Expected Attributes to Design Sleeping Facilities for the Elderly based on the Potential Stakeholders Point of View

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Abstract: Adequate sleep to rest is a beneficial activity to maintain health. Therefore, the facilities that support this activity need to be appropriately designed. In accordance with the fact that after entering retirement age, the elderly are often supported by their adult children, so most of the time, the elderly's life's necessities will be handled by their child(ren). Hence, this study aims to analyze the perceptions of the two main stakeholders, namely: potential target buyers (children) and target users (parents) of sleeping facilities that can differ from one another related to the expected value. This study explores expected design attributes to achieve elderly's good sleep quality using in-depth interviews with the selected participants and get 22 valid and reliable attributes by sharing 70 pairs of children-parents using non-parametric Mann Whitney-U. Unexpectedly, these two different generations perceived the proposed attributes as similar to one another. Further analysis using the Kano method found that two attributes need to be fulfilled by design: (1) sliding the bed; (2) the lower area of the bed should be cleaned easily. These two attributes are then discussed from the perspective of Indonesian natural resource usage and habits.

1 INTRODUCTION

Indonesia, as the fourth most populous country, already entering an aging population since 2015 with its elderly population more than 7% and consistently increased to 9.92% (26.86 million people) in 2020 (McDonald, 2014). The prediction of its elderly population will become nearly 20% in 2045 (Sari et al., 2020). Significant changes in demographic proportion caused this developing country has an urgent need to set their point of view on how the society regularly works. In general, the elderly will be divide into potential and non-potential elderly (*Act of the Republic of Indonesia on welfare of the elderly (Undang-undang Republik Indonesia tentang kesejahteraan lanjut usia)*, 1998) and with a tendency of declining health condition once people get older,

then this demographic changing will directly add the burden of the productive community. Nevertheless, World Health Organization proposed the healthy aging concept which emphasizes for the elderly to live a long and healthy life despite of free of disease condition which might not be feasible for older people.

This study is a continuation from the previous study which shown that the anthropometric data for the elderly has a correlation with their living condition: community-dwelling or retirement home (Sarvia, Wianto, Yudiantyo, Apriyani, & Costa, 2021). Even though becoming old is not a disease, but once the individual reach maturity state, their physical ability inevitably will deteriorate (Castillo-Rodríguez, Onetti-Onetti, Mendes, & Chinchilla-Minguet, 2020).

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Sleeping pattern for the elderly will change as older people tend to sleep earlier but also wake earlier, more frequently during the night and experiencing fragmented sleep. Some of these changes directly relate to sleeping disorders such as snoring and obstructive sleep apnea (Wolkove, Elkholy, Baltzan, & Palayew, 2007). Other sleeping-related activities also indicating that low sleeping quality can be associated with poor cognitive performance of the elderly (Blackwell et al., 2006; Nebes, Buysse, Halligan, Houck, & Monk, 2009). Nevertheless, quality of sleep constitutes many factors, and will optimize the functional ability and quality of life (Bliwise, 1993).

Considering the urgencies to support the good quality of sleep, then this study is trying to explore the attributes to design adequate sleeping facilities. Most of the times, large-size furniture including a bed has a long time of use, sometimes furniture with specific material can be passed down to generations as they excel in quality and become a family heirloom. However, due to the change of needs for the elderly while sleeping, as well as to reduce another undesirable occasion such as falls (Sahota et al., 2014), then changing sleeping facilities while the elderly still in a potential state is arguably beneficial.

By using the preference of potential buyers and potential users (older people), then discussion related to the design of sleeping facilities for the elderly will be discussed and formulated. The target user for these specific mediated tools will be the older person which still categorized as potential elderly; therefore, the design will be distinguished with the hospital or long-term care bed.

2 METHODS

This study is an action research considering the potential user to improve the related existing product. Data collection method used in this study divided into two steps. The first step is to explore the potential attributes preferred by the elderly, caregiver, or the children of the elderly. The second step is to validate the emerged attributes from the first step. Both of the steps were using purposive and snowball sampling structure as part of a non-probability sampling technique with inclusion criteria to the Indonesian adult with an experience in taking care of the elderly or has the possibilities as the potential buyer for the designed sleeping facilities.

For the first step, we gathered data collection by: (1) in-depth interview related to the sleeping facilities of the elderly, like/ dislike aspects of their own bed,

their activities before, while wake up during the night and once wake up in the morning. (2) focus group discussion related to the preferred function of sleeping activities including its surroundings.

Combining those two data collection techniques was needed in this study. Along the way, the in-depth interview resulted in not too clear attributes, especially from the elderly who in general stated that they are already satisfied with their own sleeping facilities. Therefore, from the in-depth interview, it is found out that the answers are already saturated (Braun & Clarke, 2019). Hence, the saturation of the data was our argument to conduct different technique to explore the attributes.

All of the attributes emerged from step one, then converted into functional (positive statement) and dysfunctional (negative statement) following the Kano model. After converted into a functional and dysfunctional statement, in this study name as variables. Each variable will follow the Kano method as the selected approach to analyse attribute of features to design products or services. The Kano model is applied to identified customer needs and calculate customer satisfaction that helps to prioritize the importance of service qualities that can increase customer satisfaction in health service (Gupta & Srivastava, 2011). The identification of urgencies by customer requirements should then convert into Kano model using five expressions of: like, must be, neutral, live with/ neutral and dislike. However, for this study, we modified this model into 5 five steps of the Likert scale to enable inferential statistical analysis.

For the second step, the questionnaire was given in the form of functional-dysfunctional statements which were divided into three aspects: (1) mattress (14 variables); (2) divan/ bed (40 variables); and (3) surroundings of sleeping facilities (10 variables). Total 64 variables, divided into every 32 attributes were shared with paired children and elderly parents. The purpose of pairing the answers was to understand whether any discrepancies of preferred variables to define good sleeping facilities for the elderly

Other additional questions to add clustered group once needed also asked in form of: (1) sex; (2) education level; (3) appropriate price for elderly's single bed.

2.1 Participants

Participants in the first step of data collection were gathered by means of qualitative information. In this step, seven people were invited to join in-depth interview (four elderly and three caregiver/ adult who

has experience in taking care of the elderly) and for the additional data, focus group discussion were held separately. Each group discussion consists of 7 people (4 male, 3 female); 4 people (1 male, 3 female); 6 people (1 male, 5 female); and 4 people (4 female) not including at least one researcher as the moderator.

The second step data collected by sharing to 70 paired adult children with their parent(s) using an online questionnaire. Between February and April 2021, 70 paired Indonesian adults with their elderly parent(s) were given their consent to be recruited in this study. The age range for overall participants were 21-74 years old, with two majorities of age range 39-47 years old for 34% and 48-56 years old for 26%. The youngest elderly is with the age of 60 years old. The majority of the participants is women for 61%. Two majorities of education level were having bachelor's degree and master's degree for 48% and 21% respectively. The validity and reliability of each attribute explain in point 2.2.

2.2 Valid and Reliable Attributes

After the data was collected from 70 pairs of parent and child respondents, the validities of 64 variables (32 attributes) were tested and it was found that there were 10 invalid variables, so that the 10 invalid variables were filtered again to find their functional/dysfunctional partners to be dropped along with these invalid variables. Those 22 retained attributes (44 variables) then consider valid to be further usage (Sugiyono, 2017). Thereafter the process continues with a reliability test to make sure measurement reliability. The Alpha Cronbach obtains 0.875 and is believed as having high consistency to measures adequate sleeping facilities aspects for the elderly.

3 RESULTS AND DISCUSSION

Results and discussion of this study divided into point 3.1 for Mann-Whitney U-Test and 3.2 for classification using Kano method.

3.1 Mann-Whitney U Test

The pairs of children's and parent's answers to 44 variables (22 attributes) that passed the validity and reliability tests were tested on the distribution form of the answers obtained. The results of the data normality test using Kolmogorov Smirnov on the variable answers of the child and parent participants

showed that the data were not normally distributed (p <0.05), so the proof of the hypothesis would be followed by the Mann Whitney test. The results of the Mann Whitney test on 44 variables (22 attributes) show that there is no difference in opinion between the child's partner (as a potential buyer) and the parents/elderly (as a potential user) on the variables that are important in the design of bed facilities, so it can be concluded that the opinion parent is similar with their child regarding sleeping facilities for the elderly.

The results of Mann-Whitney U Test for the attributes shows that all of the null hypothesis should be retained. Here is the point of significance of each attribute, by their aspects, as follows:

1. Four valid attributes for mattress were proven for K1_2, K1_5 with the Sig. 0.179 and 0.841 respectively.
2. Eighteen valid attributes for bed/ divan proven for R1_3, R1_4, R1_5, R1_6, R1_7, R1_8, R1_9, R1_10, R1_11, R1_12, R1_13, R1_14, R1_15, R1_16, R1_17, R1_18, R1_19, R1_20 with the Sig. 0.776, 0.525, 0.693, 0.887, 0.474, 0.054, 0.189, 0.844, 0.521, 0.961, 0.689, 0.320, 0.967, 0.810, 0.505, 0.600, 0.456, 0.618 respectively
3. Four valid attributes for surroundings were proved for L1_4 and L1_5 with the Sig. 0.405 and 0.561 respectively.

3.2 Classification of the Attributes using Kano Method

The output of the functional and dysfunctional variable statements will be calculated according to the Kano classification which is divided into 6 (six) classifications according to the exposure in Table 1.

Table 1: Kano decision matrix, modified from original form (Berger, Blauth, & Boger, 1993)

Customer Requirement		Dysfunctional (negative) statement				
		L	M	N	A	D
Functional (positive) statement	L	Q	At	At	At	O
	M	R	I	I	I	M
	N	R	I	I	I	M
	A	R	I	I	I	M
	D	R	R	R	R	Q

Note:
L: Like
M: Must Be
R: Reverse
O: One Dimensional

A: Acceptable
D: Do not like
Q: Questionable
I: Indifference

N: No feeling/ Neutral
At: Attractive

Kano classification was determined by Blauth's formula (Ginting, Siregar, & Ginting, 2015) with the following algorithm:

1. (O+At+M) > (I+R+Q) with the result O/A/M selected by maximum value,
2. (O+At+M) < (I+R+Q), with the result I/R/Q selected by maximum value,
3. (O+At+M) = (I+R+Q), with the result O/A/ M/I/R/Q.

Attribute classification has the purpose to divide the strong attributes to count in the next process according to the potential customers (elderly as the user, and adult children as the potential buyer). The retained attribute will be signed with M (Must Be), At (Attractive), and O (One Dimensional) while the set aside attribute is the one with sign I (Indifference), R (Reverse), and Q (Questionable).

Attributes R1_12 (The bed needs to be easy to move) and R1_13 (The bed needs to be easy to clean underneath were the only two attributes categories as One Dimensional (O) while attributes K1_2 (The mattress is made of hard foam material) categories as Reverse (R). The other 19 attributes categories as Indifferent (I) thus will not be considered or discussed further in this study because of the inability of the attributes to influence potential customer satisfaction (Gupta & Srivastava, 2012).

Attribute coded with K1_2 (The mattress is made of hard foam material) proven categorized as a Reverse attribute. This class can be explained as the specific requirement for the quality should not appear on the product otherwise the satisfaction will be less. The mattress is a lying mat used while sleeping. A comfortable mattress is an essential element in a good night's sleep, one of which is using an excellent and comfortable type of mattress that can improve sleeping quality, fitness, relieve pain and sleepiness during the day Individuals differ as to the degree of mattress firmness that is associated with their best sleep. The best sleep quality is usually influenced by actigraphic motion, the number of awakenings, and how long the user awake during the night (Hogan, Edinger, Bieler, & Krystal, 2011).

However, this attribute is considered inconsistent and doubtful because the perception of the hardness of the mattresses is perceived differently, because in one of not validated variables, we also offer the statement with 'soft foam material' and proven to be not valid. Thus, the statement related to the mattress hardness should be directly tried by the participants, thus required further definition and explanation.

Table 2: Attributes tabulation of Kano's classification.

Code	Attributes	Q	At	O	I	M	R	OAtM	IRQ	Class.
K1_2	The mattress is made of hard foam material	26	11	3	38	1	61	15	125	R
K1_5	The mattress is equipped with anti-decubitus mats (dead tissue conditions due to sitting / sleeping too long)	6	33	29	55	10	7	72	68	I
R1_3	The bed is equipped with a headboard at the head	2	16	38	68	5	11	59	81	I
R1_4	The upper bed can be tilted (for an upright/reclining position, etc.)	2	32	24	70	3	9	59	81	I
R1_5	The lower bunk is tiltable (to raise the legs)	3	28	20	76	4	9	52	88	I
R1_6	The bed is equipped with a barrier on either side	4	20	16	73	6	21	42	98	I
R1_7	The bed is equipped with a handle that makes it easy to get out of bed	2	29	30	53	12	14	71	69	I
R1_8	The barrier on the right and left of the bed is made of a hard material when held	6	16	24	72	10	12	50	90	I
R1_9	The barrier on the right and left side of the bed is made of cold material when touched (example: iron)	5	9	10	78	4	34	23	117	I
R1_10	Light bed	3	21	21	75	5	15	47	93	I
R1_11	Heavy bed	3	11	7	88	4	27	22	118	I
R1_12	**The bed needs to be easy to move**	4	28	46	44	13	5	87	53	**O**
R1_13	**The bed needs to be easy to clean underneath**	3	26	73	19	17	2	116	24	**O**
R1_14	Bed with voice command for specific commands (example: raise down to lower position)	6	20	10	83	8	13	38	102	I
R1_15	The bed is equipped with a storage area for sanitary and medical equipment (water hoses, soap, towels, tensimeter, oxygen cylinders, necessities, etc.)	6	23	22	67	10	12	55	85	I
R1_16	The bed is equipped with a walking stick	6	24	12	79	8	11	44	96	I
R1_17	The bed is equipped with an electricity socket	2	18	22	74	4	20	44	96	I
R1_18	The bed is equipped with heaters	4	25	11	77	10	13	46	94	I
R1_19	Near the bed there is a bell/alarm that is easily accessible from a lying position	4	18	36	65	11	6	65	75	I
R1_20	There is a panic/emergency button	5	25	28	62	13	7	66	74	I
L1_4	The bed is equipped with a table for eating in bed	2	32	18	69	4	15	54	86	I
L1_5	There is an area to use the potty	3	23	22	65	10	17	55	85	I

Attribute coded with R1_12: The bed needs to be easy to move, one of two attributes that need to be fulfilled by the furniture and interior designer. The importance of moving the bed could emerge due to various reasons, including changing the arrangement or layout of furniture in the bedroom due to changes in the way of life (e.g., death of the spouse causing the space in the bed is often adapted or adjusted to current conditions). Additional furniture in the room (e.g., there are other items or storage for storing things), or adjustments due to replacement of old furniture for various reasons and these changes result in changes to the layout of the room because the size of new furniture does not match the size of the old furniture. Another reason why the bed finally needs to be moved easily can also occur because the needs to clean the house thoroughly frequently (e.g., for Chinese Indonesian people, annually cleaning the house, including the bed right before Chinese New Year).

Attribute coded with R1_13: The bed needs to be easy to clean underneath, which is the other attribute that needs to be fulfilled by furniture designers or service providers to consumers (elderly). The bed needs to be easy to clean underneath for comfort reasons to achieve hygienic reasons. A bed that is easy to clean underneath should, in other ways can be fulfilled when the bed is easily moved. However, not every bedroom's layout has the flexibility to move furniture when cleaning the room. The need or urgency for cleaning the room is directly related to the material used to traditionally fill the mattress, namely kapok (Java Cotton). Mattress filling materials nowadays have gradually changed by foam, spring bed, latex, and even using a special contoured material to treat the patient's decubitus condition. However, for the elderly that most of whom were born in 1960 and earlier, it is still common to use kapok as a filler for mattresses, pillows, and bolsters.

The standard preference to use kapok as the material used also correlates with Indonesia's condition as one of the largest kapok producers in the world (Mardiyati, Raden Reza Rizkiansyah, Steven Steven, Arif Basuki, & Suratman., 2016) which allows easy access or use of this material. Unfortunately, kapok, which is a natural material, has a weakness, namely, it produces visible dust particles and needs to be cleaned periodically because of the potential as a place for mites to develop. As for cleaning the cotton mattress, occasionally, the mattress will be lay under the sun and turned over. The method, although frequently done to prevent house dust mites, will expel even more dust particles into the air. The activity of laying and turning the

mattress also results in a thinner mattress design so that it is lighter to lift when compared to a spring bed type.

Once associated with bed designs that need to be easily cleaned at the bottom, the bed design for cotton mattresses is often different from bed designs for spring or latex mattresses. Bed designs for cotton mattresses in Indonesia generally use a solid wood (e.g., teak wood) or iron frame that is painted or layered, the bottom of the bed often has space, and by calculating the thickness of the mattress that ranges from 8 to 15 cm, the area at the bottom of the bed is relatively easy to clean using traditional cleaning tools. The habit of cleaning the bottom of the bed regularly done by the elderly has changed gradually with the trend of optimizing free space underneath to make it more useful because there is a reduction in a room or house with higher property prices. However, both of the attributes concern as the additional value for elderly's sleeping facilities, not must have one.

4 CONCLUSIONS

This study shows that the two generations still have the same perception about providing the best sleeping facilities for the elderly. There is no difference in perceptions of the attributes that have been previously explored in this study. However, not all attributes influence user satisfaction.

The two attributes that are still desirable in the design of sleeping facilities for the elderly related to the habits of society in Indonesia can be said to be unique and still need to be maintained well to the procurement for furniture or interior designers because the increasing number of elderly populations will lead to higher demand. Even though, in general, the use of furniture has a long service life, it cannot be denied that there are changes in the way of life of the elderly in their old age, causing the need for a readjustment of interior design both in the bedroom in general, as well as in the creation of the bed in particular.

Furthermore, paying attention to the good habits of the elderly who have been fostered since they were young and combining them with technology, materials, and designs is alleged to be maintained the quality of life of the elderly in their old age.

For further research, this study will be followed up with recommendations for the design of sleeping facilities for potential older adults by taking into account the attributes obtained and the two main attributes, namely the ease of the bed that is easily

shifted and the bottom part of which is easy to clean which most affects user satisfaction.

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REFERENCES

Act of the Republic of Indonesia on welfare of the elderly (Undang-undang Republik Indonesia tentang kesejahteraan lanjut usia). (no. 13). (1998).

Berger, C., Blauth, R. E., & Boger, D. (1993). Kano's methods for understanding customer-defined quality. *CQM journal, 2*(4), 3-35.

Blackwell, T., Yaffe, K., Ancoli-Israel, S., Schneider, J. L., Cauley, J. A., Hillier, T. A., . . . Stone, K. L. (2006). Poor sleep is associated with impaired cognitive function in older women: the study of osteoporotic fractures. *J Gerontol A Biol Sci Med Sci, 61*(4), 405-410. doi:10.1093/gerona/61.4.405

Bliwise, D. L. (1993). Sleep in normal aging and dementia. *Sleep, 16*(1), 40-81. doi:10.1093/sleep/16.1.40

Braun, V., & Clarke, V. (2019). To saturate or not to saturate? Questioning data saturation as a useful concept for thematic analysis and sample-size rationales. *Qual Res Sport Exerc Health*. doi:10.1080/2159676X.2019.1704846

Castillo-Rodríguez, A., Onetti-Onetti, W., Mendes, R. S., & Chinchilla-Minguet, J. L. (2020). Relationship between Leg Strength and Balance and Lean Body Mass. Benefits for Active Aging. *Sustainability, 12*(6), 2380. doi:10.3390/su12062380

Ginting, R., Siregar, I., & Ginting, T. U. H. S. (2015). Perancangan alat penyadap karet di kabupaten langkat Sumatera Utara dengan metode Quality Function Deployment (QFD) dan model Kano. *J@ti Undip: Jurnal Teknik Industri,, X*(1), 33-40.

Gupta, P., & Srivastava, R. K. (2011). Customer satisfaction for designing attractive qualities of healthcare service in India using Kano model and Quality Function Deployment. *MIT International Journal of Mechanical Engineering, 1*, 101-107.

Gupta, P., & Srivastava, R. K. (2012). Analysis of customer satisfaction of the hotel industry in India using Kano model & QFD. *IJRCM 2*(1 (January)), 74-81.

Hogan, S., Edinger, J. D., Bieler, G., & Krystal, A. D. (2011). Choosing the best mattress: an experiment in testing whether individuals choose a bed that leads to improved sleep. doi:10.3768/rtipress.2011.rr.0016.1108

Mardiyati, M., Raden Reza Rizkiansyah, Steven Steven, Arif Basuki, & Suratman., R. (2016). Serat kapuk sebagai bahan baku pembuatan mikrokristalin selulosa. *JUSAMI, 17*(4), 172-177. doi:10.17146/jsmi.2016.17.4.4179

McDonald, P. (2014). A population projection for Indonesia, 2010–2035. *Bull. Indones. Econ. Stud., 50*(1), 123-129. doi:10.1080/00074918.2014.896240

Nebes, R. D., Buysse, D. J., Halligan, E. M., Houck, P. R., & Monk, T. H. (2009). Self-reported sleep quality predicts poor cognitive performance in healthy older adults. *The journals of gerontology. Series B, Psychological sciences and social sciences, 64*(2), 180-187. doi:10.1093/geronb/gbn037

Sahota, O., Drummond, A., Kendrick, D., Grainge, M. J., Vass, C., Sach, T., . . . Avis, M. (2014). REFINE (REducing Falls in In-patieNt Elderly) using bed and bedside chair pressure sensors linked to radio-pagers in acute hospital care: a randomised controlled trial. *Age Ageing, 43*(2), 247-253. doi:10.1093/ageing/aft155

Sari, N. R., Maylasari, I., Dewi, F. W. R., Putrianti, R., Nugroho, S. W., & Wilson, H. (2020). *Statistik penduduk lanjut usia 2020 (Elderly population statistics 2020)*. Retrieved from Jakarta:

Sarvia, E., Wianto, E., Yudiantyo, W., Apriyani, P., & Costa, G. B. d. (2021). Anthropometric database for initial screening of elderly health status (basis data antropometri untuk skrining awal status kesehatan lansia). *JIS, 4*(1).

Sugiyono. (2017). *Metode penelitian kuantitatif, kualitatif dan R&D*. Bandung: Alfabeta.

Wolkove, N., Elkholy, O., Baltzan, M., & Palayew, M. (2007). Sleep and aging: Sleep disorders commonly found in older people. *CMAJ 176*(9), 1299-1304. doi:10.1503/cmaj.060792