Utility model of preventive behaviour

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ABSTRACT The utility model of preventive behaviour is presented as an alternative to psychosociological analysis. All preventive actions are viewed as the consumption of those “goods” that affect the risk of illness or injury. Levels of consumption depend on, inter alia, utility (perceived benefit) and cost. Total utility yielded by risk affecting goods is the sum of that derived from the use value of the good, if any, and that from reduced anxiety which results from reduced risk. Many risk affecting goods are consumed mainly for their use value. An examination of the nature of risk affecting goods is presented, followed by an analysis of the factors that determine the anxiety associated with unwanted outcomes. The utility model places preventive behaviour within the framework of the economic theory of demand. The economic principles used in this analysis are explained and their relevance to the consumption of risk affecting goods is determined.

There is a growing belief that much illness and injury can be prevented by adopting a lifestyle orientated towards prevention and that the greatest potential for reducing rates of morbidity and mortality lies in bringing about a change in an individual's preventive behaviour.^{1,2} An understanding of what determines such behaviour ought to show where the greatest scope for change lies, and how resources to promote behaviour change can be directed most effectively and most efficiently.

The determinants of preventive behaviour have been examined extensively from a psychological standpoint.^{3–7} Most research centres around the health belief model (HBM), which was formulated in the early 1950s.³ The present paper presents an alternative model of preventive behaviour in the belief that the insights provided from the perspective of another discipline can help in understanding those aspects of behaviour not fully explained by psychosociological analysis. Clearly, many elements will be common to both models, and the utility model is not intended as a contradiction of the HBM.

In the HBM preventive behaviour is described in terms of “preventive actions” that depend on (1) the size of the threat, incorporating perceptions of likelihood and severity; (2) the efficacy of the

preventive action in reducing the size of the threat; and (3) the barriers to preventive actions. The utility model retains these three elements but postulates that the primary motivating factor in preventive behaviour is the anxiety associated with the threat, rather than the threat itself. Anxiety results from an awareness of being at risk and, generally, any perceived reduction in risk will result in a reduction in anxiety. All preventive behaviour is viewed as the *consumption* of those goods, services, and activities known to affect risk. Levels of consumption depend on perceived benefits relative to perceived costs. Since no illness or injury is certain to occur and few preventive actions are of 100% efficacy, the benefits of such consumption stem from the reduced anxiety that results from the reduced risk, rather than from reduced illness or injury. Indeed, the individual is rarely, if ever, aware of what would have occurred had a different consumption decision been made.

The initial level of anxiety is dependent on (1) the perceived level of risk, which, in common with the “threat” in the HBM contains both a probability and a severity dimension; (2) when the outcome is expected; (3) the individual's attitude to present versus future time; and (4) the degree to which the individual is averse to risk. The benefits of consumption—that is, the reduction in anxiety—depend on the perceived efficacy of the good, service, or activity in reducing the perceived risk.

Though perceptions of cost and benefits are relevant in the HBM as well, they subsume all other

* It is the policy of *Journal of Epidemiology and Community Health* to avoid technical terminology outside the disciplines of medicine and the social sciences. This paper is based on economic theory and therefore it has been essential to retain the precision of economic terminology. Editor.

variables in the utility model. Thus as the "predisposing factors" of the HBM are a determinant of initial anxiety, "reinforcing factors" are a determinant of final anxiety, and some "enabling factors" affect the difference between the two, all are here contained within the concept of benefits. Those enabling factors that do not affect benefits—that is, the individual's skills and resources—do affect the constraint which limits total consumption and are, therefore, also part of the cost/benefit comparison. Preventive behaviour is viewed as being determined solely by the relation between perceived benefits and costs.

The utility model recognises that most goods, services, and activities that affect risk are not consumed solely for their risk affecting qualities and, therefore, yield benefits in addition to those derived from the reduced anxiety. Such benefits are shown to be often of great importance. In many cases they overshadow the risk affecting qualities in the consumption decision.

After an explanation of the terms used, an analysis of the two types of benefit derived from most risk affecting goods, service, and activities is presented. The utility model is then explained, highlighting the policy implications that emerge from this approach. The utility model is presented as the basis of a theory that requires further empirical evidence to validate.

Utility and consumption

Utility is a concept used in economic theory to provide a common measure for the satisfaction derived from all consumption. An *economic good* is defined as anything which yields utility, and thus refers to services and activities as well as to tangible commodities. A *risk affecting good* is any good, the consumption of which alters the risk of illness or injury. These goods will be either "risk reducing" or "risk increasing" according to whether their consumption reduces or increases the risk of future ill health.

Risk affecting goods can contain attributes of two distinctly different types. By definition all such goods contain risk affecting qualities. If it is assumed that the anxiety associated with any risk varies with the size of the risk, then these risk affecting qualities can also be viewed as anxiety affecting qualities. Since lower anxiety is assumed to be preferred to higher anxiety, there is a utility gain associated with the consumption of risk reducing goods, and a utility loss associated with the consumption of risk increasing goods. Such utility (positive or negative) is here called *utility in anticipation*. It refers to utility derived from today's reduction (increase) in anxiety and not to the anticipation of the future outcome

which generates the anxiety.

Most risk affecting goods also contain a second class of attributes which yield utility from their use value. Thus *utility in use* can be derived from the taste and hunger satisfying qualities of wholemeal bread, while at the same time, utility in anticipation is derived from the belief that a high fibre diet reduces the risk of constipation and bowel cancer. The consumption decision will depend on the sum of the two.

It should be noted that while the term utility in anticipation can be and has been used in a more general context to refer to other forms of non-use utility,⁸ its use here is restricted to its knowledge of being protected form.

Risk reducing goods fall on a continuum that stretches from those that yield mainly utility in use, and are consumed primarily for their non-risk affecting attributes, to those that yield only utility in anticipation, and are consumed *solely* for their risk affecting attributes. A vaccine is an example of the latter type of good. At the time of consumption it provides no utility other than that derived from the knowledge that it reduces the risk of contracting the disease. Since the individual is unaware of whether or not he will contract the disease without being vaccinated, and will never know what would have occurred had he not been vaccinated, it is only utility in anticipation that is relevant at the time of consumption for this class of good.

Most risk affecting goods, however, contain non-risk affecting attributes as well, yielding utility in use in addition to utility in anticipation. These goods fall somewhere along the continuum, as in the example of wholemeal bread above.

As with utility in anticipation, utility in use can also be negative—for instance, the pain of an injection. For a good to be willingly consumed, even at zero price, net utility must be positive. In the case of risk reducing goods utility in anticipation is always positive; thus utility in use (if present) must be either positive as well or, if negative, must be less than the positive utility in anticipation. In the case of risk increasing goods utility in anticipation is always negative; thus utility in use must not only be positive but must outweigh the negative utility in use. Anything that yields net negative utility, such as air pollution, is outside this analysis.

From the perspective of the individual consumer, all benefits from consumption are in the form of utility. In the same manner the costs of consumption can also be expressed in utility terms. Money and time, like everything else, have a utility value to the individual. The cost of consuming represents a utility loss whereas the benefit represents a utility gain. Consumption of any unit of a good will take

Utility model of preventative behaviour

place if the utility derived from that unit exceeds its utility cost, as the consumer will be left in a better position. Consumption levels can therefore be influenced by (1) increasing perceptions of utility in use, (2) increasing perceptions of utility in anticipation, or (3) decreasing perceptions of cost.

Utility model of preventive behaviour

The utility model (figure) assumes that all preventive behaviour can be expressed as the consumption of risk affecting economic goods. Increased prevention refers to an increase in the consumption of risk reducing goods or a decrease in

the consumption in risk increasing goods. The level of consumption depends on, inter alia, the relation between net utility and cost. In instances where utility in use forms the major component of net utility, consumption may not be regarded by the individual as a preventive action at all.

Both types of utility are subjective concepts. Utility in anticipation depends on the difference between initial and final anxiety, which in turn depends on the perceived efficacy of the risk reducing good or the perceived threat from the risk increasing good. The initial level of anxiety is determined by the elements labelled 1–5 in the figure.

Utility model of preventive behaviour.

The expected loss from any unwanted outcome is defined as the product of the probability of its occurrence and the severity of its outcome. As it is the individual's perception of the expected loss which matters, the relevant variables are the perceived severity and the perceived probability.

This definition, however, does not account for different outcomes occurring at different times. Since all preventable outcomes are future outcomes, the value of the expected loss, in these cases, must contain a time dimension as well. A loss next year will be preferred—that is, will represent a smaller value of loss—to a nominally equal loss today. Similarly, a loss in two years will be preferred to a nominally equal loss in one year's time. In recognition of the differing values attached to nominally equal losses (or gains) in different time periods, economic analysis uses the technique of *discounting* to express all future losses (or gains) in terms of their *present values*. Present values depend on (1) the duration of the period between the present and when the loss is expected to occur and (2) the rate of discount used, which in this context is determined by the individual's own rate of time preference.^{9 10} Current anxiety depends on the present value rather than the nominal value of the expected loss.

Another factor in the determination of initial anxiety is the degree to which the individual is averse to risk. This can be most easily explained by means of a simple example. Assume that a good which contains only risk reducing attributes—that is, one providing no utility in use—is perceived to be of 100% efficacy. In this case the individual is in a gambling position. He can accept the gamble, by *not* consuming the good, or he can opt out of the gamble by consuming it, thereby ensuring avoidance of the outcome. Opting out, however, is not costless as the good can be consumed only at some cost, either monetary or in terms of time etc. A person is defined as being *risk neutral* if he is indifferent between the certainty of a loss X (in this case the cost of the good) and any gamble with expected outcome X (in this case the present value of the expected loss).¹¹ A risk averse person will, when offered this choice, always prefer the certainty to the gamble—that is, he will always consume the good when its cost is just equal to the present value of the expected loss. The more risk averse he is, the greater the cost he will be prepared to incur to avoid the gamble (consume the good). Since consumption can be viewed as buying utility, however, and consumption depends on, inter alia, utility and cost the greater the degree of risk aversion the greater the utility in anticipation derived from consuming the good. In this example because the good is 100% effective, the final anxiety

is zero. The greater the degree of risk aversion, the greater will be the initial anxiety associated with the assessment of any outcome.

Policy implications

The figure shows that preventive behaviour can be influenced by measures affecting perceptions of (1) cost; (2) utility in use; or (3) utility in anticipation. The most *cost effective* measure (or combination of measures) will be that which produces the greatest change in the quantity of a good consumed for any given expenditure.

The utility model suggests that an examination of both the nature of the risk affecting good, and the *target audience*, ought to provide insights into the most cost effective approach. Where the demand for particular goods is highly responsive to small changes in price, then taxes, subsidies, or other measures on the supply side may prove to be a more efficient means of altering consumption than measures aimed at altering perceptions of either type of utility. In the case of goods which provide relatively small amounts of utility in anticipation, promotion aimed at altering perceptions of utility in use may prove to be more efficient, despite the effect that consumption of this good has on risk.

For example, a cigarette is a risk increasing good that provides obvious utility in use to smokers but also negative utility in anticipation from the knowledge that smoking increases the risks of lung cancer, heart disease, and bronchitis. If the positive utility in use from smoking greatly overshadows the negative utility in anticipation for most smokers then an antismoking campaign aimed at reducing perceptions of utility in use, perhaps by emphasising the annoyance caused to non-smokers, may prove a more efficient way of reducing smoking than a campaign that tries to increase perceptions of disutility in anticipation via the health message.

Measures to alter perceptions of utility in anticipation should reflect the characteristics of the target audience. Groups that can be shown to have a relatively high rate of time preference or a relatively low degree of risk aversion will have lower levels of initial anxiety than will groups with the opposite characteristics. In these cases the effectiveness of health education campaigns aimed at increasing perceptions of the relatively unimportant utility in anticipation will be lower, other things being equal, than campaigns aimed at groups with the opposite characteristics.

The utility model further shows when the provision (and subsequent consumption) of "objective" information can be effective in increasing perceptions of utility in anticipation, and when the imposition of a different set of values is the

Utility model of preventative behaviour

only means of achieving this end. There are two factors involved: (1) the probability of an outcome occurring and (2) the effectiveness of a risk reducing good in reducing this probability, both of which are in theory capable of being scientifically determined. If an individual underestimates either of these then the utility in anticipation derived from consuming the risk reducing good will be less than if they were accurately estimated. In either case the provision (and consumption) of information should, in theory, result in increased consumption of the good. Thus though all the determinants of anxiety are subjective, the probability dimension is the only one that can be altered by information that is not value laden. Any attempt to alter the other determinants of anxiety represents an attempt to impose a "preferred" set of values on a less preferred set. These determinants will be taken as given if there is a desire to avoid such an imposition of values.

Conclusions

The utility model is put forward as an alternative to a psychosociological approach such as that of the health belief model. Similarities are evident; the economic approach is not intended as a contradiction.

Whereas further empirical research is clearly required to validate parts of the model, the following observations may be made.

(1) Those elements of the health belief model which are least contentious⁵ are contained within the utility model—that is perceived severity, perceived likelihood, and perceived efficacy.

(2) The utility model recognises that the value of the threat (expected loss) will vary according to when its occurrence is expected and the individual's own views regarding preference for the present compared with the future.

(3) Varying degrees of risk aversion will affect the anxiety resulting from the discounted expected loss.

(4) 1–3 above define how great the "benefit" (utility in anticipation) will be from altered consumption of the good. This, however, is not the only benefit that can be derived from most risk reducing goods and all risk increasing goods: there is also utility in use.

(5) If the utility in use derived from consumption greatly outweighs the utility in anticipation (positive or negative) *either* because of the nature of the good *or* because of the characteristics of the group to be influenced, then measures aimed at altering consumption will be more efficient if they do not focus on the utility in anticipation aspects of the good.

(6) The "barriers" of the health belief model are expressed as costs in the utility model. As consumption decisions depend on utility relative to cost, cost affecting measures are alternatives to those aimed at altering perceptions of either types of utility.

A major advantage of this approach is that it explains the consumption of *all* goods, whether preventive, hazardous, or neutral. Many preventive actions are not viewed as such by those who engage, or fail to engage, in them. Thus many people are non-smokers because they derive little or no utility in use from smoking rather than from any fear of the health risks. Many people eat wholemeal bread solely because they prefer its taste to that of white bread. In the utility model all behaviour can be explained within the same framework.

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