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# DOMICILIARY ASSISTANCE SATISFACTION AMONG AGED AND DISABLED BENEFICIARIES: A RASCH ANALYSIS

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***Abstract***: *In the European Union countries we assist to a gradual but stable increase of aged segment in the society composition. Accordingly, local governments have undertaken programs to improve the quality of life of elderly and disabled and policy makers are focusing more on quality of assistance for social services.*
*In this study we want to measure home assistance satisfaction among aged and disabled people by developing an appropriate questionnaire. We also aim at identifying aspects of the social service requiring immediate action as they might achieve a low quality score even if they are considered of primary importance. In this respect, a questionnaire is administrated to a sample of 117 elderly and disabled people with home assistance services, provided by social services of eight municipalities of Pescara (Italy) district. To comply with the aims of this study, the Rasch model is employed as a statistical, appropriate tool for calibrating the questionnaire itself. Finally, in order to obtain a "strengths and weakness" analysis, the Rasch item evaluation in each dimension is crossed with the importance level.*

***Keywords***: *Latent trait, perceived quality, domiciliary assistance satisfaction, Rasch model.*

## 1. Introduction

In the past decades, a structural and inevitable phenomenon of western societies, regards the ageing of population. One assists to a gradual shift from a society dominated by young individuals to a society in which the elderly becomes the majority [18]. Accordingly, central and

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local public administrations have to acquire knowledge about this trend and adapt social change through actions and research aimed at supporting families with non self-sufficient elders. Many elderly people express the desire to live independently and maintain control over their lives, preferably in their own home, avoiding, as long as possible, institutionalized assistance [24]. Then policies and services are focusing more and more on the need for the provision of home assistance. The demand for this kind of social service is exacerbated by the observed social exclusion, financial difficulties and health problems related to this particular age groups [26]. Along with health outcomes and costs, one important component of quality of assistance is satisfaction with services: in fact a regular feedback is essential to delivering a quality service, in order to better serves the needs for beneficiaries. Although patient satisfaction has been studied widely in hospital, clinics and other area of medical field, little is published regarding client satisfaction in home assistance setting. The satisfaction level of beneficiary receiving home care is an indicator that is rarely evaluated, partly because of the special characteristics of the services. Besides, it is objectively difficult to gather data concerning this issue and there are a countless number of variables that could influence an evaluation. Hence, very specific challenges arise in relation to the measurement of beneficiaries' satisfaction in home care. The aim of this study is to quantify the satisfaction level of the beneficiaries of domiciliary assistance provided by the social services of eight municipalities of the Pescara (Italy) district, developing a reliable and valid client satisfaction survey instrument. A questionnaire with 13 questions was used to explore the satisfaction with the organizational, relational and professional aspects of domiciliary assistance for aged and younger people with physical disabilities.

As known, satisfaction is an important component of quality of care. Satisfaction relates to how beneficiaries experience the care received compared to their standard or expectations [14]. The evaluation of individual satisfaction, as well as, the evaluation of attitudes, capabilities, is one of the most important problem of experimental sciences. Satisfaction is not directly observable and measurable but it is a latent variable. To perform the evaluation it is necessary to replace the qualitative modalities with some scores on a interval scale. A possible solution to obtain this kind of measure is represented by the Rasch models. They provide the theoretical framework to assess the consistency between the latent trait, i.e. the underlying construct, and the specific responses on a set of items. Through the Rasch analysis, we are able in this study, to evaluate the items unidimensionality for each dimension and the model fit, to estimate the items and subjects parameters as well as the threshold values. Moreover, in order to obtain a "strengths and weakness" analysis, the Rasch item evaluation in each dimension is crossed with the importance level. Although the process of Rasch analysis is described in detail elsewhere [9], in Section 2, we will present a brief review of the methodology with special emphasis on the main characteristics of the Rasch models. The sample and data collection are described in Section 3, along with some preliminary findings. The results of Rasch analysis are illustrated in Section 4. In Section 5, by the quadrant analysis, we aim at prioritising items where the most improvement is needed. Finally, conclusions are given in Section 6.

## 2. Methodology: the basic properties of Rasch models

In 1960 the Danish mathematician G.Rasch [20], suggested a model which has provided a theoretical background to assess the consistency between the latent trait, i.e. the underlying

construct, and the specific responses to a set of items. The Rasch Model (RM) is a family of measurements models that starting from raw scores, resulted from items, are able to construct continuous, linear measures of both items and subjects. Initially, the Rasch models have been broadly used in psychometrics mainly to measure the ability of subjects to respond correctly to appropriately chosen tests. Subsequently, because of their general applicability and their key characteristics, the Rasch models are increasingly being used in other areas including, health profession, market research, evaluation of a service [8]. When the Rasch models are applied to evaluate ability tests, the assessment depends on two factors: subject' s ability along a continuum of the unidimensional construct underlying the items and item's intrinsic difficulties. In this study, on the other hand, assessment is intended as an evaluation of the global quality of service, which has been segmented in single features (items). Accordingly, the two factors previously identified in psychometrics, now become: the subject's satisfaction and the perceived quality on the *j-th* component (item) of the service. One of the simplest and most popular version of these models is a logistic model for a binary response. Consider a set of N individuals having answered a questionnaire of J dichotomous items. Let $Y_{ij}$ be the answer of individual *i* to item *j* where $Y_{ij} = 1$ if the *i-th* individual has a positive response (correct, agree) for item *j* and $Y_{ij} = 0$ if the *i-th* individual has a negative response (false, disagree) otherwise. The probability that a subject *i* scores 1 on the item *j* ($Y_{ij}$) is obtained through the Rasch models for dichotomous data, formally defined as:

$$\Pr\left(Y_{ij} = 1 \middle| \beta_i, \delta_j\right) = \frac{\exp(\beta_i - \delta_j)}{1 + \exp(\beta_i - \delta_j)} \quad (1)$$

The right side of this formula is known as a logistic function. Hence, under the Rasch model, the probability of observing a given response for a subject is modelled as a function of difference between the satisfaction level ($\beta$) expressed by the *i-th* subject and the perceived quality ($\delta$) on the *j-th* component (item) of a service. The subject satisfaction and the item quality parameters are estimated jointly to produce estimates (reported in logit or log-odds) which are sample independent as well as instruments independents. Consequently, estimates of person satisfaction are not dependent on specific items used and the estimated perceived quality on the items are likewise independent of the specific groups of person to which items were administrated. This principle is better known as *invariant comparison*. Another important feature of Rasch models regards the *local independence*, that is the answers to an item are independent of answers to other items. It should be noted that the formal structure of Rasch model also permits algebraic separation of the person and item parameters, in the sense that the person parameter can be eliminated during the process of statistical estimation of item parameters. The consequence is that the raw score for an item or person is the sufficient statistic for the item or person parameter. This is the *sufficiency property* of the Rasch models. Finally, it worth be noting that successful applications of Rasch analysis require the respect of another fundamental criterion: the *unidimensionality*. The items should measure only one latent feature. Based on the aforementioned considerations, the Rasch technique allows the transformation of ordinal scale into interval scale, yielding linear values. Hereby the subject and item parameter can be expressed according to a common measurement unit on the same continuum (*parameter linearity*

*property*). Importantly the Rasch model is the closest to accomplishing the sort of objective fundamental measurement so long invoked in the physical sciences. In the traditional Rasch framework, it is well known that is not possible to evaluate extreme response patterns: that is both the position of subjects giving right o wrong answer to all items and the position of item receiving only right or wrong answers [27]. The dichotomous model represents the basis to build the models that have more than two categories. A generalisation of dichotomous model is constituted by the polytomous models which can be applied in context where successive integer scores represent categories of increasing level or magnitude of a latent trait. The literature offers a number of models to deal with polytomous item responses: three of these are the Rating Scale Model (RSM) [2], the Partial Credit Model (PCM) [28] and the Extended Logistic Model (ELM) [3]. They rely on the assumption that between each category and the next there is a threshold that quantifies the item's position. The threshold can be viewed as the cut-off point for the probabilities of choosing one of two adjacent response categories, that is the point over which a category of response becomes more probable than one preceding it. The Partial Credit Model as well as the Extended Logistic Model assume that respondents have a specific perception of K response categories for each item. In a word, these models do not impose threshold to be the same for all items (as required by the more restrictive Rating Scale Model) but they can vary from one item to the other. Therefore, when the items are polytomous with a different number of categories which have not the same distance and when there is the belief that the same response category can have different attractiveness for each item, the PCM and the ELM are the most appropriate. Based on Rasch's polytomous expression, [3] gives the following representation for the probability that subject *i* gives the response *x* to the item *j* having $\kappa_j$ categories:

$$\Pr\left(X = x_{ij} \middle| \beta_i, \delta_j, \kappa_{jx}\right) = \frac{\exp(\kappa_{jx} + x(\beta_i - \delta_j))}{\sum_{k=0}^{K} \exp(\kappa_{jk} + k(\beta_i - \delta_j))} \qquad (2)$$

for $x = 0,1,...(K-1)$. In equation (2) $\kappa_{jx}$ are the coefficients for each category *x* for each item *j*. They can be estimated imposing the following conditions:

$\kappa_{j0} = \kappa_{jK} \equiv 0$ i.e. the first and last parameter are equal to zero and $\kappa_{jx} = -\sum_{k=1}^{x} \tau_{jk}$, i.e. the category coefficients are defined in terms of thresholds. It is worth noting that $\tau_{jk}$ is the *k-th* ordered threshold for the item *j*. Whatever is the model that we use, we need for an estimation criterion to obtain parameter values. To date, estimation procedures include the following methods: Conditional Maximum Likelihood (CLM), Marginal Maximum Likelihood (MML), Joint Maximum Likelihood (JML) and Bayesian estimation method [28]; [9]; [5]. Several computer packages, implementing these methods, are available. Recently in R language are available different packages applying the Rasch Models: eRm Package [15], RaschSampler Package [25], ltm Package [22].

## 3. Data collection and preliminary results

Feedback in domiciliary assistance is important to measure and document as it can help administrators to evaluate the appropriateness of quality of the service by identifying beneficiaries' concerns.
In this study, we developed and tested a questionnaire for measuring home care satisfaction in 8 municipalities of Pescara (Italy) district. It is important to point out that there are not differences in the structures and mode of provision of home care service to elderly and disabled living in different residence areas.
In such a way we are able to produce equivalent data related to individuals' needs and expectations. The questionnaire was administrated to 117 enrolees of home care programs, who were elderly, in the age group of 65 to 94 years, and disabled. The sample was approached from April 15 to May 30 2010, with face-to face interviews by trained interviewers. Before survey, information was given about the aim of the study, research method, procedure, anonymity with regard to data analysis. The quality of care is defined as the degree to which perceived performances of social care services meets the needs of people with respect to some important features. The questionnaire is hypothesized to capture several distinct theoretical constructs, each measured by many individual items. Items were carefully selected after an extensive literature research (theoretical papers, questionnaire validations and qualitative analyses). It should be noted that there are differences in the number and content of scales in the home care satisfaction literature (see [13], [6]; [11]; [10], [12]). The difficulty lies in the multidimensional and subjective nature of this concept as well as in the cultural and social factors affecting the mode of provision of home care services among countries. Our study explores the domain of home care satisfaction as essentially assessed by the Client Satisfaction Survey developed by [21], later revisited and updated by [1].
Following also the research studies relating to social services for older people (see, among others, [19]), six themes were identified that appear to be central to the concept of home care satisfaction among aged and disabled beneficiaries. More specifically, the 32 items included in the questionnaire refer to six different dimensions of beneficiary's satisfaction, namely: "*caregivers*" which giving importance to the human factor of the assistance other than to technical abilities of caregivers; "*service planning", "house care", "personal care", "meals" and "support to beneficiary's autonomy"*. We measured satisfaction ratings of the 32 quality aspects by four point Likert-type items, usually considered in practice as an intuitive scale, although it is in principle ordinal. Scores are calculated for the categories 1= "*not satisfied*", 2= "*slight satisfied*", 3= "*fairly satisfied*", 4= "*very satisfied*". Positively and negatively worded items were interchanged to avoid bias. Therefore negative worded questions were subsequently re-coded so that higher values would indicated higher level of enrolee satisfaction and *vice versa.*
To investigate the association between the use and satisfaction of these social services and other determinants some demographic and socioeconomic variables were recorded, such as gender, age, geographical residence of elderly and disabled, family status, educational level, enrolment duration, knowledge of social service supply. For each dimension there is also a score giving a measure of its importance, ranging from 1 ("*not important*") to 4 ("*very important*"). The last part of the questionnaire concerns the overall satisfaction, evaluated through a score ranging from 1 ("*very low satisfaction*") to 4 ("*very high satisfaction*"). The majority of respondents was women and had a little or no education. Mean age of the response group was 72 years (SD 16.7),

with ages ranging from 11 to 94 years. With respect to their physical limitations, 56 respondents (47.9%) declared to be partially self-reliant. Most of beneficiaries have been receiving the service for more than five years. In general, social services beneficiaries were very satisfied with the service they receive. The responses that emerged from this sample of respondents concerning the satisfaction level were very positive. In particular, very high percentages of beneficiaries rated paid caregivers as well-trained, timely, conscientious and able to establish good interactions with them and with their families. Each aspect has a high satisfaction percentage that was always beyond 70% (level 3 plus 4). Relative few persons experience some of the negative aspects of assistance, mostly related to the "*Meals*" and "*Support to beneficiary's autonomy"* dimensions. The importance measure evaluation shows that dimension with the highest level of importance is "*Caregivers*", investigating the relational and professional aspects of paid caregivers. The importance recognized to that dimension is in agreement with the high opinion that respondents have on these segments of quality. The responses to the last question of questionnaire, reflecting the overall satisfaction with domiciliary assistance, is a further confirm of the very high level of satisfaction expressed by the respondents.

## 4. Rasch analysis results

To analyse polytomous response options and test the appropriateness of Rasch-based scoring for measuring home assistance satisfaction among aged and disabled people, we considered the Partial Credit Model, in the version known as Extended Logistic Model (ELM), proposed and developed by Andrich.
Information criteria (loglikelihood, Akaike Information Criterion and Bayesian Information Criterion), summarized in Table 1, were initially computed to motivate this choice. Table 1 shows that, according to AIC, the Extended Logistic Model, which accommodates items with different number of response categories, seems to be the most appropriate approach to analyse quality of home assistance aspects, for almost all the six dimensions designed to investigate this latent construct.

**Table 1. Information criteria: comparing Extended Logistic Model (ELM) vs Rating Scale Model (RSM).**

| Dimensions | Extended Logistic Model (ELM) | | | Rating Scale Model (RSM) | | |
|---|---|---|---|---|---|---|
| | LogLik | AIC | BIC | LogLik | AIC | BIC |
| Caregivers | -123.51 | 269.03 | 298.53 | -124.23 | 260.47 | 276.56 |
| Service planning | -231.52 | 497.05 | 541.33 | -242.49 | 498.99 | 517.23 |
| House care | -67.33 | 156.67 | 183.01 | -74.60 | 159.20 | 171.17 |
| Personal Care | -96.38 | 206.77 | 221.99 | -92.22 | 218.45 | 255.41 |
| Meals | -45.68 | 119.37 | 144.97 | -59.29 | 130.58 | 141.56 |
| Support to beneficiary's autonomy | -88.78 | 193.57 | 208.20 | -86.23 | 212.47 | 249.04 |

Maximum likelihood estimation of items and persons locations was performed using the standard software for Rasch analysis RUMM 2010 [23], which uses a conditional maximum likelihood procedure to estimate item calibrations and person measures. When applying the Rasch model, data must fit the model. In this section the task is to check if the observed pattern of responses to items, grouped in six different dimensions, conforms to the Rasch model expectations, as the

model defines how such responses should be if interval data is to be constructed. For each previously identified dimension of home assistance service's quality, we assess the unidimensionality assumption, identifying those items that do not satisfy such requirements as they may belong to another continuum or may gather related aspects of service's quality. Besides, the ability of range measurements provided by the Rasch model for each item to cover all possible satisfaction levels required by elderly and disabled is also explored. There are different tools to evaluate the goodness-of-fit of the model to observed data. To prove the coherence with unidimensionality hypothesis, we refer to the summary statistics, obtained through the software RUMM [4]. Table 2 displays the fit analysis results: the overall $\chi^2$ with relative p-value and the reliability index, expressed as person separation index, usually employed to check the reliability in Rasch model see [7]. It should be noted that the number of items in each dimension is not the same. Hence, being the degrees of freedom different, the absolute values of the overall $\chi^2$ of dimensions are not comparable.

**Table 2. Item trait interaction index and reliability index.**

| N. | Dimensions | Number of items in each dimension | Item-Trait Interaction | | Person Separation Index |
|---|---|---|---|---|---|
| | | | $\lambda^2$ | p-value | |
| 1 | Caregivers | 6 | 14.18 | 0.29 | 0.87 |
| 2 | Service planning | 6 | 48.36 | 0.00 | 0.82 |
| 3 | House care | 4 | 7.28 | 0.49 | 0.90 |
| 4 | Personal Care | 6 | 3.59 | 0.99 | 0.99 |
| 5 | Meals | 5 | 13.11 | 0.19 | 0.97 |
| 6 | Support to beneficiary's autonomy | 7 | 10.79 | 0.70 | 0.95 |

Looking at values in Table 2, the person separation reliability, which is equivalent to Cronbach's alpha, was found very good, suggesting that reliability is achieved in all dimensions. From this output we can observe that chi-squares tests are instead statistically significant (chi-square probabilities less than 0.05) for the dimension associated to the *Service planning*. For this dimension there are some item location parameters not able to fit correctly. That means that person location parameter and item location parameter do not follow the same order along the continuum of the latent trait. Accordingly, the important subsequent step will be to examine individually which items present a significant chi-square value.
Through values in Table 3 it is possible to check coherence for each item.

**Table 3. Service planning items: goodness-of-fit statistics.**

| Item description | $\lambda^2$ | df. | p-value |
|---|---|---|---|
| Waiting before service's start | 20.189 | 2 | 0 |
| Schedule of service | 0.712 | 2 | 0.693 |
| Respect of scheduled days of visits | 7.331 | 2 | 0 |
| Respect of timetable of visits | 5.431 | 2 | 0.041 |
| Caregivers' punctuality | 9.291 | 2 | 0 |
| Turnover of caregivers | 5.41 | 2 | 0.042 |

The severity of misfit in each item is revealed by the highest $\chi^2$ values and by the corresponding lower p-value. For this dimension at least three missfitting items can be identified. Theoretically, items exhibiting misfit statistic should be removed from the scale as they do not satisfy the assumption of unidimensionality. In a word, they do not measure the same construct as the other items in the questionnaire. As known, the possible reasons of inadequate coherence of item can be ascribed to an erroneous way to formulate the question or to the impossibility of related question to evaluate the quality of attribute (wrong specification of items' dimensionality). In this respect, it is recognised that, sometimes the use of chi-square statistics appears limited and the practical sense of researcher has to act in choosing the criterion for misfit analysis (Master, 1982).

In our context, further analysis reveals that although the item ("*Waiting before service's start"*) does not fit the model well its discrimination curve looks reasonable, so it could be retained. On the other hand, the omission of the items referring to the following aspects: "*Respect of scheduled days of visits*", "*Caregivers' punctuality"*, leads to a significant improvement in the items fit: the overall fit of items to the model improves markedly whereas the reliability has dropped slightly (from 0.82 to 0.78).

Rasch diagnostics also provide statistical guidance in evaluating how well the response categories function to create an interpretable measure. In particular threshold parameter can be used to ensure if the response categories are appropriate: threshold parameters have to be monotonically increasing and distance from adjacent categories have not to be very small. The inspection of the Category Probability Curves (CPC) should display an ordered, even succession of hills. Not disordered thresholds were observed in many items, providing support for the response format.

In what follows, we show the most challenging situations for items exhibiting disordered thresholds. The items mainly belong to the dimension "*caregivers*" associated to the relational and professional aspects of paid caregivers. The response categories for each item displayed in Figure 1 (a-d) are not functioning according to expectations, as the thresholds do not appear in their natural order.

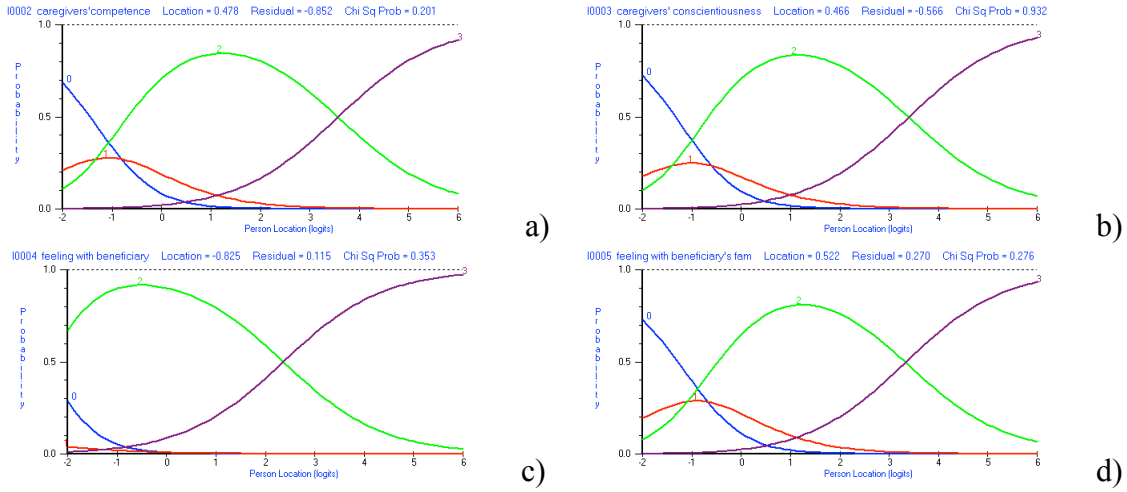



**Figure 1. Category Probability Curves for the following items: "caregivers' competence" (a), "caregivers' conscientiousness " (b), "feeling with beneficiary"(c), "feeling with beneficiary's family"(d).**

To improve the interpretation of the measure it could be appropriate to combine categories post-hoc and investigate the kinds of categorization that might work. Below (Figure 2), there are the curves of probability of categories for the same items when categories have been collapsed from four to two, by rescoring them as follows: items are rescored with 1/2/3=0 and 4=1 on the basis of category characteristic curves patterns. In terms of category descriptions, this means collapsing *"not satisfied"*, *"slight satisfied*", *"fairly satisfied"* and leaving *"very satisfied"* separated. On comparing Figure 1 and 2 it may seen that the way the categories work is much improved when there are two rather than four categories. Evaluating the effect on the overall fit of items to the model in the two cases of using four or two categories reveals that the overall fit of items to the model increases: the person separation index is equal to 0.871 in the case of four categories and is equal to 0.917 in the case of collapsed category data.
Based on this evidence, the number of categories for these items has been reduced from four to two and all subsequent analyses have been carried out using a smaller number of response categories.

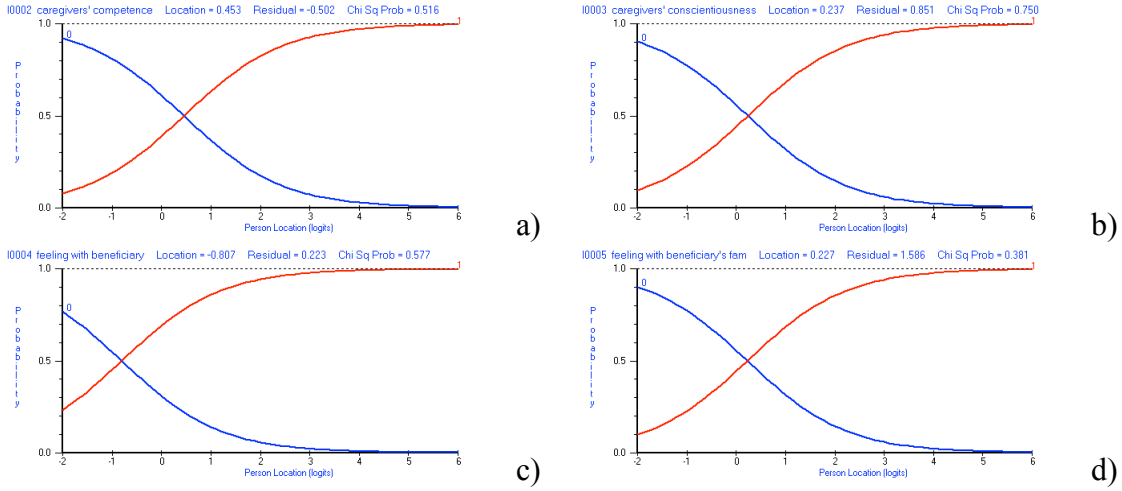



**Figure 2. Category Probability Curves with two categories for the following items: "*caregivers' competence*" (a), "*caregivers' conscientiousness "*(b), "*feeling with beneficiary"*(c), *"feeling with beneficiary's family"*(d)**

For that dimension, before pooling the response categories, we also plotted the person location parameter and the item measure along the same latent trait. In order to guarantee an equilibrium between person and item measures, the two scales should have a similar range. Figure 3 exemplifies the person-item threshold distribution of dimension *"Caregivers",* with the distribution of persons shown in the top half and the item thresholds in the bottom half. This representation allows the identifications of areas of latent construct that are poorly assessed by the items. The results for person measure demonstrated that for relational and professional aspects of paid caregivers on the satisfaction level ranged from -0.21 to 8.50 logits. Instead, item location measure revealed that items covered a range between "-6 and 4" logits. Accordingly the range of person measures extends beyond the upper limit of item location with a large percentage of person measures falling outside the range of item locations. The overall person logit is 3.77 which show that respondents had level of satisfaction higher than the target for the scale, which would be indicated by a mean of zero.

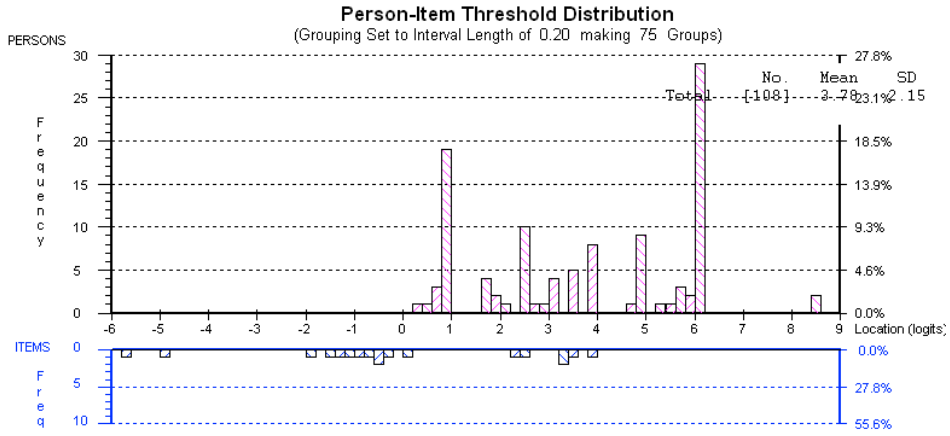



**Figure 3. Comparison of parameters' distribution for the dimension "Caregivers".**

The range of satisfaction and quality parameters for all dimensions, along with other descriptive statistics, are reported in Table 4.

**Table 4. Satisfaction ( $\beta_i$ ) and quality ( $\delta_i$ ) parameters statistics.**

| N. | Dimensions | Satisfaction Parameters | | | | Quality Parameters | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Min | Max | Mean | SD | Min | Max | Mean | SD |
| 1 | Caregivers | -2.99 | 2.96 | 0.47 | 2.28 | -0.80 | 0.69 | 0.00 | 0.64 |
| 2 | Service planning | -0.91 | 5.44 | 2.43 | 1.71 | -0.85 | 1.45 | 0.00 | 0.97 |
| 3 | House care | -6.79 | 6.54 | 2.83 | 2.60 | -1.29 | 1.57 | 0.00 | 1.50 |
| 4 | Personal Care | -3.85 | 4.36 | 1.63 | 2.28 | -1.14 | 1.37 | 0.00 | 0.89 |
| 5 | Meals | -8.93 | 4.66 | 0.13 | 4.62 | -1.85 | 0.95 | 0.00 | 1.10 |
| 6 | Support to beneficiary's autonomy | -3.65 | 4.84 | 0.49 | 2.59 | -1.15 | 1.05 | 0.00 | 0.90 |

Finally, the examination of the order and the item location parameters, i.e. the perceived quality of the service feature posed on the continuum, can provide additional evidence of the validity of the scale.

It is important to recall that negative values of these estimates describe features of the service with a satisfactory quality level, whereas positive values of the estimates show features with an unsatisfactory quality level. Item location parameters in each dimension demonstrate that items covered a quite narrow range (approximately up to extent of -1.5 and +1.5 logits).

Inspection of location order for *"Caregivers"* dimension indicates that the item "*Caregivers' courtesy and willingness*" is the "easiest" item for respondents to agree to, that is, many beneficiaries of home care service were rated high on it.

For the "*Service planning*" dimension we observe that the item with the best quality rating is "*Caregivers' punctuality*" and the item with the lowest quality rating is "*Waiting before service's start*". In the "*House care*" dimension the aspect of service marked by the highest level of quality is "*Housekeeping*"; with regard to the "*Personal care*" dimension the highest quality is represented by the feature related to "*Assistance with personal care*". The item location parameters found for the "*Meals*" dimension shows that the highest perceived quality is on the

following component of the service: "*Cleaning dinner service*". The item estimates for the last dimension (*"Support to beneficiary's autonomy"*) indicate that the feature of service with a satisfactory quality level regards the statement "*improvement in social functioning via companionship"*.

## 5. Strengths and weakness analysis: the quadrant map

In this section we aim at identifying strengths and weakness in the domiciliary assistance service relative to beneficiaries' perceptions and actual experiences. By considering importance scores we will be aware of aspects of the social service requiring immediate action as they might achieve a low quality scores even if they are considered of primary importance. As previously pointed out, for each dimension, the questionnaire includes a score giving a measure of its importance while it does not entail an individual importance level of the items, in order to avoid to enlarge the questionnaire's length. For this reason we rely on "derived" measures of importance, which are based on some measures of statistical association between the series of attributes being measured and a summary measure, such as overall satisfaction with the service. In this respect, we calculated Kendall's Tau b correlation between the ordinal scores exhibited by the single item, reflecting item's ability to produce satisfaction, and the overall satisfaction. Kendall's Tau b correlation index is a distribution-free measure, suitable for ordinal data since it is based on ranks of data and assumes values in the range [-1,1]. The correlation of an item with the overall satisfaction can be interpreted as a proxy for the importance level of every item. Hereby, the higher is the absolute Kendall's Tau b correlation value, the greater is the importance of that item in determining the overall satisfaction. In other terms, items with high correlation are supposed to have more impact on satisfaction than items with low correlation. In particular, positive values of Kendall's Tau b indicate that items' satisfaction ratings are concordant with the observed global satisfaction measure expressed by the respondents. On the other hand, negative values of that correlation measure suggest that the scores of service's characteristics are discordant with those of the overall satisfaction. Satisfaction and importance when analysed jointly allow to create a four-quadrant map that serves as a guide to resources allocation. To obtain a strengths and weakness analysis for each dimension of questionnaire, we look at the quadrant analysis chart (see Figure 4) which combines the "derived" importance of attributes (horizontal scale) and the quality level (vertical scale).

By plotting the correlation scores and quality scores in two dimensional space, it becomes apparent which items need immediate attention. That visualisation allows the identification of 4 areas, detailed as follows. The quadrant A (top-right side of Figure 4) contains features of service displaying relative high level of importance whereas their quality score is unsatisfactory. These items belong to a priority area and deserve immediate action. In the quadrant B (top-left side of the chart) we find items characterised by a relative low level of importance and by a poor quality scores.

For these attributes is desirable to focus on improvement measures. The quadrant C (bottom left side of Figure 4) shows items describing service features with a satisfactory quality level but their attributed importance level is below the related average value. In that case the local public administrator should undertake actions to better emphasize them.

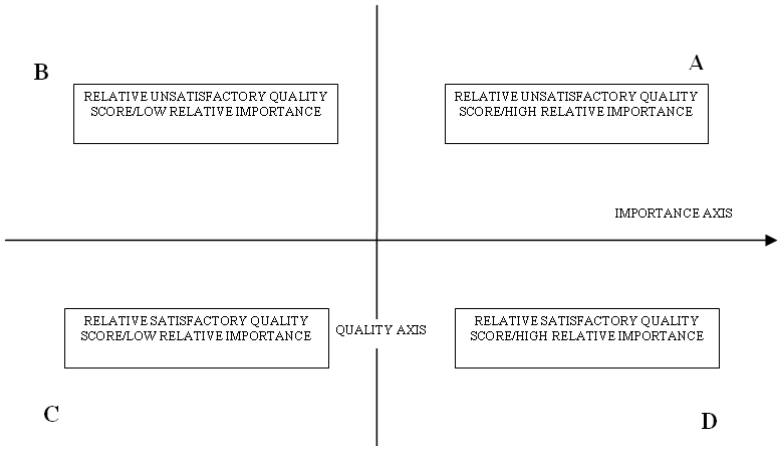
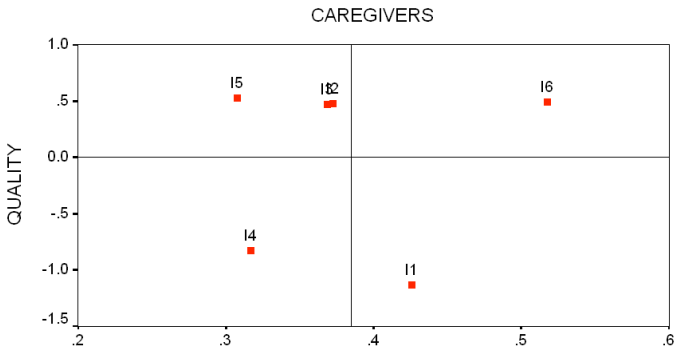
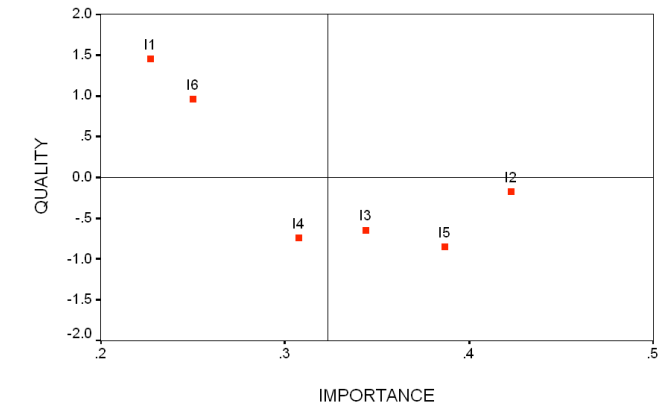



**Figure 4. Quadrant analysis identifying priorities for action.**

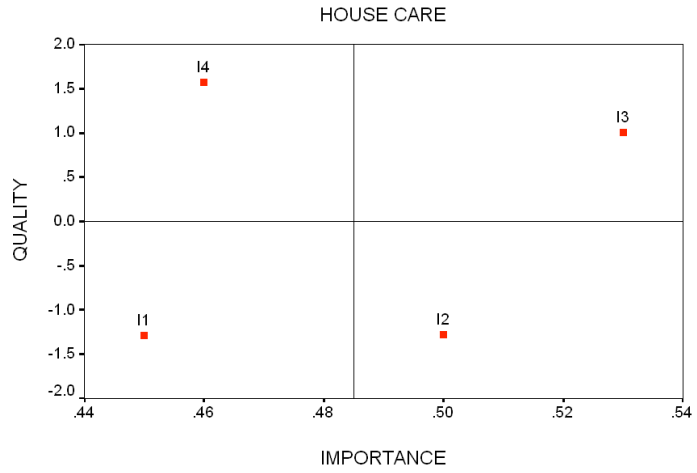
Finally, in the last quadrant D (bottom-right side of Figure 4) are positioned items achieving a relative high quality scores as well as high correlation values. These features are deemed "fields of excellence" and actions to preserve their standards need to be performed. Quadrant analysis results for each dimension are displayed in Figure 5.



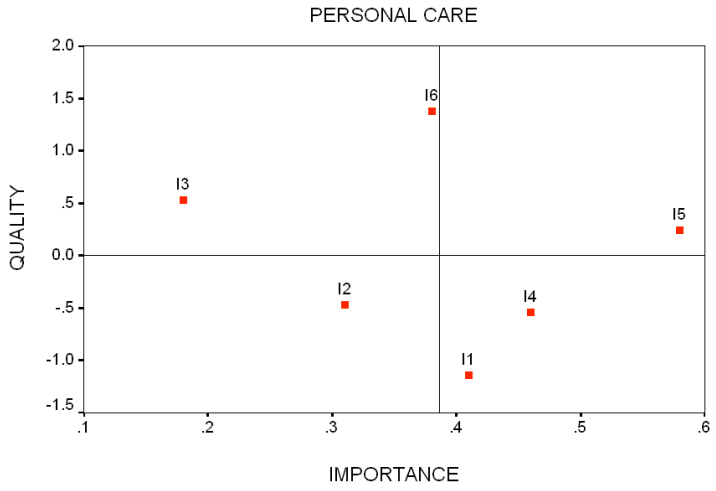

Items:
I1= "*Courtesy and willingness*";
I2= "*Competence"*;
I3= "*Conscientiousness*"
I4=*"Feeling with beneficiary"*
I5= *"Feeling with beneficiary's family"*;
I6= "*Speed of action in case of need"*



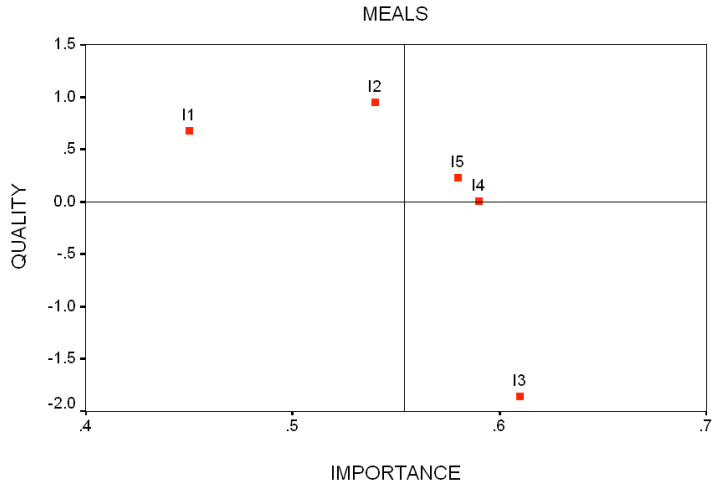

Items:
I1= "*Waiting before service's start* "
I2= *"Schedule of service"*
I3= "*Respect of scheduled days of visits"*
I4= *"Respect of timetable of visits"*
I5= *"Caregivers' punctuality"*
I6= "*Turnover of caregivers"*



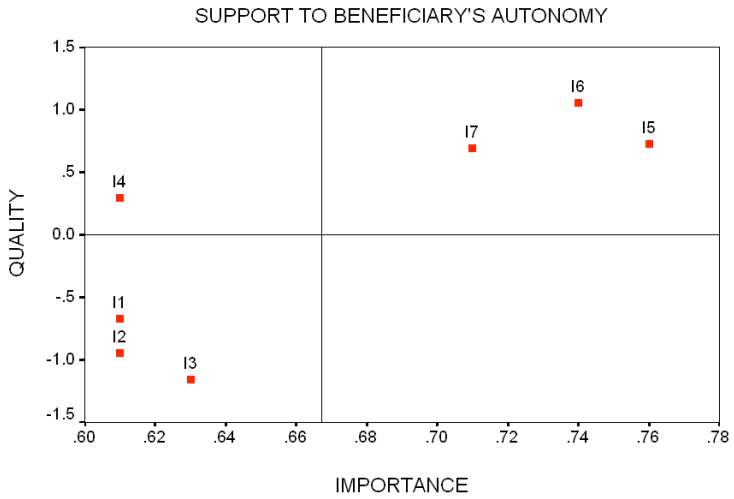

Items:
I1= *"Housekeeping"*
I2= *"Everyday grooming"*
I3= *"Special cleaning"*
I4= *"Assistance with laundry"*




Items:
I1=*"Assistance with personal care"*
I2= "*Assistance with bathing"*
I3= "*Assistance with dressing*"
I4= "*Assistance with hygiene*"
I5= "*Assistance with health care"*
I6= "*Medicine supervision"*




*Items:*
*I1= "Meals preparation"*
*I2= "Serving meals"*
*I3= "Cleaning dinner service"*
*I4= "Assistance in choosing food"*
*I5= "Assistance in food conservation"*




*Items:*
*I1= "Assistance with medical appointment"*
*I2= "Psychological assistance"*
*I3= "Companionship"*
*I4= "Assistance with shopping "*
*I5= "Personal errands"*
*I6= "Support in activity of daily living"*
*I7= "Support in outdoor activities"*

**Figure 5. Quadrant analysis results for each dimension.**

Looking at the mean scores for quality and importance within each dimension of domiciliary assistance service, we are able to summarise the following results. As for "*Caregivers*" dimension, the quadrant analysis reveals that in the priority area, consisting of the attributes that beneficiaries of service judge very important but are rated low on quality level, there is the aspect related to "*the speed of action of caregivers in case of need*". In the high importance and high quality area (quadrant D) is positioned the item concerning "*caregivers courtesy and willingness*". Subsequently, we also plotted the correlation and the quality scores for the "*Service planning*" dimension. Three items of this dimension are located in the "high importance and high quality" area (quadrant D) and they are related to the following aspects of the service: "*Schedule of visits*", "*Caregivers' punctuality*" and "*Respect of scheduled days of visit*". It should be noted that no items are located in the priority area of the map. Looking at the "*House care"* and "*Personal care*" maps, we find that features requiring immediate action, as they fell into the priority area, are : "*special cleaning*" and "*health care*", respectively. We explore further the results for the last two dimensions: "*Meals*" and "*Support to beneficiary's autonomy*". Items showing relative unsatisfactory quality and high relative importance refer to the following aspects of service: *"Assistance in choosing food"* and *"Assistance in food conservation"* for the "*Meals*" dimension and *"Personal errands", "Support in activity of daily living" and "Support in outdoor activities"* for the features grouped into the "*Support to beneficiary's autonomy*" dimension.

## 6. Concluding remarks

The aim of this study was to quantify the home assistance satisfaction among aged and disabled people, developing a reliable and valid questionnaire. This quantification is a challenging task because it implies the translation of subjective perceptions into a single objective measure. To comply with the purpose of the study, we employed the Rasch model. As known, the Rasch model possesses important properties and has, at least, two notable advantages over the

traditional methods: the resulting measure is on interval scale and the extent to which data fit the model is assessed. Hence, the Rasch model allowed us to calibrate the questionnaire and obtain a measure of satisfaction, on a proper and meaningful metric, for every respondent. The trait of interest in this study was the service quality, which is considered a latent variable, derived from the combination of some other independent latent variables (dimensions). The Rasch analysis results provide general support for the measurement properties and internal consistency reliability for most of the six dimensions in which items have been grouped. The property of unidimensionality does not hold for the *"Service planning"* dimension. Our analysis suggest to remove some of items of this dimension to achieve fit to Rasch model. Generally, the four categories of choice, included in the questionnaire, are valid in this instrument, as indicated by well defined steps in the scale. However, in some cases the hypothesis of equal distance between categories cannot be preserved and reversed threshold are also observed. For these items it has been appropriate a merging of the response categories. The item parameters, measuring quality associated to each item, displayed a quite narrow range. We have no explanation for this trend; it is probably a function of the particular sample. Additionally, in order to achieve a comprehensive satisfaction survey analysis, we also performed the quadrant analysis, as a common method for helping stakeholders to establish priorities. Exploiting the Rasch analysis results this graphic technique permitted us to identify strengths and weakness in the social service analysed, relative to beneficiaries' perception and actual experiences. Using the quadrant analysis, a prioritised list of items for improvement has been gathered relatively easily. The main limitation of the present study is related to the relatively small sample size. We know that in order to be effective the Rasch model requires a very large dataset at the outset, to guarantee a sufficient number of records to remain after the data cleansing process. Therefore we recommend to confirm the findings of the current study in larger and appropriately target sample from other home assistance programs. Future research should also validate the questionnaire with the use of factor analysis.

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