Adaptation, validation and application of the Healthcare Empowerment Questionnaire (HCEQ) in an Egyptian inpatient setting

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ABSTRACT

Individual patient empowerment (IPE) is becoming a prominent priority for healthcare policy makers allover the globe. Ten-item Health Care Empowerment Questionnaire (HCEQ) was formally translated from English to Arabic and was used to measure IPE among inpatients in surgical and medical departments in an Egyptian university hospital. Factorial validity of the standard tridimensional HCEQ structure was established through global and local fit diagnostics. The unidimensional structure proved to be a non-viable option. A competing more parsimonious two-factor structure proved to be a viable but less well-fitting than the standard tridimensional model. Convergent validity was demonstrated via adequate subscales alpha coefficients, composite reliabilities, variances extracted, and weight and significance of item loadings. Discriminant validity was verified by moderate interfactor correlations and subscales composite reliabilities were greater than average variance extracted. Multiple group confirmatory analysis authenticated model's invariance across two randomly split subsamples, departments and genders. IPE was calibrated at items, subscales and overall scale levels and it was realized that IPE belonged to “Non-empowered” category at all levels of analysis. Significant - albeit weak- negative and positive relationships were respectively discerned between overall HCEQ score and age; and literacy. No significant associations were detected between overall HCRQ score and gender, marital state, department, employment status, rural/urban residence, and dwelling

outside/inside Alexandria. Findings of the present study uncovered the worth of educating patients and training physicians about the import of IPE.

Keywords: Cross-cultural adaptation, Validation, Factor Analysis, Structural Equation Modeling, Multigroup Confirmatory Factor Analysis, Measurement invariance, Individual Patient Empowerment, inpatient setting

INTRODUCTION

Empowerment (EMP) is a positive democratic social value (Lo Biondo & Rodriguez, 2012); entailing individuals' participation, involvement and fortitude over various aspects of their lives (Perkins & Zimmerman, 1995). EMP is a multilevel concept ubiquitous to today's globalized culture and applicable to individuals, organizations and communities in contexts such as healthcare organizations (HCOs),schools, neighborhoods, and voluntary bodies (Kloos et al., 2011; Rappaport, 1987).EMP oriented social programming practices have found their way in health promotion policies in sundry countries, including developing ones (Vanderplaat, 1995).

In a health service delivery context individual patient empowerment (IPE) can be conceptualized as a community and personal process steering consumers of healthcare to augment their participation, involvement, advocacy, influence and control apropos therapeutic situations, problems, decisions, actions and , interactions affecting their health (WHO, 1998). In both developed and developing countries, IPE is becoming a prominent priority for healthcare policy makers, thence is insistently infused into the fabric of many HCOs(Barr, et al., 2015; Wallerstein, 2006; Wensing, 2000).IPE-oriented policies enunciate the notion of developing actions and practices aiming to enhance patients and families control and involvement in interactions and decisions pertaining to their healthcare delivery process (Anderson, & Funnell, 2005; Coulter, Entwistle, & Gilbert, 1999; Opie, 1998).An empowerment-oriented model of healthcare delivery presents an enlightened

alternative to the process of care delivery that warrants patients' self-determination, independence, autonomy, enablement, and involvement in the course of acting and interacting with the healthcare system (Myers, 1995).Augmentation of IPE is conducive to enhancing quality of care thru increased responsiveness to patients' needs, requirements, enteritis and preferences (Eisenthal & Lazare, 1979).Present-day evidence maintains that optimizing therapeutic interventions is based not only on appropriate diagnoses and medicinal procedures, but also on scrutinizing IPE in relation to personal healthcare services (Orth, Stiles & Scherwitz, 1987).Evidence-based IPE cherishes a customer-oriented approach that endeavors to realign traditional power relations within the healthcare delivery system (Opie, 1998; Wensing, 2000).

Over the past two decades, EMP evaluation has demonstrated its worth as a practical and valuable counterpart of conventional evaluation approaches (Miller & Lennie, 2005). IPE is a multidimensional construct (Cavalieri & Almeida, 2018; Menon, 1999; Page & Czuba, 1999; Rappaport, 1987).Tens of psychometrically adequate questionnaires purported to assess IPE have been presented in the literature. A systematic review conducted by Herbert, Gagnon, Rennick, & O'Loughlin (2009) spotted fifty such questionnaires; another study identified thirty such tools (Barr et al., 2015).These tools can be classified into two broad categories; condition/specialty specific and generic.

Specific IPE measuring tools include:- Empowerment Scale for Mental Health Patients(Wowra & McCarter, 1999);Empowerment Scale—Version 2 for Mental Health Patients(Corrigan, Faber, Rashid, & Leary, 1999);Health Promotion Intervention Questionnaire for Mental Health Patients (Svedberg, Svensson, Arvidsson, & Hansson, 2007); Empowerment Questionnaire for Inpatients(Lopez, Orrell , Morgan, & Warner, 2010);Psoriasis Empowerment Enquiry in the Routine Practice Questionnaire(Pagliarello, Di Pietro, Paradisi, Abeni, &Tabolli, 2010),The Swedish Rheumatic Disease Empowerment Scale (Arvidsson, Bergman, Arvidsson,

Fridlund, &Tingstrom, 2012).Generic IPE measures include:- The Health Care Empowerment Questionnaire [HCEQ] (Gagnon, Hébert, Dubé, & Dubois, 2006); Perceived Involvement in Care Scale (Lerman et al., 1990); Patient Empowerment Scale (Faulkner, 2001); Kim Alliance Scale (Kim, Boren, &Solem, 2001); Treatment Related Empowerment Scale (Webb, Horne, & Pinching, 2001); Health Care Empowerment Inventory (Johnson, Rose, Dilworth, & Neilands, 2012) Health Education Impact Questionnaire (Osborne , Elsworth, & Whitfield, 2007); and a scale developed by Bann, Sirois, & walsh, 2010).

Psychometric assessments have shown that the HCEQ is useful in advancing knowledge about individual empowerment in relation to personal healthcare and services (Gagnon et al., 2006). Application of HCEQ to measure IPE yields three related dimensions/latent variables, namely; (i) Involvement in Decisions, (ii) Involvement in Interactions with healthcare providers and (iii) Degree of Control (Gagnon et al., 2006).“Involvement in Decisions” subscale focuses on patient's propensity to take an active role in making informed healthcare choices (Menon, 1999). “Involvement in Interactions” factor is linked to enabling the expression of patients’ needs, requests and pleas related to one’s healthcare situation; and obtaining information concerning the care process (Barr & Cochran, 1992).“Degree of Control” dimension pertains to actual contribution to the healthcare decision process as well as to the availability of resources, in other words, it stand for patient’s feeling that one is acting hand in hand with the healthcare professional and is being implicated in the process that determines the resources required to meet one’s health needs(Opie, 1998). In the context of the present study, “being in control” points to patient’s perceptions regarding his/her taking an active role in information exchange and choices pertaining to one's healthcare concerns (Barr & Cochran, 1992; Parsons, Jorgenses, & Hernandez, 1994). However, most studies of IPE were performed in Western countries and some in Asia; and - despite mounting policy interest - there is limited evidence to support the existence

of psychometrically adequate measures in developing countries (Barr, et al., 2015; Herbert, et al., 2009).

To the extent of the researcher's knowledge, there is no formal Arabic translation of an IPE questionnaire. In the current study, HCEQ was chosen for purposes translation, validation and application due to its conceptual clarity, global generic all-patients nature, personal healthcare services focus, reliability, including internal consistency and test-retest types, and validity (including content, construct, convergent and discriminant varieties (Gagnon et al., 2006; Mohebbi et al., 2017).

The objectives of the present study are to:-(i) formally translate the HCEQ from English to Arabic; (ii) assess the construct validity of the translated HCEQ; (ii) apply the translated tool to calibrate the gradient of IPE on the overall scale and subscale levels; (iv) and investigate possible relations between IPE and some personal patient characteristics.

METHODS

An observational analytical cross-sectional study was conducted at surgical and medical departments in Alexandria Main University Hospital (AMUH), Egypt, in the period from 1/6/2018 till 31/7/2018, after obtaining permission from hospital authorities and formal approval of Ethics Committee of Faculty of Medicine/Alexandria University on May 16th 2018. The study population consisted of inpatients who attended the aforesaid two departments in the indicated study period. Patients eligible for the study were ≥ 16 years of age, whose length of stay was ≥ 48 hours and who were able and willing to participate in the study. Intensive care and critical condition patients were excluded from the study for difficulty of collecting accurate data. Participation was voluntary and verbal informed consent was obtained from patients approached to take part in the study. The purpose of the study was explained and participants were assured about the confidentiality and anonymity of the collected data. The researcher complied with International Guidelines for Research Ethics and Academy of Management Code of Ethics.

Sample size was calculated using the following formula (Daniel, 1999; Naing, Winn, & Rusli, 2006).

n = [P (1-P) Z^2/ d^2] where:-

n = sample size collected using a simple random sampling technique,

P = expected prevalence or proportion of patient empowerment in the study population,

d = degree of precision 5 %,

Z = 1.96 (Z statistic for a 95% level of confidence), alpha = 0.05.

Since it was unworkable to come up with a good estimate for $P$from literature or practical experience, the researcher set P equal to 0.5 to yield the maximum sample size as suggested by a number of authors (e.g., Daniel, 1999; Lwanga & Lemeshow, 1991).Research experience shows that it is appropriate to have a precision (d) of 5%, if the prevalence of the investigated phenomenon is conjectured to be between 10% and 90% as this precision would give the width of 95% CI as 10% (Naing, et al., 2006). Given the above mentioned formula and assuming (P) = .5, (d) = 5%, then required (n) = 384 patients. Sample size calculation formula does not need a finite population correction factor as the study population is infinite i.e. n/N < 0.05, where N is the population size (Daniel, 1999; Naing et al., 2006).In order to assure the desired precision and anticipating non-response or missing data, the researcher oversampled by about 10% of the computed number (Naing et al., 2006). Thus it was decided to obtain a random sample of (384 * 1.1= 422. 4 ≈ 420).Using an equally stratified random sampling procedure, the sample was equally allocated between the two departments and between male and female patients, expressly, 105 male and 105 females from each department.

The ten items of the HCEQ were translated from English to Arabic conferring to the translation guidelines recommended by WHO (World Health Organization, 2019). The translation procedure included an interactive process of forward and backward translation,

complemented by a review process whereby bilingual translators ensured conceptual, semantic, and technical equivalence of the translated version (Hilton & Skrutkowski, 2002).Dependability of the translation method is part of the internal validity of a questionnaire (Kalfoss, Isaksen, Thuen, & Alve, 2008), and the ensuing six steps were performed. First, the ten questionnaire items were forwardly translated from English to Arabic by three independent bilingual native Arabic speaker expert consultants who work as physicians and public health professors at the High Institute of Public Health (HIPH)/ Alexandria University (step I). Three versions were then compared and were conciliated and incorporated into an Arabic version by an expert panel working collaboratively and using nominal group technique as a consensus technique to effect requisite linguistic revisions. This expert panel consisted of three professors of public health who are bilingual native Arabic speaking consultant physicians working in HIPH. The expert panel reviewed the three forwardly translated documents, checked all items and included their recommendations into the questionnaire and due adjustments were effected to any awkwardly translated item so as to produce an apposite translated version (step II).

Back translation into English was carried out by two independent bilingual native English speakers working as professional teachers and translators, who had no knowledge or access of the HCEQ (step III). Lastly the forward translating committee compared the two backward translations with the original English text. There was no critical difference between the original and the backtranslated versions and the backward translated versions were pondered to be in agreement with the English initial version (step IV). Afterwards the translated version was pretested through a pilot study carried out on 25 inpatients of the study population. The pilot survey resulted in modification of the verbalization of only one word in item number two (step V). No difficulties were met with the questionnaire and eventually, the adjusted document was formatted and finalized for use in the present study (step VI).

A specifically designed structured interview schedule (interviewer-administered questionnaire) was presented in Arabic to all participants. The interview schedule enclosed three sections. The first section introduced the researcher to the participants and informed them that the leading purpose of the questionnaire was to elicit their responses about their participation and involvement in decisionmaking and interactions with their healthcare providers regarding their current inpatient admission. The second section included items of personal data pertaining to participants' age, therapeutic department, gender, marital status, and education.

The third section contained questions designed to collect data about IPE through the Arabic translated ten items comprising HCEQ originally developed by Gagnon et al., 2006. Ten items are “That you ask for explanations”, “That you ask questions”, “That you ask for advice” ,“That you are able to talk to a professional to answer your questions”, “That your choices are respected”, “That you obtain all the information you want”, “That you get the help you need”, “That you and your loved ones decide the need for the healthcare and services received”, “That you and your loved ones decide the type of healthcare and services received”, and “That you and your loved ones decide the amount of healthcare and services received”. In turn, these items were coded from Q1 through Q10. Concurring to Gagnon et al., 2006; responses to each item were anchored on a four-point Likert scale ranging from “Completely” to “Never”. “Completely” was assigned a score of three; “To a great extent” was assigned a score of two]; “To some extent” was assigned a score of one; and “Never” was assigned a score of zero. On this basis the level of measurement is considered an interval scale suitable for correlational analyses.

HCEQ items with a mean item score of < 1; $1 - \leq 2$; $> 2 – 3$;$> 3 - 4$ were considered items of “Disempowerment” “Non-Empowerment”; “Moderate Empowerment”; and “High Empowerment”, consecutively. According to Gagnon et al.'s, 2006 study, the content validity of the HCEQ was assured by identifying IPE indicators from the literature, generating

corresponding items, pre-testing the tool, and procuring expert judgment. The immediately mentioned study established the tridimensional nature of IPE concept (three factors explained almost 69% of the total variance), Cronhbach's alpha internal consistency coefficient (c-α)of HCEQ was .83 and the intraclass correlation coefficient (test-retest reliability) was .70 (95% CI: .48–.83). Another study using a Persian version of HCEQ acknowledged the questionnaire's content validity, internal consistency reliability (Cronhbach's α = .7) and the standard tridimensional structure that accounted for 63.2% of variance (Mohebbi et al., 2017). Corresponding to Gagnon et al., 2006; the ten items are grouped into three underlying latent factors, specifically; "Involvement in decisions", "Involvement in interactions", and "Degree of control". These factors are designated F1, F2, and F3 respectively. F1 is reflected by indicators Q1, Q2, and Q3. F2 is reflected by items Q4, Q5, Q6 and Q7. F3 is reflected by manifest variables Q8, Q9, and Q10.

Preliminary screening of the HCEQ ten-item dataset was conducted to assure the feasibility of carrying out factor analysis(FA).Internal consistency reliability and homogeneity of the scale were assessed using the next cutoff points: .7 for Cronbach's (α), Guttman, and Spearman-Brown reliability coefficients; .3 for corrected item-total correlation (CITC) and mean interitem correlation (MIC). Kaiser-Mayer-Olkin (KMO) coefficient of .8 was considered meritorious. Measures of Sampling Adequacy (MSA) of individual elements on the anti-image correlation matrix above .5 were considered adequate. An extraction communality – using Principle Axis Factoring(PAF) - exceeding (0.3) threshold, justified the inclusion of the manifest variable in FA. Skewness and kurtosis indices < |2| indicated that skewness and kurtosis were not a problem for the manifest variables. Multivariable outliers were assessed using Mahalanobis distance where a multivariate outlier was defined as a case that is associated with a Mahalanobis distance greater than a critical distance specified by a $p < .001$.Multivariate normality was

assessed through Mardia's normalised coefficient when Mardia's kurtosis critical ratio > 10.00 was indicative of violation of the assumption of multivariate normality. Maximal likelihood estimator (MLE) with bootstrapping (Bollen-Stine procedure) was applied.

Multicollinearity was reconnoitered with the help of tolerance values (TVs) and its reciprocal, variance inflation factors (VIFs). TVs < 0.1 or VIFs > 10 denote that multicollinearity may be problematic; however, a Condition Index (CIX) > 30 dispels concerns about multicollinearity.

Factorial validity of the standard HCEQ model was assessed by running confirmatory factor analysis (CFA) – via structural equation modeling (SEM)- using the following fit indices, given with their threshold values:- Chi-square (χ^2) ($p > .05$); Normed chi-square (χ^2/df) < 3; Root Mean Square Residual (RMR) < .08; Standardized Root Means square Residual (SRMR) < 0.08; Goodness of Fit Index (GFI) > .95, Adjusted Goodness of Fit Index (AGFI) > .9; Normed Fit Index (NFI) > .95; Relative Fit Index (RFI) > .95; Incremental Fit Index (IFI) > .95; Tucker-Lewis index (TLI) > .95; Comparative Fit Index (CFI) > .95; Root Means Square Error of Approximation (RMSEA) < .06 together with 90% CI (lower bound < .05 and upper bound < .08, PCLOSE > .05. Factor loadings (λs) with a standardized value > .4 were considered to be good-sized regression paths. Residual analysis (RA) and modification indices (MI) were conducted to ascertain proper local model fit at the individualized elements level. Standardized covariance residual (SCR) values < |4.0| were a sign of absence of local areas of model misfit. MI were contemplated as inconsequential if their expected parameter change (EPC) was less than .3.

Internal consistency and composite reliability (CR) of a construct were respectively sized up via c-α and Raykov rho coefficients. Convergent validity of the measurement model was appraised by virtue of c-α ≥ .7, Raykov rho ≥ .8, significant (λs) with standardized values > .4,

average variance extracted (AVE) ≥ .5, and positive significant moderate interitem correlations (IIC) of indicators reflecting a specified factor. Discriminant validity was supported through a number of procedures including: - (i) values of Pearson's moment interfactor pairwise correlations < |.95|, (ii) CR >AVE for each factor, (iii) Exploratory factor analysis (EFA) run in a confirmatory mode (CEFA) to further authenticate the tridimensionality of the standard model, and (iv) CFA run in an exploratory mode (ECFA) to discard the one-factor and two-factor solutions. Expected cross-validation index (ECVI)and Mean Expected Cross-Validation Index (MECVI) were used to match up competing models.

In the process of HCEQ construct validation multigroup CFA (MG-CFA) was performed to test measurement model invariance across two subsamples, departments and genders. Using random number generator in Statistica 8, the total sample (n = 420) was randomly spilt into two equal subsamples, namely, subsample1 (n_1= 210) and subsample2 (n_2 = 210). Model's invariance was successively tested through at least four progressive levels, scilicet, configural [i.e. equivalent item-factor structures between groups], metric [i.e. equivalent unstandardized (λs) between groups], scalar [i.e. equivalent item intercepts between groups], and residual [i.e. equivalent error term variances between groups]. These models were sequentially labeled {Model A}, {Model B}, {Model C}, and {Model D}.The invariant factor variance model was dubbed {Model E}.Chi-square difference test (χ^2_{diff}) and ΔCFI were used to compare these hierarchally nested models where ΔCFI< .01 was considered statistically insignificant (ns).

Additionally, the congeneric model (n = 420) was tested for tau-equivalence and parallelism (parallel indicators). Tau-equivalent and parallel models assumed independent error terms and were fitted to a covariance matrix. As the condition of tau-equivalence was not fulfilled, indicators were not given equal weight when calculating overall HCEQ scale and subscale scores. Thence, a weighted sum score method was applied, where sum scale and subscale scores were created by multiplying each item's score by its λbefore summing. A higher score indicates greater empowerment.

Overall level of IPE and domain-specific levels of IPE (n = 420) were measured by calculating average score for the overall scale and each subscale for the whole sample.

Overall IPE score gradient (OESG) was defined on a 0-1 scale by the formula:-

OESG = Overall Scale Score /Maximal Attainable Overall Scale Score.

Subscale score gradient (SSG) was defined on a 0-1 scale by the formula:-

SSG = Subscale Score /Maximal Attainable Subscale Score.

OESG or SSG gradients from 1-.8 were considered “Highly Empowered”; from < .8 - .5 “Moderately Empowered”; from < .5 - .25 “Non-empowered”; and from < .25 - 0 “Disempowered”.

Pearson’s correlation coefficient (r) was used to investigate associations between overall HCEQ score and patients’ age and literacy. Literacy was handled as a dummy variable whence values of one and two were assigned to illiterate and literate patients respectively. In a parallel vein, t-test for mean comparisons was used to analyze associations between overall HCRQ score and

department, gender, literacy, marital state, employment status, rural/urban residence, dwelling outside/inside Alexandria.

SEM was performed using AMOS.24 (Analysis of Moment Structures-version 24). All other analyses were conducted using SPSS.25 (Statistical Package of Social Sciences-version 25). Parallel Analysis (PA) was run using PA Calculator (Department of Obstetrics and Gynecology of the Chinese University of Hong Kong & New Territories East Cluster, 2017).

RESULTS

Participation rate was almost 100% since only one male patient refused to participate in the study and another one was tendered. Because of the absence of missing data, final number of cases utilized in the analyses was the exact number of respondents (n = 420).Age (in years) of study participants was normally distributed with a mean of 47.8286 ± 15.5931, a median of 50, and a mode of 55. Maximum age was 86; minimum was 16 with a range of 70.Age skewness index equaled -.258, with a standard error of .119.Age Kurtosis index was -.752, with a standard error of.238.About three fourths (74.8 %) of patients were married, one-tenth (11.9%) were single and the remaining 13.3% were divorced, separated or widowers/widows. Slightly more than one-third (35.2%) of participants were on the workforce while approximately one-fifth (10.4%) were unemployed. Around four-tenths (42.9%) were housewives, less than one-tenth (8.6%) were on pension. Less than three percent (2.9%) were students. More than one-tenth (13.6 %) were unskilled workers. Slightly more than one-tenth (12.4%) were semi-skilled workers, while 4.3% were skilled workers. Four percent were farmers. Four percent were merchants. About five percent (5.2%) were professionals, semi-professionals and governmental employees. Slightly less than one-half (46.2%) of participants were illiterate. About one-tenth (10.7%) can only read and write. Less than one-tenth

(8.1%) completed merely primary school. Nearly one-tenth (10.2%) barely completed preparatory school. Less than two percent (1.4%) completed solely secondary school. Less than nine percent (8.8%) completed a commercial school. Less than 8 % (7.4%) completed a technical school. Less than five percent (4.3%) completed college. Nearly two percent (2.1%) finished an agricultural school. And a very tiny percentage (.7%) had a postgraduate degree. About two-thirds of study participants (65.7%) settle inside Alexandria Governorate, while the remaining 34.3% live outside Alexandria. More than one-half (57.1%) dwell in urban areas, while the remaining 42.9% reside in rural areas.

Data entries of the ten-itemed HCEQ were screened and no missing data were detected entailing that all partaking cases were usable for the analysis. Heuristically and before undertaking formal analytical tests of sampling adequacy (such as Bartlett's Sphericity and KMO tests), a sample size of 420 was contemplated sufficient for FA considering five general guidelines. First, for a ten-itemed inventory the participants to items ratio is 420/10 = 42, a ratio that is amply in concert with a rule-of- thumb endorsing a sample size that is ten times the number of scale items (Hatcher, 2005; Knafl, 2017).Second, a sample size of 420 cases complies with are commended n ≥ 100 rule of the thumb (Ding, Velicer, &Harlow, 1995;Hair, Anderson, Tatham, & Black, 1995;In'nami& Koizumi, 2013). Thirdly, a sample size of 420 is in line Tabachnick's (2007) rule of thumb advising at least 300 cases for FA. Fourthly, Comery and Lee (1992) proclaim n= 100 as poor, n = 200 as fair, n = 300 as good, n= 500 as very good, and n = 1000 or more as excellent for FA.A fifth rule of the thumb, call for at least ten participants for every free parameter estimated (q), i.e. n: q≥ 10 (Schreiber, Stage, King, Nora, &Barlow (2006); given n = 420, q = 23, then, n: q = 420/23 = 18.26, which smoothly comply with the just mentioned rule of the thumb. The ten-itemed HCEQ dataset contained no univariate outliers since the attained maximum score for any item was three and the minimum was zero. Mean of

indicators spanned from 1.076±1.279 to 1.902± 1.155 (see Table 1). Median of indicators Q1, Q2, Q3, Q4, and Q6 was two each, that of Q5 and Q7 was one each, and that of Q8, Q9, and Q10 was zero each (see Table 1). Mode for indicators Q1, Q2, Q3, Q4 and Q6 was three each, that of Q5, Q7, Q8, Q9, and Q10 was zero each (see Table 1).

Table 1.
Descriptive statistics , communalities, Cronbach's(α) if item deleted, and corrected item-total correlations (CITCs) of ten indicators of Health Care Empowerment Questionnaire HCEQ (n= 420)

Manifest Variable	$\bar{X}$ ± S.D.	Median	Mode	Max.	Min.	I. Comm.†	E. Comm. ††	Cronbach's α If Item Deleted	CITC
Q1	1.663±1.208	2.00	3.00	3.0	0.0	.524	.565	.892	.648
Q2	1.902± 1.155	2.00	3.00	3.0	0.0	.572	.618	.892	.652
Q3	1.783±1.224	2.00	3.00	3.0	0.0	.600	.669	.890	.691
Q4	1. 955±1.150	2.00	3.00	3.0	0.0	.561	.627	.891	.668
Q5	1.114±1.244	1.00	0.00	3.0	0.0	.274	.268	.902	.503
Q6	1.645±1.251	2.00	3.00	3.0	0.0	.518	.570	.891	.669
Q7	1.307±1.305	1.00	0.00	3.0	0.0	.373	.396	.898	.569
Q8	1.091±1.288	0.00	0.00	3.0	0.0	.967	.969	.888	.715
Q9	1.076±1.279	0.00	0.00	3.0	0.0	.997	.995	.888	.715
Q10	1.081±1.283	0.00	0.00	3.0	0.0	.997	.998	.888	.718

†Initial communality. ††Extraction communality. Extraction method: Principle Axis Factoring.
Cronbach's α reliability coefficient of the overall HCEQ scale is 0.902.
All CITCs were significant (two-tailed, P = 0.000).
HCEQ = Health Care Empowerment Questionnaire
Means of initial and extraction communalities are.6383± 0.2599; and .6675± 0.2505 respectively.

Internal reliability analysis of the ten-item inventory disclosed that Cronbach's (α), Spearman-Brown, and Guttman's split-half reliability coefficients exceeded .8 with values of .902, .803 and .801 respectively, well- surpassing a .7 cutoff point and giving evidence of adequate internal consistency reliability and homogeneity of HCEQ scale. Still, these values are not too high,

as they did not exceed a recommended maximal threshold of 0.95, and alluded that items were not too interrelated and not redundant and that the inventory did not need to be shortened.

For HCEQ ten items CITCs were highly significant (two-tailed, p = 0.000) and exceeded the .3 threshold as their values ranged between .718 and .503, presenting more evidence of the internal consistency reliability and homogeneity of the scale (see Table 1). Additional evidence of the internal consistency reliability and homogeneity of the HCEQ scale was maintained by finding that Chronbach's (α) if item deleted values nestled in the range of 0.902 to 0.888, such as their values were not more than the value of Cronbach's α (α= 0.902) of the scale (see Table 1) and there was no need to eliminate any item from the scale.

All IIC were positive and highly significant (two-tailed, *P* = 0). IIC ranged between .287 and .999. All IIC exceeded the .3 cutoff value except IIC between items Q5 & Q7. All other IIC were below .667, except IICs between Q8 & Q9 (r = .981); Q8 & Q10 (r = .983); and Q9 & Q10 (r = .999). MIC was .4797± .1708, a value exceeding the .3 threshold and signaling the factorability of the ten-itemed scale. The linearity assumption was maintained since most items were significantly and moderately correlated. The linearity assumption was further assured using graphical methods since scatterplots relating pairs of the ten observed variables displayed linear homoscedastic smooth cigar-shaped outline. However, IICs > .980 may indicate a problem of multicolinearity. The determinant of the inter-item correlation matrix of the ten observed items was 2.608E-6 (i.e. < 0.00001) denoting that the correlation matrix may have some multicolinarity problems. However, the determinant is greater than zero and the IIC matrix is not an identity matrix and that the dataset of the ten observed variables is not afflicted with a singularity problem. Consequently, under colinearity diagnostics TVs for each manifest variable were checked. TVs for items Q1, Q2, Q3,

Q4, Q5, Q6, & Q7 ranged from .428 to .726 and their VIFs ranged from 1.377 to 2.502; unquestionably denoting that there were no multicolinarity problems concerning these seven items. Yet, TVs for items Q8, Q9 & Q10 were .033, .003, and .003, and their VIFs were 30.017, 348.394 & 377.862 respectively. It is recognized that a TV < 0.1 in sync with a VIF >10 may suggest a multicolinearity problem with items Q8, Q9 and Q10. After all, all CIXs were < 30 since CIXs were <10 for all items, except for CIX for item Q10 where CIX was 25.36. It was concluded that there was no singularity or serious multicolinearity troubles.

A significant Bartlett's Sphericity Test (Approximate $\chi^2 = 5333.477$, df = 45, p = 0.000) provided an articulate global diagnostic clue that the ten items of HCEQ were sufficiently intercorrelated, the IIC matrix was a factorable non- identity matrix and that the sample size was adequate for conducting FA. Also RA (Extraction method: PAF) flaunted no problem carrying out FA since inspecting the ten items correlation matrix residuals imparted that most correlations residuals were zero or close to zero. The average of correlations residuals was zero, the maximum was .053 and the minimum was –.052.The values of absolute residuals ranged between a maximum of |0.053| and a minimum of |0.002|.Average of absolute residuals was |.017|. The infinitesimal values of residuals (all residuals were very close to zero) forestalled a good model fit. Additionally RA submitted only three (i.e. only 6.0%) nonredundant residuals with absolute values greater than 0.05, giving extra evidence of the presence of a patterned relation among the ten items of HCEQ since a good model fit requires less than 50 % of non-redundant residuals to be greater than |0.05|.A histogram of residuals uttered that they were normally distributed. A normal Q-Q plot of residuals presented an approximately straight line denoting that residuals were coming from a normal distribution with a mean of approximately zero.

A KMO coefficient was found to be .880, attesting to the global sampling adequacy of the HCEQ. MSA were in the range from .967 to .748, indicating sampling adequacy at the individual items level and supporting the inclusion of all ten indicators of HCEQ in FA. Extraction communalities - using PAF- were in the range of .268 to .998, in other words, all extraction communalities – except that of item Q5- surpassed a .3 threshold and gave extra justification of the inclusion of all ten indicators in FA (see table 1).

Histograms, stem-and-leaf diagrams and box-plots of the ten manifest variables paraded symmetrical distributions and the appropriate proportions of distributional height to width of scores of all HCEQ indicators and delivered a pictorial substantiation of the univariate normality of the ten manifest variables. Univariate normality was more rigorously gauged by scrutinizing skewness and kurtosis indexes of the ten indicators. Skewness indices were in the range of |0.12323| to |0.64064|, and kurtosis indices were in the range of |-1.31206| and |-1.66430|, giving an indication of non-violation of the assumption of univariate normality.SEM literature is unanimous about retaining items whose skewness and kurtosis parametersare<|2| (Kline, 2005).

The assumption of bivariate normality was assured by inspecting pairwise scatter plots among ten items which put on show the linear relationship between each pair of observed variables and flaunted the absence of bivariate outliers. For the ten-itemed scale, the highest Mahalanobis distance for six cases were209.845, 209.845, 159.969, 73.541, 72.892, and 71.943, values that were more than the critical $\chi 2$ value ($\chi 2$= 29.59;df =10, p<0.001), indicating that these cases were multivariate outliers. The next highest Mahalanobis distance for a case is (29.093), a value that is < critical $\chi 2$ value ($\chi 2$= 29.59; df =10, p<0.001), indicating that there are only six cases that can be ruminated as multivariate outliers. The researcher mused that six outlying cases out of 420 (i.e. 6/420 = .014)wouldnot deform the analysis and no case was removed. Mardia's normalised coefficient was 281.685 with a critical ratio of 186.317, indicating the violation of the assumption of multivariate normality and MLE with Bollen–Stine bootstrapping procedure was used.

The standard HCEQ model was specified as shown in the methodology section and was identified by fixing (λs) of Q3, Q4, and Q10 on F1, F2 and F3 respectively to one (see figure 1).

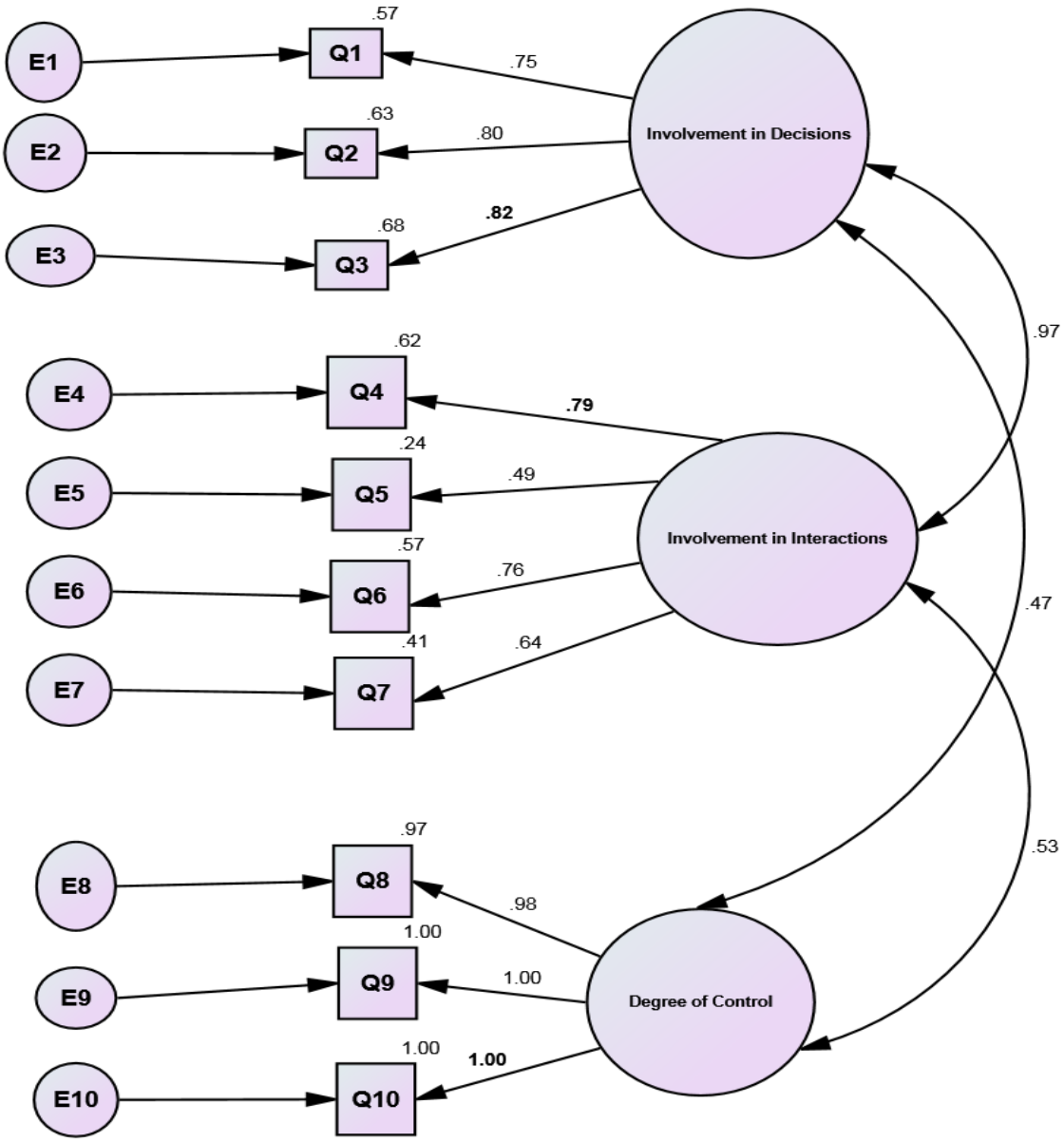

Figure 1. Specified three-factor HCEQ model with standardized estimates

Regression weights of ten error terms on their respective items were also fixed to one. All other parameters of the model were freely estimated. The model was estimated and a minimum was achieved (see Figure 1).Despite a statistically significant $\chi 2$(i.e. $p < .05$) [$\chi 2 = 77.277$, df = 32, p=

0.000], the model exhibited acceptable fit indices;χ^2/df< 3 [χ^2/df = 2.415]; RMR < .08 [RMR = .068]; SRMR < .08 [SRMR = .0444]; GFI > .95 [GFI = .964]; AGFI > .9 [AGFI = .939]; NFI> .95 [NFI = .986]; RFI > .95 [RFI = .980];IFI > .95 [IFI = .992]; TLI > .95 [TLI = .988]; CFI > .95 [CFI = .992]; RMSEA < .06 together with 90% CI (lower bound < .05 and upper bound < .08, PCLOSE > .05) [RMSEA = 0.058, 90% confidence interval of 0.042 to .075, PCLOSE = .196].Generated values of the abovementioned fit indices collectively impart a clear verification of an adequate overall fit of the standard HCEQ model.

Local fit was ascertained by finding that all SCR values were < |4.0| as they lied in the range from |3.313 | to 0.000, and providing a sign of adequate model fit on individual item level. Only three out of fifty-five SCRs exceeded the |.3| mark. Mean SCR and mean absolute SCR were .1183and |.4889| respectively. Additionally, the normal Q-Q plot of the SCRs produced an approximately straight line testifying that they are coming from a normal distribution with a central tendency towards zero, a finding that adds extra evidence to the adequacy of model fit. Local fit of the model elements was further ascertained by realizing that all item loadings were statistically significant (p < .001, two-tailed) and their standardized values were sizable as exceeded a .4 cutoff point and lied in the range of .493 to 1 (Table 2).

Table 2.
Unstandardized and standardized regression weights, and squared multiple correlations (SMCs) of the standard HCEQ model (n = 420).

Regression Line	Unstandardized Estimate	Standard Error (S.E.)	Critical Ratio (C.R.)	P (Two-tailed)	Standardized Estimate	SMCs
F1 ---> Q1	0.906	.055	16.485	< .001	.755	0.430
F1 ---> Q2	0.914	.051	17.947	< .001	.796	0.634
F1 ---> Q3	1.000				.823	0.677
F2 ---> Q4	1.000				.790	0.624
F2 ---> Q5	0.674	.068	9.862	< .001	.493	0.243
F2 ---> Q6	1.041	.056	16.131	< .001	.756	0.572
F2 ---> Q7	0.915	.069	13.190	< .001	.637	0.406
F3 ---> Q8	0.986	.009	108.714	< .001	.983	0.966
F3 ---> Q9	0.996	.003	373.960	< .001	.999	0.998
F3 ---> Q10	1.000				1.00	1.000

EPC of all MI were < .3 and deemed inconsequential. All EPC were < .1, except a submitted parameter between F3 and error term of item Q5, which recorded a value of .262. Accordingly it was concluded that the standard specified model had no missing parameters.

Covariances of the three factors were significant at (p < .001, two-tailed) and their inter correlations ranged from .932 to .529. Positive, substantial and significant interfactor correlations give an extra evidence of the robustness the standard HCEQ model (Table 3).

Table 3.
Interfactor covariances and correlations, and shared variances in the standard HCEQ model (n = 420)

Interfactor associations	Covariance	Standard Error (S.E.)	Critical Ratio (C.R.)	P-value (One-tailed)	Correlation (r)	Shared Variance(r^2)
F1<--> F2	.888	.080	11.076	< .001	.973	0.947
F2<--> F3	.621	.073	8.545	< .001	.534	0.285
F3<--> F1	.605	.077	7.849	< .001	.469	0.220

Shared variance among factors were 0.220, .285 and 0.947, which are not high enough to warrant a problem of overlap or halo effect among subscales, a point that is further substantiated upon examining discriminant validity. Adequate fit of the HCEQ standard model warranted its factorial validity.

Subsequently convergent validity was authenticated by the following techniques: (i) respectively, c-αs of F1, F2, & F3 were (0.834, 0.760, and 0.996) exceeding a .7 threshold, however, c-αof F3 outstripped .95 level, a finding that may hint at some redundancy among three indicators of F3;(ii) in turn, CRs of F1, F2, & F3 were (.834, .769, and .996) befittingly attaining the .7 threshold; (iii) all (λs) were significant with substantial standardized values higher than .4,(iv) one by one, AVE for F1, F2, & F3 were (.580, .461, and .988), values that are > .5; (iv) positive significant moderate intercorrelations of indicators reflecting a certain factor; (v) MICs within subscales F1, F2 and F3 were.627, .467, and .988 respectively, values that are sizable and outstrip a .3 threshold commended as a signal for the internal consistency reliability and homogeneity of a subscale; as well (vi) CITCs within sub-scale F1, F2 & F3 were {.671, .732, .682}; { .624, .433, .657, .534}; and { .982, .994, and .995} respectively. It is plain that CITCs within the three subscales well-exceeded the 0.3 cutoff point indorsed as evidence of internal consistency reliability and homogeneity of a subscale.

Discriminant validity was endorsed by the following procedures: (i) interfactor correlations between F2 & F3; and F1 and F3 were not excessive (i.e. <|0.95|; (ii) for subscale F1, CR > AVE F1 (i.e. .834> .580); also for subscale F2, CR > AVE i.e. .769> .461;(iii) CEFA was run to substantiate the felicitous number of factors, (iv) ECFA was bidden to discard the one-factor and

two-factor solutions. Table (4) illustrates the results of CEFA (using PAF extraction which is robust to non-normal data distributions and promax oblique rotation), where cumulative variance explained by the three-factor solution was more than 78% of the unrotated solution, compared to (71.305%) for the two-factor unrotated solution. Thus, the third factor explained more than 7.0% of the variance of the unrotated solution, a finding that substantiates the construct validity and robustness of the three-factor solution. However, a three-factor rotated solution was found to explain (69.411 %) of variance, compared to (67.211%) for the two-factor rotated solution, in other words, the third factor explained only 2.200 % of the variance of the rotated solution (see Table 4). However, a scree-plot of eigenvalues, distinctly displayed three factors above the inflexion point and ratified the adoption of the three-factor model as the most appropriate solution.

Table (4) points out that initial EVs ranged between 5.350 and .001.Applying Kaiser criterion (i.e. retaining factors with EVs > 1) yield a two-factor solution. Then again, applying Jolliffe's criterion (i.e. retaining factors with EVs > .7) generates a three-factor solution.

Table 4. Total variance explainedby the standard HCEQ model{extraction method: Principal Axis Factoring, oblique promax rotation, with Kaiser normalization.Rotation converged in four iterations (n = 420).

Factor	Initial eigenvalues			Extraction sums of squared loadings			Rotation sums of squared loadings[a]			Simulated eigenvalues in Parallel analysis [b]
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total			$\bar{x} \pm s$
1	5.350	53.500	53.500	5.091	0.908	50.908	4.360			1.2488 ± 0.0350
2	1.780	17.804	71.305	1.630	6.303	67.211	3.982			1.1737 ± 0.0294
3	.727	7.272	78.577	.220	.200	69.411	.456			1.1166 ± 0.0258
4	.601	6.010	84.587							1.0642 ± 0.0213
5	.454	4.539	89.126							1.0179 ± 0.0196
6	.433	4.329	93.455							0.9720 ± 0.0200
7	.330	3.304	96.759							0.9272 ± 0.0208
8	.300	2.997	99.757							0.8810 ± 0.0229
9	.023	.229	99.986							0.8287 ± 0.0251
10	.001	.014	100.000							0.7699 ± 0.0321

a. When factors are correlated, sums of squared loadings cannot be added to obtain a total variance.
b. Averaged variances of simulated eigenvalues, their standard deviations using normally distributed randon numbers for ten manifest variables in a sample size of 420 and 500 replications in parallel analysis.

Therefore, it is clear that the two-factor solution could be a competing – and more parsimonious- model for the standard three-factor model; however, the two factor solution is not supported by theory. PA suggested a one-factor solution(Table 4), yet, a one-factor solution is also not backed by theory as previous research is anonymous in maintaining that TWC is a multidimensional concept (Gagnon et al., 2006; Mohebbi et al., 2017).

In this vein it should be recounted that a number of studies averred that PA has a tendency towards factor under extraction (Beauducel, 2001; Yang &Xia, 2015).Running ECFA disclosed that the unidimensional structure was a thoroughly non-fitting solution. Nonetheless, running ECFA with the two-factor solution (merging F1 and F2), unveiled that the two-factor model is a well-fitting model, whereχ^2 was statistically significant ($p < .05$) [$\chi 2$ = 51.081, df = 34, p= 0.030]; χ^2/df< 2 [χ^2/df = 1.502]; RMR >.08 [RMR = .090]; SRMR < .08 [SRMR = .0562]; GFI > .95 [GFI = .954]; AGFI > .9 [AGFI = .926]; NFI > .95 [NFI = .981]; RFI > .95 [RFI = .954]; IFI > .95 [IFI = .993]; TLI > .95 [TLI = .991]; CFI > .95 [CFI = .993]; RMSEA < .06 together with 90% CI (lower bound < .05 and upper bound < .08, PCLOSE > .05) [RMSEA = 0.049, 90% confidence interval of 0.016 to .075, PCLOSE = .196].$\chi^2_{diff}$was utilized to compare between the two competing models. For the three-factor model: $\chi^2_{(32)}$= 77.277, p = .0.000; for the two-factor model: $\chi^2_{(34)}$= 51.081, p = .030. χ^2diff. = $\chi^2_{(32)} - \chi^2_{(34)} = 77.277_{(32)} - 51.081_{(34)} = 26.196_{(2)}$, which is a significant difference for calculated chi > critical chi, at .001; (i.e., 26.196> 13.8155); a finding exposing that the three-factor model is significantly better fitting than the two-factor one. Besides, ECVI for the three-factor solution was (ECVI = .294, LO 90 = .242, HI 90 = .365), while that of two-factor model was ECVI = .445, LO 90 = .372, HI 90 = .557). MECVI for the three-factor model was .297, while that of the two-factor model was .457. It is maintained that ECVI and MECVI values reductions portend a better fitting model. Accordingly the researcher settled on the standard three-factor solution.

As the ten-item HCEQ model met the condition of congenerity, the investigation proceeded to assess it for tau-equivalence. Tau-equivalence was tested by imposing equality constraints on the unstandardized (λs), i.e., they were all fixed to 1.0 and factor variances were freely estimated. It was realized that the fit of the tau-equivalent model was significantly worse than of the congeneric model. For the congeneric model: $\chi^2_{(32)}$= 77.277, p = .000; for the tau-equivalent model: $\chi^2_{(39)}$= 110.155, p = .000. χ^2diff. = $\chi^2_{(39)} - \chi^2_{(32)} = 110.155_{(39)} - 77.277_{(32)} = 32.878_{(7)}$, which is a significant difference since calculated χ^2> critical χ^2, at .001; (i.e., 32.878> 29.5883). As the condition of tau-equivalence was not fulfilled, the analysis did not ensue to evaluating the condition of parallelism. And so, indicators were not given equal weight while calculating overall HCEQ scale and subscale scores, and a weighted sum score method was applied, where sum scores were created by multiplying each item's score by its standardized λ before summing.

The analysis proceeded to using MG-CFA to test measurement invariance across two subsamples (n_1& n_2), two departments (surgery & internal medicine) and patients' genders. A baseline model (Model A) was specified for the two subsamples, where all (λs)were freely estimated. Configural invariance of the two subsamples was documented by adequate fit indices of model A, where $\chi 2$ was statistically significant (p < .05) [$\chi 2$ = 92.329, df = 64, p= 0.000]; χ^2/df< 3 [χ^2/df = 1.443]; RMR < .08 [RMR = .072]; SRMR < .08 [SRMR = .0503]; GFI > .95 [GFI = .959]; AGFI > .9 [AGFI = .929]; NFI > .95 [NFI = .983]; RFI > .95 [RFI = .976]; IFI >.95 [IFI = .995]; TLI > .95 [TLI = .993]; CFI > .95 [CFI = .995]; RMSEA < .06 together with 90% CI (lower bound < .05 and upper bound < .08, PCLOSE > .05) [RMSEA = 0.033, 90% confidence interval of 0.016 to .047, PCLOSE = .982].

For the two subsamples metric invariance was established since $\Delta \chi^2$ and ΔCFI for models A & B were not significant, that is to say, the difference of fit of the full metric model was not significantly worse than the configural model. For the metric model: $\chi^2_{(71)}$= 96.475; for the configural model: $\chi^2_{(64)}$= 92.329;χ^2diff. = $\chi^2_{(71)} - \chi^2_{(64)} = 96.475_{(71)} - 92.329_{(64)} = 4.146_{(7)}$, *ns*.$\chi^2_{diff}$ was not significant as calculated χ^2< critical χ^2, at .001; (i.e., 4.146<24.3219).Also ΔCFI was zero (see table 5). Since metric invariance was established, the analysis proceeded to appraising scalar invariance for the two subsamples. Scalar invariance was acknowledged since $\Delta \chi^2$ and ΔCFI for models B & C were not significant, that is the difference of fit between the scalar and metric models was not significant. For the scalar model: $\chi^2_{(81)}$= 101.215; for the metric model: $\chi^2_{(71)}$= 96.475;χ^2diff. = $\chi^2_{(81)} - \chi^2_{(71)} = 101.215_{(81)} - 96.475_{(71)} = 4.74_{(10)}$, *ns*.$\chi^2_{diff}$ was not significant as calculated χ^2< critical χ^2, at .001; (i.e., 4.74< 29.5883).Also ΔCFI was .001 i.e. <.01 (see table 5).

Table5.
Measurement invariance tests of Health Care Empowerment Questionnaire (HCEQ) across two subsamples, two departments and genders.

Type of Invariance	χ^2 (*df, P*)	**CFI**	**TLI**	**RMSEA (90%CI; P-close)**	**Δ χ^2**	**ΔCFI**
Subsamples						
Configural	92.329 (64,.012)	.995	.993	.033 (.016, .047; .982)	----	----
Full metric	96.475 (71, .024)	.995	.994	.029 (.011, .043; .995)	4.146_{ns}	0.000_{ns}
Full scalar	101.215 (81, .065)	.996	.996	.024 (.024, .038; .999)	4.470_{ns}	0.001_{ns}
Full residual	226.235 (91, .000)	.975	.975	.060 (.050, .069; .051)	125.02_{ns}	0.021_{ns}
Departments						
Configural	120.740 (64, .000)	.990	.986	.046 (.033, .059; .050)	----	----
Full metric	126.467 (71, .000)	.990	.988	.043 (.031, .055; .812)	5.727_{ns}	0.000_{ns}
Full scalar	150.463 (81, .000)	.998	.987	.045 (.034, .056; .744)	23.996_{ns}	0.002_{ns}
Full residual	543.902 (91, .000)	.921	.922	.109 (.100, .118; .000)	393.439_{ns}	$.077_{ns}$
Genders						
Configural	109.605 (64, .000)	.991	.987	.041 (.028, .054; .683)	----	----
Full metric	116.321 (71, .001)	.991	.989	.039 (.026, .052; .923)	6.716_{ns}	0.000_{ns}
Full scalar	125.918 (81, .001)	.991	.990	.036 (.023, .048; .970)	9.597_{ns}	0.000_{ns}
Full residual	171.006 (91, .000)	.984	.985	.046 (.035, .056; .730)	45.088_{ns}	0.007_{ns}
Invariant factor variances	174.020 (94, .000)	.984	.985	.045 (.035, .056; .770)	3.014_{ns}	0.000_{ns}

Since scalar invariance was established, the analysis progressed to gauging residual invariance for the two subsamples. Noninvariance of the full residual and full scalar models was recorded since $\Delta \chi^2$ and ΔCFI for models C & D were significant, in other words, the fit of the residual model was significantly worse than the scalar model. For the residual model: $\chi^2_{(91)}$= 226.235; for the scalar model: $\chi^2_{(81)}$= 101.215;χ^2diff. = $\chi^2_{(91)} - \chi^2_{(81)} = 226.235_{(91)} - 101.215_{(81)} = 125.02_{(10)}$.Calculated chi > critical chi, at .001; (i.e., 125.02> 29.5883).Also ΔCFI was0.021 i.e. >.01 (see table 5).

Running MG-CFA, configural invariance of the two department groups was documented by adequate fit indices of the configural model, where $\chi 2$ was statistically significant ($p < .05$) [$\chi 2$ = 120.740, df = 64, p= 0.000]. χ^2/df< 3 [χ^2/df = 1.887]; RMR ≈.08 [RMR = .081]; SRMR < .08 [SRMR = .0568]; GFI ≈ .95 [GFI = .947]; AGFI > .9 [AGFI = .909]; NFI > .95 [NFI = .979]; RFI > .95 [RFI = .971]; IFI > .95 [IFI = .990]; TLI > .95 [TLI = .986]; CFI > .95 [CFI = .990]; RMSEA < .06 together with 90% CI (lower bound < .05 and upper bound < .08, PCLOSE > .05) [RMSEA = 0.046 with 90% confidence interval of 0.033 to .059, PCLOSE = .683]. For the two department's groups metric invariance was established since $\Delta \chi^2$ and ΔCFI for models A & B were not significant, that is to say, the difference of fit of the full metric model was not significantly worse than the configural model. For the metric model: $\chi^2_{(71)}$= 126.467; for the configural model: $\chi^2_{(64)}$= 120.740; χ^2diff. = $\chi^2_{(71)} - \chi^2_{(64)} = 126.467_{(71)} - 120.740_{(64)} = 5.727_{(7)}$, *ns*. χ^2_{diff} was not significant as calculated χ^2< critical χ^2, at .001; (i.e., 5.727< 24.3219).Also ΔCFI was zero (see table 5). Since metric invariance was established, the analysis advanced to appraising scalar invariance for the two department groups. Scalar invariance was acknowledged since $\Delta \chi^2$ and ΔCFI for models B & C were not significant, that is the difference of fit between

the scalar and metric models was not significant. For the scalar model: $\chi^2_{(81)}$= 150.463; for the metric model: $\chi^2_{(71)}$= 126.467; χ^2diff. = $\chi^2_{(81)}$ - $\chi^2_{(71)}$ = $150.463_{(81)}$ - $126.467_{(71)}$ = $23.996_{(10)}$, *ns*. χ^2_{diff}test was not significant as calculated χ^2< critical χ^2, at .001; (i.e., 23.996< 29.5883). Also ΔCFI was 0.002 i.e. < .01 (see table 5).Since scalar invariance was established for the two department groups, the analysis continued to gauging residual invariance. Noninvariance of the full residual and full scalar models was recorded since Δ χ^2 and ΔCFI for models C & D was significant, in other words, the fit of the residual model was significantly worse than the scalar model. For the residual model: $\chi^2_{(91)}$= 226.235; for the scalar model: $\chi^2_{(81)}$= 101.215; χ^2diff. = $\chi^2_{(91)}$ - $\chi^2_{(81)}$ = $226.235_{(91)}$ - $101.215_{(81)}$ = $125.02_{(10)}$. Calculated chi > critical chi, at .001; (i.e., 125.02 > 29.5883). Also ΔCFI was .077 i.e. > .01 (see table 5).

Running MG-CFA, configural invariance of the two gender groups was documented by adequate fit indices of the configural model, where χ^2 was statistically significant (p < .05) [$\chi 2$ = 109.605, df = 64, p= 0.000]. χ^2/df< 3 [χ^2/df = 1.713]; RMR ≈.08 [RMR = .081]; SRMR < .08 [SRMR = .0556]; GFI > .95 [GFI = .951]; AGFI > .9 [AGFI = .917]; NFI > .95 [NFI = .979]; RFI > .95 [RFI = .970]; IFI > .95 [IFI = .991]; TLI > .95 [TLI = .987]; CFI > .95 [CFI = .991]; RMSEA < .06 together with 90% CI (lower bound < .05 and upper bound < .08, PCLOSE > .05) [RMSEA = 0.041 with 90% confidence interval of 0.028 to .054, PCLOSE = .683]. For the two gender groups metric invariance was established since Δ χ^2 and ΔCFI for models A & B were not significant, that is to say, the difference of fit of the full metric model was not significantly worse than the configural model. For the metric model: $\chi^2_{(71)}$= 116.321; for the configural model: $\chi^2_{(64)}$= 109.605; χ^2diff. = $\chi^2_{(71)}$ - $\chi^2_{(64)}$ = $116.321_{(71)}$ - $109.605_{(64)}$ = $6.716_{(7)}$, *ns*. $\chi^2_{diff}$was not significant as calculated χ^2 < critical χ^2, at .001; (i.e., 6.716< 24.3219). Also ΔCFI was zero (see table 5).Since metric invariance was established, the analysis advanced to appraising scalar

invariance for the two gender groups. Scalar invariance was acknowledged since $\Delta \chi^2$ and ΔCFI for models B & C were not significant, that is the difference of fit between the scalar and metric models was not significant. For the scalar model: $\chi^2_{(81)} = 125.918$; for the metric model: $\chi^2_{(71)} = 116.321$; χ^2diff. $= \chi^2_{(81)} - \chi^2_{(71)} = 125.918_{(81)} - 116.321_{(71)} = 9.597_{(10)}$, *ns*. $\chi^2_{diff}$was not significant as calculated $\chi^2 <$ critical χ^2, at .001; (i.e., 9.597< 29.5883). Also ΔCFI was zero (see table 5).

Since scalar invariance was established for the two gender groups, the analysis continued to gauging residual invariance. Invariance of the full residual and full scalar models was recorded since $\Delta \chi^2$ and ΔCFI for models C & D was not significant, in other words, the fit of the residual model was significantly worse than the scalar model. For the residual model: $\chi^2_{(91)} = 171.006$; for the scalar model: $\chi^2_{(81)} = 125.918$; χ^2diff. $= \chi^2_{(91)} - \chi^2_{(81)} = 171.006_{(91)} - 125.918_{(81)} = 45.088_{(10)}$. Calculated chi > critical chi, at .001; (i.e., 45.088 > 29.5883). However, ΔCFI was 0.007 i.e. < .01 (see table 5) and the analysis carried to investigate invariant factor variances. Invariance of Model E was proved as $\Delta \chi^2$ and ΔCFI for models D and E were not significant, in other words, the fit of model E was not significantly worse than model D. For model E: $\chi^2_{(94)} = 174.020$; for model D: $\chi^2_{(91)} = 171.006$; χ^2diff. $= \chi^2_{(94)} - \chi^2_{(91)} = 174.020_{(94)} - 171.008_{(91)} = 3.012_{(10)}$. Calculated chi < critical chi, at .001; (i.e., 3.012< 29.5883).Also ΔCFI was zero (see table 5).The model did not proceed to test for invariance regarding factor intercepts because the ensuing model would be unidentified.

As the psychometric properties of the standard HCEQ model (n = 420) were assured, it was employed to calibrate and grade the state of IPE in the study setting on the item, subscale and overall scale levels. As exhibited in table (1) all HCEQ item means lied in the range > 1 to < 2; then each and every item was considered as an item of "Non-Empowerment". No item was considered as an item of "Disempowerment", "Moderate Empowerment, or "High Empowerment". Frequencies and percentages of various degrees of empowerment on HCEQ items are displayed in Table 6.

Table 6.
Frequencies, percentages of degrees of empowerment on HCEQ items(n = 420).

Item	AC		AG		AS		CUA	
	No	%	No	%	No	%	No	%
Q1	152	36.2	67	16.0	96	22.9	105	25.0
Q2	193	46.0	61	14.5	98	23.2	68	16.2
Q3	183	43.6	58	13.8	84	20.0	95	22.6
Q4	206	49.0	51	12.1	101	24.0	62	14.8
Q5	104	24.8	39	9.3	78	18.6	199	47.4
Q6	164	39.0	59	14.0	81	19.3	116	27.6
Q7	133	31.7	42	10.0	66	15.7	179	42.6
Q8	116	27.6	20	4.8	70	16.7	214	51.0
Q9	114	27.1	18	4.3	74	17.6	214	51.0
Q10	115	27.4	18	4.3	73	17.4	214	51.0

AC: Completely Able; AG: Able to a great extent; AS: Able to some extent; CUA: Completely Unable.

Slightly less than half of patients (47.9%) were either completely unable or able to some extent to "Ask for explanations" (Item Q1). More than third (38.4%) were either completely unable or able to some extent to "Ask questions" (Item Q2). More than four-tenths (42.6%) were either completely unable or able to some extent to "Ask for advice" (Item Q3). More than third (38.8%)were either completely unable or able to some extent to "Talk to a professional to answer patient's questions" (Item Q4). About two-thirds (66%)were either completely unable or able to some extent to "Have patient's choices are respected" (Item Q5). Slightly less half (46.9%) were either completely unable or able to some extent to "Obtain all wanted information" (Item Q6).Largely more than half (58.3%) were either completely unable or able to some extent to "Get

needed help" (Item Q7). More than two-thirds (67.7%) were either completely unable or able to some extent to "Decide – together with their loved ones- the need for the healthcare and services received" (Item Q8). Again more than two-thirds (68.6%) were either completely unable or able to some extent to "Decide– together with their loved ones- the type of healthcare and services received"(Item Q9). All over again, more than two-thirds (68.4%) were either completely unable or able to some extent to "Decide– together with their loved ones- the amount of healthcare and services received"(Item Q10). Table (7) displays OESG and SSGs and their calculating formulae. All gradients belonged to the "non-empowered" category since they lied in the range < .5 - .25.

Table 7.
Chronbach's α, descriptive statistics, maximal attainable score, gradient and grade of overall scale and subscales of the standard ten item HCEQ model † (n = 420).

Scale/subscale	α	($\bar{X}$)± S.D.	Median	Mode	Max.	Min.	Maximal Attainable Score	Gradient†
Overall scale	.902	11.6132±7.3962	11.1245	.000	24.1	.00	24.00	11.6132/24 = .48388
Subscale (F1)	.834	4.2151± 2.4610	4.7140	7.1	7.12	.00	7.12	4.2151/7.12 = .59200
Subscale (F2)	.760	4.1701± 2.5566	4.0735	8.0	8.03	.00	8.28	4.0735/8.28 = .49200
Subscale (F3)	.996	3.2280± 3.8101	0.0000	0.000	8.95	.00	8.95	3.2280/8.95 = .36067

† Gradient is calculated by dividing average attained score by maximal attainable score for a scale or subscale. All gradients belonged to the "Non-empowered" grade since they lied in the range < .5 - .25.

There was a weak, negative, significant relationship between age and overall HCEQ score (r = -.252, p = .000, two-tailed). Besides, there was a weak, positive, significant relationship between literacy and overall HCEQ score (r = .106, p = .029, two-tailed).T-test for mean comparisons, uncovered no statistically significant associations between overall HCRQ score and department, gender, marital state, employment status, rural/urban residence, and dwelling outside/inside

Alexandria (Table 8). Nonetheless, t-test exposes a significant association between literacy and overall HCRQ score (Table 8).

Table 8.
Associations between some demographic patients' characteristics and mean overall HCEQ score ($\bar{X}_O$).

Variables	$\bar{X}_o$ ± SD	t value	df	Two-tailed significance	Mean Difference	Standard Error of Difference	Confidence Interval of the Difference	
							Lower	Upper
Literacy								
Illiterate	10.77 ± 7.368							
		- 2.187	418	.029	- 1.57	.721	-2.99	-.159
Literate	12.34 ± 7.358							
Gender								
Males	12.11 ± 4.741							
		1.369	418	.172	0.99	.721	-.430	2.40
Females	11.12 ± 7.017							
Marital State								
Married	11.55 ±7.322							
Not married	11.80 ±7.645	-.294	418	. 769	- .245	.832	- 1.88	1.39
Employment								
Employed	12.63 ± 7.77							
Not employed	11.24 ± 7.32	1 .706	418	.089	1.39	.814	- .212	2.99
Department								
Surgery	12.09 ± 7.73							
Internal medicine	11.13 ± 7.03	1.33	418	.183	.960	.721	- .457	2.38
Residence								
Urban	11.25 ± 7.385							
Rural	12.10 ± 7.403	-1.163	418	.246	.8477	.729	- 2.28	.585
Dwelling								
Inside Alexandria	11.57 ± 7.34	-.167	418	.868	.1271	.761	- 1.62	.137
Outside Alexandria	11.70± 7.52							

Discussion

Countries all over the globe, including low-and middle-income nations, are grabbling with the need to move away from traditional notions of patients as passive recipients of care (All Party Parliamentary Groups on Global Health, 2014). The study of IPE is very limited in Egypt, and there are virtually no validated tools of measurement. Therefore, the current study aimed to formally translate the HCEQ into Arabic, test its psychometric properties and apply it in an inpatient setting. Of identifiable interest was HCEQ as a generic self-report measure that is not constricted to a specific disease/ condition. Non-diseasespecific measures include questions that are so worded that they are transferrable across various conditions and still capable of retaining their functionality(Mavis et al., 2015).Characterizing latent factors underlying IPE is remarkably important for its improvement initiatives (Chiauzzi, et al., 2016; Corrigan, Faber, Rashid, & Leary, 1999;Johnson, Rose, Dilworth, & Neilands, 2012;Small, Bower, Chew-Graham, Whalley, & Protheroe, 2013).

IPE is a faceted, multidimensional, complex concept (Gagnonet al., 2006; Herbert et al., 2009; Rappaport, 1987; Small et al.,2013;Virtanen, Leino-Kilpi, &Salanterä; Yeh, Lin& Tung, 2014). Concurring with previous studies (e.g. Chiauzzi et al., 2016), the current study attested to the unviability of a unidimentional structure of IPE. The five dimensions identified through conceptual analysis and qualitative work in a preliminary study were not empirically confirmed in a closing follow-up study, and a three factor solution was considered to have the simplest structure (Small et al., 2013).

The present study concurred with many other studies (e.g. Gagnon et al., 2006; and Mohebbi et al., 2017) in substantiating the three-factor solution which is capable on explaining more than 60% of variance. In the current study, the ten items in three dimensions of HCEQ explained about 69.4% of total variance, a percentage that is very close to 68.65% demonstrated

by Gagnon et al., 2006' study. In a similar vein, Mohebbi et al. 2017's study indicated that the tridimensional structure of ten HCEQ items explained 63.2% of total variance. The present study demonstrated an adequate internal consistency reliability evidenced by c-α of .902 for the overall HCEQ scale. Comparably Gagnon et al. 2006's study and Mohebbi et al. 2017's study respectively yielded c-αs of .83and .70 for the overall HCEQ scale. In my study the internal consistency analyses produced c-αs of .834, .760, and .996for factors 1, 2, and 3,respectively a result that is akin to values of .79, .79, and .89 registered by Gagnon et al., 2006's study. The unequivocal saturation of the items on the three factors confirmed the specificity of each factor, a result that is congruent with Gagnon et al.'s 2006 study. Abidimensional structure (namely, Positive Patient–Provider Interaction and Knowledge; and Personal Control) has been recorded in some studies (e.g. Chiauzzi et al., 2016; and Small et al., 2013). The present study illustrated that the two-factor solution is a viable and well-fitting one; however, it is less fitting than the less parsimonious three-factor solution.

In this study, multiple group model analysis was an expansion to previous studies. MG-CFA demonstrated that the concept of IPE was invariant across two randomly split samples, departments, and genders. Measurement invariance across various groups means that IPE construct is the same for each group, an actuality that reinforces model's construct validity and permits comparisons across group means. Gagnon et al., 2006's study stated blatantly that gender differences may be implicated in HCEQ model and that their study did not contain an examination of the psychometric properties of males in comparison to females, and commended that future research should test for model's gender invariance.

As the psychometrics of standard HCEQ model were the study proceeded to calibrate IPE at items, subscales and overall scale levels. It was realized that IPE belonged to “Non-

empowered" category at all levels of analysis. Having a nuanced and well-defined depiction of the state of IPE in the study setting, resources and interventions can be better targeted in pursuance of improving and monitoring various dimensions of IPE. Quantifiable evidence can show that transformation is taking place which helps in focusing program planning and evaluation efforts (Carr, 2016).Findings of the present study uncover the worth of educating and training patients about the importance of seeking support and encouragement towards more control and involvement in decisions and healthcare interactions. Correspondingly, greater attention needs to be directed towards training clinical healthcare providers (especially physicians and nurses) to allot sufficient time to helping patients and their families towards extra participation and involvement in healthcare encounters as well as paying more consideration to their informational needs, capabilities, resources and skills that facilitate patients' and families' making teleological choices in directing and controlling their health seeking behavior within the healthcare system.

Moreover this study sought to identify IPE association with patient characteristics. Significant - albeit weak-negative and positive relationships were respectively discerned between overall HCEQ score and age; and literacy. Chiauzziet al.2016's study kept a record that the more educated and male patients have greater levels of IPE. However, the current study uncovered no significant associations between overall HCRQ score and gender, marital state, department, employment status, rural/urban residence, and dwelling outside/inside Alexandria.

Strengths of current study included an almost 100% participation rate which is comparable to Mohebbi et al., 2017's study. Also the validation was not limited to a particular age category, in contrast to Gagnon et al., 2006's study which was limited to elderly age group. As well the study spanned both sexes in contrast to Mohebbi et al, 2017's study which was confined to women in the

reproductive age group. A notable pro of the present study is that it did not investigate IPE in a single disease or condition. In congruence with few earlier studies (such as Chiauzzi et al.,2016's) my study identifies factors of IPE across disease and conditions a feat that enables greater understanding of IPE construct.

Another strength of the present study is that the translation of the HCEQ had no problems with conveying intended meanings of statements. Generally, the Arabic wording in the translated HCEQ was clear, unambiguous, and easy to understand, an effort that is comparable to earlier attempts (e.g., Mohebbi et al., 2017) to adapt HCEQ to non-English lingos. Nonetheless, retracting test-retest reliability and concurrent validity from the inquiry are limitations that need to be addressed in future studies. Another limitation is that the study is confined to inpatients in a university hospital and the investigation needs to be replicated to other healthcare organizations including outpatient settings for sake of more generalizability.

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