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INVESTIGATING OF OLDER PEOPLE HOUSE DESIGN VARIABLES AND ITS EFFECT ON MENTAL HEALTH DISORDERS

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ABSTRACT

The Wreda's house is a specific house for older people experiencing an interpersonal conflict in the family. This conflict can cause mental disorders which coincide with increasing stress. World Health Organization expressed that 15% to 55% of the world's older people experienced such disorders. Meanwhile, in Indonesia, this condition acquires 8,34% to 12,5%. Hence, it is crucially required the house more comfortable mentally. However, the majority of the existing older people house developed still does not satisfy the Indonesian's requirements in which the older people-friendly city achievement category index was less than the standard (75%) which was 48,3%. The objective of this study is to investigate the design variables of the older people house and its effect on mental disorders. The paper-based and computer-based survey were administered to identify what the older people want for the housing development. 30 respondents were participated in this study whose age was more than 55 years old and was in normal health condition. Structural Equation Model-Partial Least Square is implemented to determine the significance level of variables considered in the design. The result of this study discovered two valid main variables which possessed a significant influence on the Mental Health Disorders considered Independent Assistance Variable (ta = 2.011) and Environmental Information Variable (t_a = 2.328). Each variable contains two dimensions and several indicators. Toileting and Bathing Standards dimension encompassed spacious restroom, sitting a closet, comfortable toilet grab bars, the door opens to the outside, toilet dry floor, comfortable shower chair, comfortable flush handle and Incontinence Avoidance dimension embodying clear guide direction. As for Purposeful Wandering dimension covering the accessible residential area, ergonomics environmental park, flexible wheelchair while Locating Individual Resident Rooms dimension contains comfortable furniture design and clear bedroom guidance.

***Keywords**: Mental Disorders, Older People House, Structural Equation Model, Partial Least Square, the Wreda's House*

INTRODUCTION

Globally, the older people population continues to increase approximately from 2015 to 2050 as much as 12% up to 22%[1]. In Indonesia, this growth had achieved about 25 million or 9.6% in the last 50 years in 2019 even more in 2021[2]. This fact obliges the government to provide reasonable facilities housing for them in accordance with Law of 1945 Article 28 letter H and Law Number 13 of 1998 concerning Elderly Welfare[3,4].

World Health Organization (WHO) conveys that 15% of the older people population in the world experiencing mental disorders as much as 10% to 55% was caused by stress[5]. Whilst in Indonesia, the prevalence of older people stress acquires 8.34% to 12.5% [6].

This stress is mostly caused by an interpersonal conflict which occurred in the family in addition to the self-condition and is associated with other people[7]. Consequently, the older people require a residence for staying comfortably understood as the Wreda's house or nursing house. However, this house should possess a criterion which satisfies what the residences want and also the existing government requirement.

In Indonesia, the existing older people homes mostly have not attained the older people-friendly city index which is still at 48.3% far below the standard (i.e., 75%). It tremendously exhibits the house which may be able to cause mental health disorders for residents. Hence, it is crucial to determine some variables of the older people house to develop.

The objective of this study is to investigate the variable and indicator design of the Wreda's house to minimize mental health disorders.

METHODS

Survey

The qualitative survey was conducted on 30 respondents to identify what the older people need of the house and the effect on mental health disorders. The respondents' age was in the range between 50 years old to 90 years old in which they possess a normal health condition and it is dominated by males.

A likert scale questionnaire was employed in this survey administering from a very disagree (1) to a very agree (5) scale for both. The first questionnaire was developed based on the Long-

Term Care Homes Guideline, consisting of Basic Design Latent Variables, Ambiance, Environment, Independence Assistance, and Environmental Information (see Figure 1)[8]. Meanwhile, identifying the mental health disorders employs the Depression, Anxiety, and Stress Scale 21 (DASS-21)[9,10,11].

Structural Equation Modeling

The non-parametric statistical analysis was administered by implementing a multivariate statistic of Partial Least Square-Structural Equation Modeling (PLS-SEM). This method does not require the assumption of a normal data distribution and allows to involve unobservant variables which are merely examined indirectly as indicator variables or latent variables[12].

PLS-SEM employing the Smart-PLS 3.0 software was evaluated through two iterative processes which are Measurement Model and Structural Model[13], elaborated as follows.

Measurement Model (Outer Model)

Convergent Validity

Convergent validity is to analyze the loading factor or correlations between item or indicators scores and construct or variables scores. The criteria of decision-making are based on the loading factor value. If the value is higher than 0.5, it is identified as a convergent. Meanwhile, the loading factor value is below 0.5, then a cut-off or dropping indicator is administered.

Discriminant Validity

Discriminant validity is employed to calculate the cross-loading of the indicators' outer loading on the associated construct. Thus, the decision-making criteria are the cross-loading value of outer loading on the associated construct which should be higher than its loading on other constructs. It implies that the cross-loading possesses good discriminant validity.

Composite Reliability

Composite reliability is employed to assess the reliability of the measurement model from each construct without any assumptions. The decision-making criteria are if the composite reliability value is 0.6, it is classified into a quite good. Moreover, if this value is 0.7, it is considered as good, and if the value is 0.8, it is very good.

Structural Model (Inner Model)

Coefficient of Determination (R^2)

Test of variance (R^2) is performed to identify how much the variability of the dependent construct is affected by the independent construct. Thus, the decision-making criteria are if the value of R^2 is 0.19, it is classified as weak. Meanwhile, if the value of R^2 is 0.30, it is considered as moderate and if the value is 0.67, it is identified as good.

Predictive Relevance (Q^2)

Predictive Relevance (Q^2) is conducted to determine how well the observed value of the model and its parameter estimates are. The decision-making criteria are if the value of Q^2 is higher than 0, the model possesses good predictive relevance. The formula implemented is as follows.

$$Q^2 = 1(1 - R1^2)(1 - R2^2)\ldots (1 - Rn^2) \quad (1)$$

Path Coefficient

Path coefficient is implemented to measure the hypothesis through the significance of the relationship between constructs by applying t-test or P-values. The decision-making criteria are if the t-test value is less than 1.699 or P-value higher than 0.5, null hypothesis (H_0) is accepted. It means that there is no significant effect between one of the independent variables and the dependent variable. The test hypothesis on the inner model is presented as follows.

***Table 1**: Hypothesis of the Model.*

Hypothesis	Descriptions
H1	Basic Design affecting the Mental Health Disorders
H2	Ambiance affecting the Mental Health Disorders
H3	Environment affecting the Mental Health Disorders
H4	Independence Assistance affecting the Mental Health Disorders
H5	Environmental Information affecting the Mental Health Disorders

RESULTS

Result of the Measurement Model Evaluation

Convergent Validity

Table 2 presents the result of the convergent validity test in which the dimension and indicator items of outer loading are valid to be convergent (> 0.5). It indicates that all items in the first order and in the second order own good correlations as they are being accurate as a substructure to construct the structural equation model of the elderly house development.

Discriminant Validity

Table 3 displays the result of the discriminant validity test among indicators to variables which indicators; BL1, BL2, BL3, BL4, BL5, BL6, PS1, PS2, PS3, AO5, AO6 possess a significant influence to Basic Design variable; RC1, RC6, RK1, RK10, RK5, RK7, FA1, FA2, FA3, FA4, FA5 possess a significant influence to Ambiance variable; EL1, EL5, EL6, CC1, CC3, CC4, TAQ5, TAQ6 own a significant influence to Environment variable; TBS10, TBS11, TBS14, TBS3, TBS4, TBS5, TBS6, TBS8, TBS9, IA3 have a significant influence to Independence Assistance variable; PW1, PW2, PW6, LRR4, LRR8

own a significant influence to Environmental Information variable; and D3, D5, A2, A3, S4, S5, S6, S7 possess a significant influence to Mental Health Disorders variable. Meanwhile, each indicator to the other variables encompasses an insignificant influence. Thus, it is indicated that all indicators can be considered as a part of their variables.

Composite Reliability

Table 4 illustrates the result of the composite reliability test in which the dimensions and the variables are classified as reliable (> 0.7). It identifies each indicator used in the survey own an internal consistency.

Result of the Structural Model for Wreda's House Development

Figure 1 presents a structural model of requirements considered for the Wreda's house development. These requirements encompass five variables. The Basic Design constitutes a variable design covering planning, designing, and building activities consisting of Building Layout dimension with indicators: freely to move, less corridor, a sign of direction, private area, no blind alley, and social activities room. Meanwhile, the Population Size dimension is provided with indicators: ample roomy, house facilities, and the lounge. Access to Outdoor dimension is provided with indicators: aisle facilities, and safe park. As for the Ambiance is a variable design encompassing creating and stimulating activities which comprises of Residential Character dimension with indicators: furniture facilities, and adjacent room. Moreover, Residential Kitchens dimension is designed with indicators: kitchen room, dish rack area, heating device, and dry kitchen. Flexibility & Autonomy dimension is arranged with indicators: relax room, special aisle, glass cupboard, furniture bedroom, and workshop room. Meanwhile, the Environment is a variable design covering lighting, noise level, temperature, colour, pattern, and contrast settings activities consisting of Exposure to Light dimension presented with indicators: ventilation, led lighting, and natural lighting. Furthermore, Color and Contrast dimension is provided with indicators: bright lighting, contrast, and not glare and noise. Temperature & Air Quality dimension is designed with indicators: temperature controller, and comfortable temperature.

The Independence Assistance is a variable design which covers support independence activities consisting of Toileting & Bathing Standards dimension arranged with indicators: mechanical toilet, solid tank toilet, swing up and down grab bars, comfortable grab bar, open-out direction door, smooth grab bar, dry bathroom, shower chair with armrest, and handle flush. Meanwhile, Incontinence Avoidance dimension is presented with indicators: clear direction sign.

The Environmental Information is a variable design encompassing orientation and direction guidance activities which comprises of Purposeful Wandering dimension with indicators: indoor and outdoor area, comfortable environment, and flexible wheelchair. Meanwhile, Locating Individual Resident Rooms dimension is provided with indicators: comfortable furniture design, and clear bedroom guidance.

Coefficient of Determination (R^2) and Predictive Relevance (Q^2)

The results of the determination coefficient test and the predictive relevance test by administering the Goodness of Fit R-Square is 0.806.

Path Coefficient

Table 5 illustrates the hypothesis test result of the structural model in which two of the five independent variables possess a significant influence on the dependent variable at 5% of the significant level.

DISCUSSION

Basic Design, Ambiance, Environment, Independence Assistance, and Environmental Information are essential variables to be the criteria which should be regarded in constructing the house for the older people. It is because they are be able to alleviate or prevent mental health disorders. Hence, when developing the house for the older people by considering the variable above emphasizing on the several referred indicators, it ensures the increase of comfort for the residents which they do not experience the mental health disorders at all. These variables indicate that the developed model possesses good quality in explaining the effect to the dependent variable as it is presented by Ghozali [13] in which the minimum of R^2 is 0.670. Meanwhile, the predictive relevance test presents a result of 0.806 implying that the Q^2 value revealed that the model owns good predictive relevance so as the structural model developed may be as basic in developing the house.

Result of path coefficient also justifies that the mental health disorders are influenced by Independence Assistance (P-value = 0.045) and Environmental Information (P-value = 0.020) seriously. These two variables are prioritized in designing older people-friendly home for minimizing the disorders includes design toileting and bathing standard to incontinence avoidance as well as an accessible indoor/outdoor area for free activities and a room to locate materials of one's own.

Table 2: Measurement Model of Convergent Validity Test

First Order			Second Order			
Dimensions	**Outer Loading**	**Decision**		**Indicators**	**Outer Loading**	**Decision**
Building Layout (BL)	0.967	Valid	BL1:	Freely to move	0.690	Valid
			BL2:	Less corridor	0.767	Valid
			BL3:	Sign of direction	0.678	Valid
			BL4:	Private area	0.599	Valid
			BL5:	No blind alley	0.747	Valid
			BL6:	Social activities room	0.748	Valid
Population Sizes (PS)	0.659	Valid	PS1:	Ample roomy	0.755	Valid
			PS2:	House facilities	0.678	Valid
			PS3:	The lounge	0.869	Valid
Access To Outdoors (AO)	0.652	Valid	AO5:	Aisle facilities	0.801	Valid
			AO6:	Safe Park	0.877	Valid
Residential Character (RC)	0.812	Valid	RC1:	Furniture facilities	0.901	Valid
			RC6:	Adjacent room	0.755	Valid
Residential Kitchens (RK)	0.933	Valid	RK1:	Kitchen room	0.850	Valid
			RK5:	Dish rack area	0.911	Valid
			RK7:	Heating device	0.825	Valid
			RK10:	Dry kitchen	0.534	Valid
Flexibility & Autonomy (FA)	0.845	Valid	FA1:	Relax room	0.583	Valid
			FA2:	Special aisle	0.774	Valid
			FA3:	Glass cupboard	0.528	Valid
			FA4:	Furniture bedroom	0.753	Valid
			FA5:	Workshop room	0.655	Valid
Exposure to Light (EL)	0.863	Valid	EL1:	Ventilation	0.713	Valid
			EL5:	LED lighting	0.709	Valid
			EL6:	Natural lighting	0.771	Valid
Colours and Contrast (CC)	0.900	Valid	CC1:	Bright lighting	0.881	Valid
			CC3:	Contrast	0.597	Valid
			CC4:	Not glare & noisy	0.841	Valid
Temperature & Air Quality (TAQ)	0.704	Valid	TAQ5:	Temperature controller	0.836	Valid
			TAQ6:	Comfort temperature	0.879	Valid
Toileting & Bathing Standards (TBS)	0.993	Valid	TBS3:	Mechanical toilet	0.654	Valid
			TBS4:	Solid tank toilet	0.756	Valid
			TBS5:	Swing up and down grab bars	0.884	Valid
			TBS6:	Comfortable grab bar	0.826	Valid
			TBS8:	Open out direction door	0.626	Valid
			TBS9:	Smooth grab bar	0.901	Valid
			TBS10:	Dry bathroom	0.863	Valid
			TBS11:	Shower chair with armrest	0.751	Valid
			TBS14:	Handle flush	0.781	Valid
Incontinence Avoidance (IA)	0.795	Valid	IA3:	Clear direction sign	1	Valid
Purposeful Wandering (PW)	0.938	Valid	PW1:	Indoor & outdoor area	0.849	Valid
			PW2:	Comfort environment	0.811	Valid
			PW6:	Flexible wheelchair	0.532	Valid
Locating Individual Resident Rooms (LRR)	0.885	Valid	LRR4:	Comfortable furniture design	0.729	Valid
			LRR8:	Clear bedroom guidance	0.885	Valid
Depression (D)	0.761	Valid	D3:	Difficult to relax	0.875	Valid
			D5:	Anxious feeling	0.904	Valid
Anxiety (A)	0.823	Valid	A2:	Difficult to breath	0.859	Valid
			A3:	Easy to limp	0.813	Valid
Stress (S)	0.929	Valid	S4:	Depression	0.591	Valid
			S5:	Lost spirit	0.681	Valid
			S6:	Worthless	0.639	Valid
			S7:	Useless	0.753	Valid

Table 3: Measurement Model of Discriminant Validity Test

Indicators	Basic Design	Ambiance	Environment	Independence Assistance	Environmental Information	Mental Health Disorders
BL1	**0.670**	0.384	0.405	-0.561	0.241	-0.607
BL2	**0.747**	0.610	-0.157	-0.568	0.395	-0.620
BL3	**0.677**	0.309	-0.037	-0.291	-0.040	-0.307
BL4	**0.552**	0.405	0.255	-0.475	0.267	-0.297
BL5	**0.692**	0.586	-0.314	-0.582	0.415	-0.631
BL6	**0.744**	0.392	0.146	-0.332	0.122	-0.423
PS1	**0.569**	0.163	0.116	-0.243	-0.069	-0.285
PS2	**0.376**	0.273	0.096	-0.168	-0.310	-0.003
PS3	**0.548**	0.058	0.147	0.028	-0.475	0.108
AO5	**0.417**	0.194	-0.201	-0.486	0.336	-0.518
AO6	**0.575**	0.202	-0.041	-0.592	0.041	-0.465
RC1	0.636	**0.772**	-0.112	-0.865	0.623	-0.788
RC6	0.185	**0.559**	-0.179	-0.322	0.301	-0.261
RK1	0.277	**0.759**	-0.113	-0.618	0.229	-0.430
RK10	0.424	**0.624**	-0.101	-0.359	0.504	-0.536
RK5	0.410	**0.841**	-0.092	-0.719	0.568	-0.696
RK7	0.429	**0.708**	0.025	-0.598	0.312	-0.543
FA1	0.353	**0.632**	0.185	-0.328	0.487	-0.488
FA2	0.425	**0.703**	-0.035	-0.511	0.356	-0.526
FA3	0.284	**0.259**	0.137	-0.029	-0.097	-0.040
FA4	0.297	**0.587**	-0.057	-0.227	0.131	-0.088
FA5	0.145	**0.456**	-0.312	-0.129	0.101	-0.104
EL1	-0.063	0.184	**0.567**	-0.230	0.125	-0.062
EL5	0.422	0.192	**0.637**	-0.126	0.270	-0.217
EL6	0.012	-0.276	**0.682**	0.182	-0.184	0.122
CC1	0.147	-0.001	**0.833**	-0.048	-0.050	-0.092
CC3	-0.215	0.061	**0.490**	0.130	0.029	0.152
CC4	0.049	-0.231	**0.742**	0.301	-0.336	0.191
TAQ5	-0.077	-0.067	**0.559**	0.217	0.043	0.115
TAQ6	-0.137	-0.279	**0.645**	0.212	0.020	0.028
TBS10	-0.485	-0.673	-0.068	**0.860**	-0.514	0.697
TBS11	-0.731	-0.724	-0.032	**0.744**	-0.222	0.644
TBS14	-0.341	-0.390	0.295	**0.770**	-0.380	0.620
TBS3	-0.416	-0.364	0.152	**0.617**	0.105	0.315
TBS4	-0.300	-0.402	0.274	**0.707**	-0.222	0.591
TBS5	-0.523	-0.696	0.187	**0.900**	-0.609	0.745
TBS6	-0.658	-0.564	0.067	**0.852**	-0.453	0.772
TBS8	-0.592	-0.408	-0.201	**0.597**	-0.042	0.467
TBS9	-0.596	-0.709	0.069	**0.919**	-0.420	0.720
IA3	-0.587	-0.701	0.198	**0.795**	-0.538	0.682
PW1	-0.038	0.218	0.030	-0.213	**0.821**	-0.409
PW2	0.115	0.235	0.237	-0.160	**0.737**	-0.459
PW6	0.326	0.458	-0.246	-0.430	**0.493**	-0.513
LRR4	-0.145	0.301	-0.097	-0.132	**0.487**	-0.219
LRR8	0.362	0.702	-0.111	-0.625	**0.874**	-0.642
D3	-0.624	-0.405	0.257	0.547	-0.269	**0.632**
D5	-0.535	-0.535	0.229	0.621	-0.504	**0.719**
A2	-0.236	-0.625	-0.082	0.551	-0.641	**0.730**
A3	-0.357	-0.226	-0.211	0.514	-0.427	**0.642**
S4	-0.322	-0.328	-0.019	0.356	-0.279	**0.580**
S5	-0.464	-0.596	0.248	0.587	-0.377	**0.602**
S6	-0.431	-0.464	-0.210	0.347	-0.649	**0.634**
S7	-0.474	-0.460	-0.011	0.700	-0.216	**0.660**

Meanwhile, Basic Design, Ambiance, and Environment variables do not possess a significant influence seriously because most respondents encountered quite satisfied with the existing house. This satisfaction shows the good mental health of the residents.

However, those variables are still very feasible to be considered in designing older people housing for an improvement. It is because those five identified variables are the result of a systematic review employing Evidence-Based Design (EBD) which possesses as many as 2.642 papers conducted by Wrublowsky[8] and in the results of the variance test, it is involved in the five variables that affecting the mental health disorders by 80.6%.

Table 4: Measurement Model of Composite Reliability Test

Dimensions	Composite Reliability
Building Layout	0.856
Population Sizes	0.815
Access to Outdoors	0.825
Residential Character	0.818
Residential Kitchens	0.868
Flexibility and Autonomy	0.796
Exposure to Light	0.775
Color and Contrast	0.822
Temperature and Air Quality	0.848
Toileting and Bathing	0.936
Standards	1
Incontinence Avoidance	0.782
Purposeful Wandering	
Locating Individual Resident	0.785
Rooms	0.883
Depression	0.823
Anxiety	0.762
Stress	
Variables	
Basic Design	0.862
Ambiance	0.881
Environmental	0.853
Assistive Measures to Support Independence	0.940
Environmental Information	0.821
Mental Health Disorders	0.854

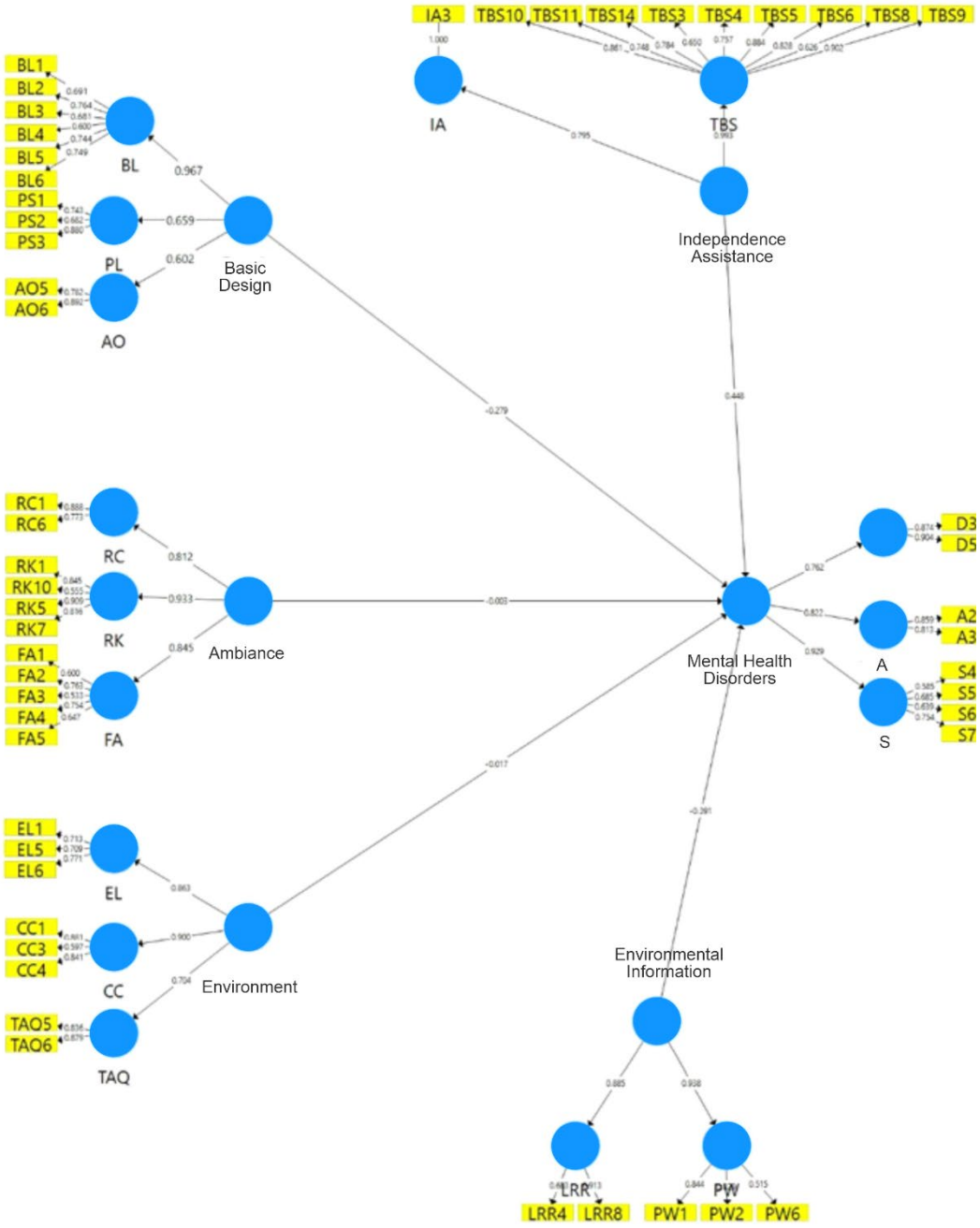

Figure 1: Structural Model for The Wreda's House Development

Table 5: Structural Model of Path Coefficient Test

Constructs Correlation	Original Sample (O)	T Statistics (|O/STDEV|)	P Values
Basic Design - Mental Health Disorders	-0.279	1.449	0.148
Ambiance - Mental Health Disorders	-0.003	0.015	0.988
Environmental - Mental Health Disorders	-0.017	0.143	0.886
Assistive Measures to Support Independence - Mental Health Disorders	0.448	2.011	0.045
Environmental Information - Mental Health Disorders	-0.391	2.328	0.02

CONCLUSION

It is concluded that what are required in fulfilling the criteria for designing an older people-friendly house are the Independent Assistance Variable with Toileting and Bathing Standards dimensions, Incontinence Avoidance and Environmental Information Variables with Purposeful Wandering and Locating Individual Resident Rooms dimensions. Meanwhile, Basic Design, Ambiance, and Environment variables along with their dimensions and indicators remain variables affecting mental health disorders in the older people but with insignificant effects in this study.

Recommendation for future research is the need for more detailed consideration to develop the wreda's house that meet these criteria by involving ergonomic and economic issues to design all supporting facilities that can prevent or alleviate resident discomfort.

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Competing interests
Authors confirm that this work is original and has not been published elsewhere, nor is it currently under consideration for publication elsewhere. And this publication is approved by all authors.

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