answers to questions related to the pharmacist as a health care provider. The questions included are: "How do you find out if a patient is not using their asthma medication properly" which reflect the patient's attitude towards poor adherence. Very close to this are the answers to the question "How would you intervene when you know a patient is not using their medication properly" which represent the way in which the pharmacists is acting to improve patient adherence to medication. Conducting Medicine Use Review (MUR) appears in this cluster despite the fact that MUR was a formalised service only in UK at the time of this study. In this cluster there is a strong representation of another question: "What do you think are the reasons patient may not take their medication properly". This question is particularly relevant because it shows that pharmacists believe that non-intentional non adherence is very common among patients and it is represented by forgetfulness, misunderstanding, and lack of knowledge. The presence of the last question "What do you think are the 3 major positive outcomes of improving patient adherence" was answered positively by pharmacists who selected improving quality of life, reduce mortality rate, and minimize adverse drug reaction (ADR). Pharmacists located in the UK are represented in this cluster. Cluster 2 relates to the pharmacists' attitude with respect to the patients' problems. This cluster includes statement which shows what pharmacists think are the reasons patients may not take their medication properly, which are frequency of dosing and poor inspiration capability. In this cluster we find Swiss pharmacists. Cluster 3 group pharmacists who misunderstood the meaning of adherence and confused with compliance. They tend to give advice to continuing patient and they confirmed that they need to improve their confidence when giving advice about inhaler technique. Other variable found in this cluster where SA10 and SA7 which are indicating the level of agreement with the fact that pharmacists needs to get involved in medicine management. This confirms the positive pharmacists' attitude towards patient issues. Here we find Italian pharmacists. Finally, the questions that come together under Custer 4 are related to the way in which pharmacists assess if patients are not using their medication properly, and the way in which the pharmacists' act when they find out. Pharmacists who belong to this cluster tend to review asthma management plan and assess patient inspiration capability.

5.3 Classification of pharmacists

Figures 1 and 2 bring together the MDS representation of keywords and their classification using Cluster Analysis. It is to be noticed that there is little overlap between the clusters, something that facilitates interpretation. We can see in figure 1 that Cluster 1 is mainly located at the centre of the axis and UK pharmacists are represented in it. They seem to have good applied knowledge and rely in between the health professional and the pharmacists involved in the dispensing procedures as well. In figure 2 Cluster 1 is mainly concentrated in the lower part of D4 (health consultant) but it is also between the pro-active and re-active dimension. Probably UK pharmacists are acting according to patients' requirement. In figure 1, cluster 2 is located on the negative axis of D1 but it seems to be present in either part of D2. This revels that Swiss pharmacists see themselves as health professionals where the knowledge seems to be spread across theoretical and applied. Figure 3 does not revel very much about cluster although it is mainly present in the negative part of D4 (health consultant). Cluster 3 appears evident in figure 2 and represents the Italian pharmacists; the theoretical knowledge is the dominant element in this cluster and they perceive themselves between health professional and dispensing activity. The dispensing component seems slightly heavier compared to the UK ones. This cluster is also present in figure 3, it is well represented in the pro-active part of D3 (negative axis) and in the health consultant (negative axis) of D4.

6 Conclusions

The visual interpretation has been able to demonstrate the way in which pharmacists reveal themselves through the questionnaire, and the cultural differences that exist in these three countries. There is much debate on the role of pharmacists as a keystone in the provision of heath. The WHO (World Health Organization) together with FIP (International Pharmaceutical Federation) discussed the role that pharmacists should aim for, and observed that pharmacists have been always linked with manufacturing and supplying of medications, but due to the increasing demand for health services, they are facing new and challenging roles. Such future roles were discussed in a conference on the 23rd November 2006 in Geneva (Switzerland) where it was observed that the complexity of new medications coupled with poor adherence to prescribed medications is contributing to a shift of the pharmacy model from drug-based to

patient-based; Wiedenmayer et al, 2006. The above suggests that there are various ways in which pharmacy can be practiced. It is therefore appropriate to ask up to what point differences in the way in which the practice of pharmacy takes place can be discerned by looking at different cultural settings. This issue has been explored by means of a questionnaire completed by pharmacists in the UK, Italy, and Switzerland. The analysis of questionnaire answers revealed that there are four dimensions to pharmacy: a community health orientation (health professional-dispense medication); theoretical-applied knowledge; the degree of involvement with the patient (pro-active – re-active); and the role of the pharmacist as a consultant-shopkeeper. It was also identified the positive answers to questions that are relevant to each type of pharmacist. It was observed that Swiss pharmacists can be described as health professionals, community oriented, where the knowledge seems to be spread across theoretical (slightly heavier) and applied and they tend to act as consultant. UK pharmacists have shown good applied knowledge and were place between the health professional and pharmacists involved in the dispensing procedures. They did not show a clear shift towards pro-active or re-active role, but they perceive themselves as health consultant too. Italian pharmacists appear to be the more shifted towards the theoretical knowledge but also to dispensing. They perceive themselves involved in patient management and so pro-active acting as health consultant. The health consultant shift is really evident in the Swiss pharmacists and less evident in the Italian and UK pharmacists respectively. This study was limited to a (relatively) small sample of pharmacists in only three countries. Further research needs to be conducted involving a larger number of pharmacists from more countries in order to fully understand and share best practice in order to achieve a patient centred pharmacy model.

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