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Pest Control Strategies in Hotel: A Case of Kathmandu Valley

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Abstract

This study examines the pest control strategies in hotel: A case of Kathmandu Valley. Customer health is the dependent variable. The selected independent variables are type of pests, pest infestation level, building and room design, cleaning and maintenance practices, environmental factor, pest control products and methods. The primary source of data is used to assess the opinions of the respondents regarding type of pests, pest infestation level, building and room design, cleaning and maintenance practices, environmental factor, pest control products and methods. The study is based on primary data of 100 respondents. To achieve the purpose of the study, structured questionnaire is designed. The regression models are estimated to test the significance and importance of pest control strategies in hotel: A case of Kathmandu Valley.

The study shows that types of pests is positively correlated to customer health. It indicates that different types of pests used by the hotels leads to reduce health related issues. Similarly, pest infestation level is positively correlated to customer health. It indicates that as the level of pest infestation increases, the risk of customer health problems also increases. Likewise, building and room design is positively correlated to customer health. It indicates that a well-designed buildings and rooms can have positive impact on customer health. Further, cleaning and maintenance is negatively correlated to customer health. It indicating that by cleaning and disinfecting surfaces regularly, businesses can help to reduce the number of germs and bacteria which can lead to reduce number of health problems. In addition, environmental factor is negatively correlated to customer health. It indicates that exposure to excessive noise levels, whether from traffic, industrial activities, or construction sites, can have negative effects on health. Moreover, pest control products and methods are also positively correlated to consumer health. It indicates that high quality product used for germ and bacteria leads to reduce issues related to customer health.

Keywords: types of pests, pest infestation level, building and room design, cleaning and maintenance practice, environmental factor, customer health

1. Introduction

Pest control is the regulation or management of a species defined as a pest, such as any animal, plant or fungus that impacts adversely on human

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activities or environment (Elliott *et al.*, 1995). Pest control is group of methods to control some species of animals and plants that are considered by humans as harmful to their health, economy, or ecology (Cranshaw, 2014). It is as old as agriculture, as there has always been a need to keep crops free from pests. To get best results from food production there was always needed to protect crops from competing plants trying to kill the crops to grow in its place (Woody and Todd, 2010). Rodents are simple pests that require only the very basics to survive food, water, and shelter. An infestation of rodents in a healthcare facility is especially dangerous because these pests can carry disease and spoil food with the bacteria and viruses they harbour in their saliva and droppings. Hiring a professional pest control company to conduct an assessment of your facility is advisable for prevention purposes. Integrated pest management is gaining more attention among researchers and its application is also increasing in the crop field. This method seeks to reduce the reliance on pesticides by emphasizing the contribution of biological control agents.

The important role of microbial pesticides in integrated pest management is well-known in agriculture, forestry, and public health. As integrated pest management, bio-pesticides give noticeable pest control reliability in case of crops (Abraha *et al.,* 2021). Biological control can also be used to manage pest populations that have developed pesticide resistance. Many are considering biological control.

Ab and Zahran (2015) found that one of the pest that the hotel try to tackle with is the bed bug which is followed many strategies to fights with bedbug by spray method they only get success to remove 66.7%. They have higher the professional pest control to control it by paying huge amount. But the complete eradication per site is very low 41.7%. Similarly, Lee *et.al.,*(1999) found that many of the hotel have used spray strategies to control the cockroach using insecticide (propoxur, chlorpyrifos, permethrin and deltamethrin) but they have seen the resistance of those chemical in the cockroach. Hotel were unable to kill the cockroach using the insecticide and their strategies was seemed to be failed. Likewise, Desoky (2019) stated that an infestation of rodents in a healthcare facility is especially dangerous because these pests can carry disease and spoil food with the bacteria and viruses they harbour in their saliva and droppings. Exposure to dangerous pathogens could be disastrous for already health-compromised Customer. In addition, Zulaikha *et al.* (2015) stated that Bed bugs cases have been at alarming rate in most foreign countries compared to Southeast Asia, especially in Malaysia.

Lack of morphological understanding and ways to control among the society and professionals have become factors of their resurgence.

An online survey was conducted among pest control operators (PCO) from different pest control companies in nine states of Malaysia to investigate the commonly used technique in treating bed bugs. The forms were distributed via online to all pest control companies but only 48 of them have responded. Other preferences such as type of premises, number of cases, number of successful treatment and resistance in bed bugs after residual treatment were also included in the questionnaires. It was found that most Pest Control companies preferred chemical and spray method for view metadata, citation, and similar papers at core.ac.uk brought to you by CORE provided by UKM journal article repository treatment (66.7%) especially in Kuala Lumpur and Selangor which also had the highest infestation of bed bugs in their premises such as hotels and residential houses. Most companies prefer RM500-1000 as charging cost per treatment site. Although professionals hardly find resistance bed bugs in their treatment cases (75%), the number of complete eradications per site has been very low (41.7%). Therefore, improvements in treating bed bugs should be investigated in detail to prevent widespread of bed bugs throughout Malaysia.

Bed bug infestations have been recorded in all 50 states of the United States and they were listed as the number one urban pest problem in 2010 by urban pest management professionals. The objective of this research was to survey urban pest management professionals of South Carolina about the importance and prevalence of bed bugs, types of infested dwellings, most common treatment strategies, and most common problems encountered when treating for bed bugs. Survey forms were distributed at the South Carolina Pest Control Association's annual meeting in 2011. Data are separated according to regions of South Carolina (upstate, midlands, and low country) for analysis. Ants and cockroaches ranked as the two most important pests in all regions, while bed bugs consistently ranked fifth in importance. Houses and apartments were reported to have the most infestations, and insecticides and mechanical removal were the most common treatment strategies. This information is beneficial to state agencies, pest control companies, and extension specialists in South Carolina who are repeatedly called for advice about bed bugs and their infestations (Lehnert *et al.,* 2012).

The above discussion shows that the empirical evidence vary greatly across the studies on the pest control strategies in hotel. Though there are above mentioned empirical evidences in the context of other countries and in

Nepal, no such findings using more recent data exist in the context of Nepal. Therefore, in order to support one view or the other, this study has been conducted.

The major objective of the study is to examine the pest control strategies in hotel: A case of Kathmandu Valley. Specifically, it examines the relationship of types of pests, pest infestation level, building and room design, cleaning and maintenance, environmental factor with customer health in Kathmandu Valley.

The remainder of this study is organised as follows: section two describes the sample, data, and methodology, section three presents the empirical results and final section draws the conclusion.

2. Methodological aspects

The study is based on the primary data which were collected from 100 respondents through questionnaire. The study employed convenience sampling method. The respondents' views were collected on types of pests, pest infestation level, building and room design, cleaning and maintenance practice, environmental factor, pest control product and methods, and customer health. This study is based on descriptive as well as causal comparative research designs.

The model

The model used in this study assumes that customer health depends upon pest control strategies. The dependent variable selected for the study is customer health. Similarly, the selected independent variables are types of pests, pest infestation level, building and room design, cleaning and maintenance practice, environmental factor, and pest control product and methods. Therefore, the model takes the following form:

$$CH = \beta_0 + \beta_1 TOP + \beta_2 PIL + \beta_3 BARD + \beta_4 CAMP + \beta_5 EF + \beta_6 PCPAM + e$$

Where,

CH = Customer health

TOP = Types of pests

PIL = Pest infestation level

BARD = Building and room design

CAMP = Cleaning and maintenance practices

EF = Environmental factor

PCPAM = Pest control product and method

Types of pests was measured using a 5-point Likert scale where the respondents were asked to indicate the responses using 1 for strongly disagree and 5 for strongly agree. There are 5 items and sample items include "The use of chemical pesticides is effective in controlling a wide range of pests and promotes consumer health", "Consumer health risks are significantly increased when using chemical pesticides to control certain types of pests" and so on. The reliability of the items was measured by computing the Cronbach's alpha ($\alpha = 0.804$).

Pest infestation level was measured using a 5-point Likert scale where the respondents were asked to indicate the responses using 1 for strongly disagree and 5 for strongly agree. There are 5 items and sample items include "The severity of pest infestation has a direct impact on consumer health", "Adequate pest control measures can prevent the transmission of diseases and infections to consumers" and so on. The reliability of the items was measured by computing the Cronbach's alpha ($\alpha = 0.737$).

Building and room design was measured using a 5-point Likert scale where the respondents were asked to indicate the responses using 1 for strongly disagree and 5 for strongly agree. There are 5 items and sample items include "The design of buildings and rooms has a significant impact on consumer health in relation to pest control strategies", "Properly designed ventilation systems can contribute to reducing pest-related health risks in buildings" and so on. The reliability of the items was measured by computing the Cronbach's alpha ($\alpha = 0.736$).

Cleaning and Maintenance practices was measured using a 5-point Likert scale where the respondents were asked to indicate the responses using 1 for strongly disagree and 5 for strongly agree. There are 5 items and sample items include "Cleaning and maintenance practices play a significant role in improving consumer health in relation to pest control strategies", "The effectiveness of pest control strategies is directly influenced by proper cleaning and maintenance practices" and so on. The reliability of the items was measured by computing the Cronbach's alpha ($\alpha = 0.886$).

Environment factor was measured using a 5-point Likert scale where the respondents were asked to indicate the responses using 1 for strongly disagree and 5 for strongly agree. There are 5 items and sample items include "The

presence of favourable environmental factors enhances the effectiveness of pest control strategies in safeguarding consumer health", "The environmental factors significantly influence the effectiveness of pest control strategies in maintaining consumer health" and so on. The reliability of the items was measured by computing the Cronbach's alpha ($\alpha = 0.835$).

Pest Control Product and Method were measured using a 5-point Likert scale where the respondents were asked to indicate the responses using 1 for strongly disagree and 5 for strongly agree. There are 5 items and sample items include "I am satisfied with the overall performance of the pest control measures in the hotel", "The pest control measures implemented in the hotel effectively control pests" and so on. The reliability of the items was measured by computing the Cronbach's alpha ($\alpha = 0.804$).

Customer Health was measured using a 5-point Likert scale where the respondents were asked to indicate the responses using 1 for strongly disagree and 5 for strongly agree. There are 5 items and sample items include "you have experienced negative health effects on customer by pest", "there are complain from customer about illness after visiting hotel." and so on. The reliability of the items was measured by computing the Cronbach's alpha ($\alpha = 0.794$).

The following section describes the independent variables used in this study along with the hypothesis formulation.

Types of pests

Pests such as mosquitoes, ticks, and rodents can transmit diseases to humans through their bites (Magnarelli and Anderson, 1988). The more types of pests a business has, the greater the risk of customer health problems. Pests can carry and spread diseases, which can make customers sick. These diseases can range from mild to severe, and some can even be fatal. Pests can contaminate food with bacteria, viruses, and other pathogens (Kitchen *et al.,* 2009). This can lead to food poisoning, which can cause nausea, vomiting, diarrhea, and other symptoms. Some people are allergic to pests, such as cockroaches and dust mites. Exposure to these pests can trigger allergic reactions, such as asthma, eczema, and rhinitis (Sarwar, 2015). Pests can also have a psychological impact on customers. Seeing or hearing pests can make people feel anxious, stressed, and even afraid. This can lead to problems such as insomnia, headaches, and fatigue (Baneth, 2014). Based on it, this study develops the following hypothesis.

H_1: There is a positive relationship between types of pests and customer health.

Pest infestation level

The relationship between pest infestation level and customer health is positive. This means that as the level of pest infestation increases, the risk of customer health problems also increases (Gorham, 1979). Pests such as rodents, insects, and other vermin can carry and transmit various diseases and pathogens that can pose health risks to humans. Pest infestations can trigger allergies and worsen symptoms in individuals who are sensitive to allergens (Kim *et al.,* 2017). Common indoor pests like cockroaches and dust mites can produce allergens that can cause respiratory issues, including asthma attacks. Pests can contaminate food and surfaces with their droppings, urine, saliva, and shed skin. This contamination can lead to the spread of bacteria, viruses, and other harmful microorganisms, resulting in foodborne illnesses or infections. Pests such as mosquitoes, ticks, fleas, and bed bugs can bite or sting humans, leading to discomfort, itching, and, in some cases, transmitting diseases (Price *et al.,* 2010). Some people may experience severe allergic reactions to these bites. Prolonged exposure to pest infestations can have psychological effects on individuals. It can cause stress, anxiety, and a decrease in overall well-being. The fear and discomfort associated with pests can also disrupt sleep patterns and daily activities (Lagerkvist *et al.,* 2012). Based on it, this study develops the following hypothesis.

H_2: There is a positive relationship between pest infestation level and customer health.

Building and room design

A well-designed buildings and rooms can have a positive impact on customer health. Poor air quality can lead to a number of health problems, including respiratory infections, headaches, and fatigue. Well-designed buildings should have good ventilation systems that help to circulate fresh air throughout the space (Fottler *et al.,* 2000). Likewise, natural light is essential for good health. Exposure to sunlight helps to regulate the body's circadian rhythm and can boost mood and energy levels. Well-designed buildings should have plenty of natural light, and artificial lighting should be used to supplement natural light when necessary. Moreover, excessive noise can be disruptive and stressful, which can have a negative impact on health. Well-designed buildings should have noise-reducing features, such as soundproofing materials and acoustic barriers (Gesler *et al.,* 2004). In addition,

extreme temperatures and humidity can make people feel uncomfortable and can lead to health problems. Well-designed buildings should have climate control systems that help to maintain comfortable temperatures and humidity levels (Sadler et al., 2008). Similarly, the layout of a building or room can also have an impact on customer health. For example, a well-designed space should be easy to navigate and should provide plenty of space for people to move around comfortably (Schweitzer et al., 2004). The materials and finishes used in a building or room can also affect health. For example, some materials can off-gas harmful chemicals, while others can trigger allergies or asthma. Well-designed buildings should use materials and finishes that are safe and healthy (Smith *et al.,* 2011). Building and room design means the structure of a building and room of the hotel and restaurant. Pest can't grow up in the proper building and room design. Building and room design also help to control the pest attack (Macmillan, 2006). Based on it, this study develops the following hypothesis.

H_3: There is a positive relationship between building and room design and customer health.

Cleaning and maintenance practices

Proper cleaning and maintenance can help to reduce the spread of germs and bacteria, which can lead to a number of health problems, such as respiratory infections, food poisoning, and allergic reactions (Norman and Skinner, 2006). By cleaning and disinfecting surfaces regularly, businesses can help to reduce the number of germs and bacteria that are present in their premises. This can help to prevent the spread of illness, especially among people who are already sick or who have weakened immune systems (Vukmir, 2006). Regular cleaning and maintenance can also help to improve air quality in a business's premises. This is important because poor air quality can lead to a number of health problems, such as respiratory infections, headaches, and fatigue (Chassin and Galvin, 1998). A clean and well-maintained business premises is a safe and comfortable environment for customers. This can help to improve customer satisfaction and loyalty (Pitt, 2016). Based on it, this study develops the following hypothesis.

H_4: There is a positive relationship between cleaning and maintenance practices and customer health.

Environmental factors

Environmental factors play a significant role in influencing customer

health. The quality of the environment in which individuals live, work, and spend their time can have both direct and indirect impacts on their well-being. Poor air quality, often caused by pollutants, allergens, and toxins, can lead to respiratory problems, allergies, asthma, and other health issues (Chen, 2009). Similarly, factors such as industrial emissions, vehicular pollution, indoor air pollutants, and exposure to secondhand smoke can contribute to respiratory problems and increase the risk of cardiovascular diseases (Stranieri *et al.,* 2017). Likewise, access to clean and safe drinking water is crucial for maintaining good health. Contamination of water sources by pollutants, chemicals, or microorganisms can lead to waterborne diseases such as cholera, dysentery, and gastrointestinal infections (Grankvist *et al.,* 2004). Moreover, exposure to excessive noise levels, whether from traffic, industrial activities, or construction sites, can have negative effects on health. Prolonged exposure to noise pollution can lead to stress, sleep disturbances, hearing loss, and increased risk of cardiovascular problems (Ahmed *et al.,* 2021). In addition, access to green spaces such as parks, gardens, and natural environments has been linked to various health benefits. Spending time in nature can reduce stress, improve mental health, enhance physical activity, and promote overall well-being (Jalal *et al.,* 2019). Based on it, this study develops the following hypothesis:

H_5: There is a positive relationship between environmental factors and customer health.

Pest control products and methods

The relationship between pest control products and methods and customer health is complex and depends on a number of factors, including the type of pest, the method of pest control, and the individual's health status. However, in general, there is a potential for pest control products and methods to pose a health risk to customers (De Ruyter *et al.,* 1998). Some people are allergic to the chemicals used in pest control products. Exposure to these chemicals can trigger allergic reactions, such as asthma, eczema, and rhinitis (Williamson *et al.,* 2008). Similarly, some pest control products release harmful fumes when they are used. Inhalation of these fumes can cause respiratory problems, such as asthma attacks and bronchitis (Ricci *et al.,* 2018). If pest control products are ingested, they can cause a variety of health problems, including poisoning, seizures, and death. There are a number of safe and effective pest control products and methods available. Businesses should choose products and methods that are appropriate for the type of pest and that pose the least risk to customer health (Roitner-Schobesberger *et*

al., 2008). Moreover, some pest control products can cause skin irritation or burns if they come into contact with the skin. The severity of the health risks associated with pest control products and methods depends on the specific product or method, the level of exposure, and the individual's health status. However, even low levels of exposure to some pest control products can pose a health risk to some people (Kinuthia *et al.,* 2019). Based on it, this study develops the following hypothesis:

H_6: There is a positive relationship between pest control products and methods and customer health.

3. Results and discussion

Correlation analysis

Correlation is a term that refers to the strength of a relationship between two variables. A strong or high correlation means that two or more variables have strong relationship with each other, while a weak or low correlation means that the variables are hardly related. This section of the study presents the results and discussions of the correlation analysis. The correlation measures the strength of the linear relationship between variables. The strength of linear association between two numerical variables in a sample of population is determined by the correlation coefficient.

Table 1 shows the computation of Kendall's Tau correlation coefficients matrix of the determinants that affects the pest control strategies of hotel.

Table 1

Kendall's Tau correlation coefficients matrix

This table presents Kendall's Tau coefficients between dependent and independent variables. The correlation coefficients are based on 100 observations. The dependent variable is CH (Customer health). The independent variables are TOP (Types of pests), PIL (Pest infestation level), BARD (Building and room design), CAM (Cleaning and maintenance), EF (Environmental factor), and PCPAM (Pest control product and method.

Variables	Mean	S.D.	CH	TOP	PIL	BARD	CAM	EF	PCPAM
CH	3.58	0.34	1						
TOP	4.29	0.22	0.091	1					
PIL	4.10	0.22	0.468**	0.250**	1				
BARD	4.72	0.38	0.529**	0.275**	-0.243**	1			
CAM	3.69	0.43	-0.678**	0.111	0.570**	-0.403**	1		
EF	3.61	0.44	-0.573**	-0.049	0.358**	-0.434**	0.499**	1	
PCPAM	2.58	0.11	0.053	0.323**	-0.109	0.151	-0.212*	0.032	1

Note: The asterisk signs (**) and (*) indicate that the results are significant at one percent and five percent levels respectively.

Table 1 shows the Kendall's Tau correlation coefficients of dependent and independent variables for customer health. The study shows that types of pests is positively correlated to customer health. It indicates that different types of pests used by the hotels leads to reduce health related issues. Similarly, pest infestation level is positively correlated to customer health. It indicates that as the level of pest infestation increases, the risk of customer health problems also increases. Likewise, building and room design is positively correlated to customer health. It indicates that a well-designed buildings and rooms can have positive impact on customer health. Further, cleaning and maintenance is negatively correlated to customer health. It indicating that by cleaning and disinfecting surfaces regularly, businesses can help to reduce the number of germs and bacteria which can lead to reduce number of health problems. In addition, environmental factor is negatively correlated to customer health. It indicates that exposure to excessive noise levels, whether from traffic, industrial activities, or construction sites, can have negative effects on health. Moreover, pest control products and methods are also positively correlated to consumer health. It indicates that high quality product used for germ and bacteria leads to reduce issues related to customer health.

Regression analysis

Regression analysis is a statistical process for estimating the relationships among variables. The regression results were estimated where types of pests, pest infestation level, building and room design, cleaning and maintenance practices, environmental factor, pest control products and methods are used as independent variables and dependent variable is customer health. The regression result of types of pests, pest infestation level, building and room design, cleaning and maintenance practices, environmental factor, pest control products and methods on customer health is shown in Table 2.

Table 2

Estimated regression result of types of pests, pest infestation level, building and room design, cleaning and maintenance, environmental factor, pest control product and method on customer health

The results are based on 100 observations using linear regression model. The model is $CH = \beta_0 + \beta_1 TOP + \beta_2 PIL + \beta_3 BARD + \beta_4 CAM + \beta_5 EF + \beta_6 PCPAM + e$ *where the dependent variable is CH (Customer health). The independent variables are TOP (Types of pests), PIL (Pest infestation level), BARD (Building and room design), CAM (Cleaning and maintenance), EF (Environmental factor), and PCPAM (Pest control product and method).*

Model	Intercept	Regression coefficients of						Adj. R_bar^2	SEE	F-value
		TOP	PIL	BARD	CAM	EF	PCPAM			
1	2.508 (20.857)**	0.020 (0.588)						-0.007	0.113	0.346
2	2.017 (9.450)**		0.131 (2.633)**					0.057	0.110	6.930
3	3.116 (15.033)**			0.131 (2.598)**				0.055	0.110	6.748
4	2.383 (16.820)**				-0.041 (1.383)			0.009	0.112	1.911
5	2.882 (30.884)**					-0.082 (3.282)**		0.090	0.108	10.769
6	2.519 (26.460)**						0.016 (0.619)	-0.006	0.113	0.395
7	1.948 (8.003)**	0.019 (0.598)	0.131 (2.622)**					0.050	0.110	3.621
8	2.445 (9.871)**	0.096 (2.803)**	0.188 (3.979)**	0.247 (4.531)**				0.209	0.100	9.742
9	2.162 (7.291)**	0.136 (3.291)**	0.158 (3.182)**	0.252 (4.658)**	-0.060 (1.698)			0.225	0.099	8.171
10	1.822 (6.767)**	0.252 (5.923)**	0.178 (4.031)**	0.071 (1.215)	-0.029 (0.918)	-0.204 (5.308)**		0.397	0.088	14.041
11	1.723 (6.543)**	0.199 (4.360)**	0.181 (4.248)**	0.072 (1.260)	-0.039 (1.277)	-0.224 (5.902)**	0.082 (2.694)**	0.435	0.085	13.690

Notes:

i. Figures in parenthesis are t-values.
ii. The asterisk signs (**) and (*) indicate that the results are significant at one percent and five percent level respectively.
iii. Customer health is the dependent variable.

The regression results show that the beta coefficients for types of pests are positive with customer health. It indicates that types of pests have positive impact on customer health. This finding is consistent with findings of (Baneth, 2014). Similarly, the beta coefficients for pest infestations level are positive with customer health. It indicates that pest infestations level has a positive impact on customer health. This finding is consistent with findings of (Price *et al.* 2010). Likewise, the beta coefficients for building and room design are positive with customer health. It indicates that building and room design have positive impact on customer health. This finding is consistent with the findings of (MacMillan, 2006). Further, the beta coefficients for cleaning and maintenance are positive with the customer health. It indicates that cleaning and maintenance have negative impact on customer health. This finding is inconsistent with the findings of (Pitt, 2016). In addition, the beta coefficients for environmental factors are negative with customer health. It indicates that environmental factors have negative impact on customer health. This finding is inconsistent with the findings of (Jalal *et al.,* 2019). Moreover, the beta coefficient for pest control products and methods are positive with customer health. It indicates that pest control products and methods have positive

impact on customer health. This finding is inconsistent with the findings of (Ricci *et al.,* 2018).

4. Summary and conclusion

Every hotel and restaurant are looking forward to tackle with the pest. It's not now we are looking for way to control the pest, but it was from the age of agriculture we are looking to solve the pest problem. However, it is found that the chemical resistance of bedbug was 75% in their treatment through chemical method (Zahran, 2015). Customer health should be taken care before implementing the pest control strategies.

This study attempts to examine the pest control strategies in hotel of Kathmandu Valley. The study is based on primary data of 100 respondents.

The major conclusion of this study is that types of pests, pest infestation level, cleaning and maintenance practices, pest control products and methods are positively related to the customer health. Similarly, building and room design, environmental factor is negatively related to customer health on pest control strategies in hotel of Kathmandu Valley. The study also concludes that building and room design followed by types of pest control is the most influencing factors that affect the customer health in pest control strategies in hotel of Kathmandu Valley.

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