ORIGINAL RESEARCH

Obedience and motivation as mechanisms for adherence to medication: a study in obese type 2 diabetic patients

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Objective: To clarify the mechanisms of adherence.

Methods: A cross-sectional, multicenter French study using a self-questionnaire administered by 116 general practitioners to 782 obese type 2 diabetic patients.

Results: The analysis of 670 completed questionnaires revealed a strong association between the adherence to medication and the behavior of fastening the seatbelt when seated in the rear of a car. Multivariate analysis indicated that this behavior was an independent determinant of adherence to medication (odds ratio [OR] 2.3, 95% confidence interval [CI] 1.4–3.6, $P < 0.001$) with the same OR as the motivation to adhere to medical prescriptions (OR 2.2, 95% CI 1.3–3.6, $P = 0.003$) in a model with good accuracy (area under the receiver operating characteristic curve 0.774). A multiple correspondence analysis suggested that adherence to medication and seatbelt behavior are "homologous" behaviors, with homology between phenomena defined by the fact that they share a common etiology.

Conclusion: Adherence may have two dimensions: passive (obedience, the main determinant of seatbelt behavior) and active (motivation). This conclusion has theoretical and practical implications. Firstly, empowerment through patient education can be defined as a process that replaces the passive mechanism of adherence in patients' minds with an active, conscious choice. Secondly, recognizing these two dimensions may help to establish a tailored patient-physician relationship to prevent nonadherence.

Keywords: adherence, compliance, motivation, obedience, reactance, patience, seatbelt, medication

Introduction

Adherence to long-term therapies is an important issue in contemporary medicine. Low adherence to prescribed treatments is very common. Typical adherence rates for pre-scribed medications are about 50%, with a range from 0% to over 100%.[1] Specifically, for diabetes, there is an inverse relationship between adherence to medication and hemoglobin A1c (HbA_{1c}).[2,3] A multivariate analysis has indicated that nonadherence is significantly associated with increased risks for all-cause hospitalization and all-cause mortality.[4] Adherence to a diabetes therapy has been found to be associated with a decrease in healthcare costs, mostly through a decrease in hospitalization.[5,6] More generally, a World Health Organization report concluded that increasing the effective-ness of adherence interventions may have a far greater impact on the health of the population than any improvement in specific medical treatments.[7]

Several studies suggest that adherence and nonadherence are general behaviors. For instance, adherers to medication are often compliant with other tasks related to their

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treatment: adherence to bisphosphonates can be predicted by adherence to another medication, for instance, a statin.[8] Two studies have shown that adherence to bisphosphonates or statins is associated with the use of preventive health services, such as prostate-specific antigen tests, fecal occult blood tests, screening mammography, and influenza and pneumococcal vaccinations.[8,9] Furthermore, nonsmokers accept a complex treatment more easily[10] and are more adherent to bisphosphonate therapy.[8] By contrast, diabetic patients who smoke are less adherent to recommendations concerning blood-glucose monitoring and exercise and skip more medical appointments than nonsmokers.[11] Similarly, alcohol consumption is a marker of poorer adherence to diabetes self-care behavior.[12] Berrigan et al, investigating the adherence to recommendations for five health behaviors (physical activity, tobacco use, alcohol consumption, fruit and vegetable consumption, and dietary fat intake), observed that the two extreme patterns, all adherence and all nonadherence, were found in approximately twice the expected proportions.[13]

This study aimed to clarify the mechanisms of adherence to medication. Obese adult type 2 diabetic patients were asked, via their general practitioner (GP), to complete a self-questionnaire assessing adherence to medication and to answer questions addressing their health, their medications, and their motivation to improve their weight, blood pressure, or diabetes control. Specifically, the hypothesis that adherence to medication may reflect an even more general human behavior was tested. Thus, a question on an apparently distinct behavior was included, asking the patients whether they fastened their seatbelt when they were seated in the rear of a car.

Methods

This cross-sectional, multicenter French study included 116 GPs and 782 patients who agreed to participate. Diabetic patients treated with a single antidiabetic oral agent, older than 18 years, with an HbA_{1c} level $\geq 6.5\%$, body mass index ≥ 30 kg/m^2, abdominal obesity according to standard criteria, and who were able to understand the recommendations were eligible to participate in the study. Pregnant women, patients with a severe disease, or those participating in another study were excluded. The participants lived in all regions of the country, both rural (9% were farmers) and urban. Each GP provided between one and 11 evaluable questionnaires (median 6.5, quartiles Q1,Q3: 3,9). Before completing the questionnaire, the patients were given a letter informing them that they could voluntarily participate in a research program with the goal of exploring the determinants of adherence

to medical recommendations. The questionnaires from 670 patients (85.7%) were considered suitable for evaluation.

The full questionnaire is shown in Appendix I. It included the following questions: (i) nine general questions, such as "Do you think that your health is important?" (possible answers: In no way, A little bit, Rather, A lot), "Does the opinion of your family count?" (possible answers: In no way, A little bit, Rather, A lot), "Generally speaking, what do you give priority to?" (possible answers: To the present, To the future), "Are you used to fastening your seatbelt when you sit in the rear of a car?" (possible answers: No, Yes); (ii) a six-item medication adherence questionnaire,[14] validated in the field of hypertension, that classified patients as nonadherers if they answered positively to at least two questions, such as "This morning, did you forget to take your medication?" (possible answers: No, Yes); (iii) 17 questions on diabetes control, blood pressure, and weight, such as "Are you satisfied with the control of your blood pressure?" (possible answers: In no way, A little bit, Rather, Completely) and "Would you be ready to make efforts to improve your weight?" (possible answers: In no way, A little bit, Rather, A lot); (iv) three questions on the motivation to follow the recommendations of the physician concerning prescribed medication, physical activity, and dietary advice, such as "Are you motivated to follow the recommendations of your physician with regard to the prescribed medication?" (possible answers: Not motivated, Little motivated, Motivated enough, Very motivated); and (v) one question, "What are the main reasons that motivate you to follow the recommendations of your physician?" for which five answers (for instance, the chance to live longer) were proposed.

For questions with four possible answers, data were dichotomized by pooling the two negative answers and the two positive answers. For the three questions concerning motivations for medication, exercise, and diet, patients were considered to be "motivated" if they stated that they were "motivated enough" or "very motivated" and they were considered "not motivated" if they stated that they were "not motivated" or "little motivated" to at least one of the three questions. Patients' HbA_{1c} levels and body mass indexes were obtained from their GPs.

SAS 8.2 software (SAS Institute Inc, Cary, NC) was used for the statistical analysis. For continuous data, the mean, standard deviation, quartiles Q1 and Q3, and median value were calculated. For categorical data, the frequency and percentage of the class level were calculated. Univariate comparisons were performed using Student's *t*-test for continuous data, the Wilcoxon rank-sum test for ordinal

categorical data, and the chi-square test for nonordinal categorical data. Multivariate logistic regression analysis was used to determine the independent predictors of adherence to medication. A multiple correspondence analysis of the data was also performed. The research protocol was approved by the University Ethics Review Board.

Results

The median age of the patients was 60 years (range 21–89 years, Q1,Q3: 53,66); 53.7% were female, 41% were retired, 12.4% were current smokers, 65.3% had hypertension, and 61.6% had hypercholesterolemia. The median body mass index was 34.1 (Q1,Q3: 31.6,37.6), and the median HbA_{1c} was 7.0% (Q1,Q3: 6.7,7.7).

As shown in Table 1, 20.1% of the patients were classified as nonadherers in the adherence questionnaire. This percentage was more than twice as high in patients who declared that they did not fasten their seatbelt compared with those who did (31.5% versus 14.5%, $P < 0.001$). In total, 32.2% of the patients declared that they did not usually fasten their seatbelt. This percentage was twice as high for nonadherers compared with adherers (51.1% versus 27.5%, $P < 0.001$). Furthermore, nonadherers more frequently had an uncontrolled HbA_{1c} level ($>7\%$) than adherers (74.2% versus 54.3%, $P < 0.001$). The same was true when comparing seatbelt nonfasteners with fasteners (64.8% versus 55.0%, $P = 0.016$).

Table 1 shows items of the questionnaire with statistically different distributions of answers when patients were classified as nonadherers or adherers. Statistical differences were exactly the same when the patients were classified as seatbelt nonfasteners or fasteners.

In a multivariate analysis, the following determinants remained associated with adherence to medication: $HbA_{1c} \leq 7\%$ (odds ratio [OR] 2.7, 95% confidence interval [CI] 1.6–4.5, $P < 0.001$), fastening the seatbelt (OR 2.3, 95% CI 1.4–3.6, $P < 0.001$), motivated concerning health (OR 2.2, 95% CI 1.3–3.6, $P = 0.003$), ready to make efforts to improve diabetes (OR 2.0, 95% CI 1.2–3.4, $P = 0.005$), declaring that it is good to follow medical prescriptions (OR 1.9, 95% CI 1.2–3.0, $P = 0.012$), and knowledge of one's HbA_{1c} level (OR 1.7, 95% CI 1.1–2.8, $P = 0.016$). The area under the receiver operating characteristic (ROC) curve describing this model was 0.774.

A multiple correspondence analysis of the answers shown in Table 1 was then performed (Figure 1). The dots appear to distinguish two nonoverlapping clusters of answers defining adherent and nonadherent behavior. This figure presents four axes, linking the answers to the questions on adherence, seatbelt behavior, motivation, and priority given to the future. The figure confirms the closeness between the "adherence" and "seatbelt" axes, indicating that these behaviors had similar relationships to the patients' other answers, as shown in Table 1.

Table 1 Questions with significantly different answer distributions between adherers and nonadherers

	Whole population (n = 670)	Adherers (n = 535)	Nonadherers (n = 135)	P	Seatbelt fasteners (n = 448)	Seatbelt nonfasteners (n = 213)	P
1 Seatbelt nonfasteners	32.2	27.5	51.1	<0.001			
2 Nonadherers	20.1				14.5	31.5	<0.001
3 Hemoglobin A1c > 7%	58.3	54.3	74.2	<0.001	55	64.8	0.016
4 Ex-smoker/current smoker	25.4	22.8	35.8	0.003	19.8	36.6	<0.001
5 Does not measure weight	48.7	43.3	70.1	<0.001	40.5	65.2	<0.001
6 Not motivated	46.9	40.9	70.4	<0.001	40.6	59.5	<0.001
7 Priority to the future: no	60.6	58.3	70	0.013	58.1	65.6	0.065
8 Not ready to make efforts to improve diabetes	25.6	19.8	48.1	<0.001	20.7	35.5	<0.001
9 Recommendations too strict	18.1	14.4	32.6	<0.001	13.8	26.7	<0.001
10 Not interested in changing lifestyle	8.4	6.4	16.3	<0.001	5.8	13.6	<0.001
11 Not a priority	8.5	6.2	17.8	<0.001	6.3	13.1	0.004
12 No time	19.9	17	31.1	<0.001	16.7	26.2	0.004
13 Your health depends on you: no	21	17.5	35.1	<0.001	17.9	27.3	0.006
14 Your health is very important: no	26.4	23	39.7	<0.001	22.2	34.7	<0.001
15 The opinion of your family is very important: no	64.4	62.2	73.3	0.016	59.9	73.6	<0.001
16 Following medical recommendations is very good: no	27.6	22.2	48.9	<0.001	23.9	35.1	0.002

Note: It presents the percentages of answers in the whole population (left column), the percentages observed in patients classified as adherers and nonadherers, and the percentages of patients who declared that they fastened their seatbelt when they were seated in the rear of a car and those who did not make this declaration.
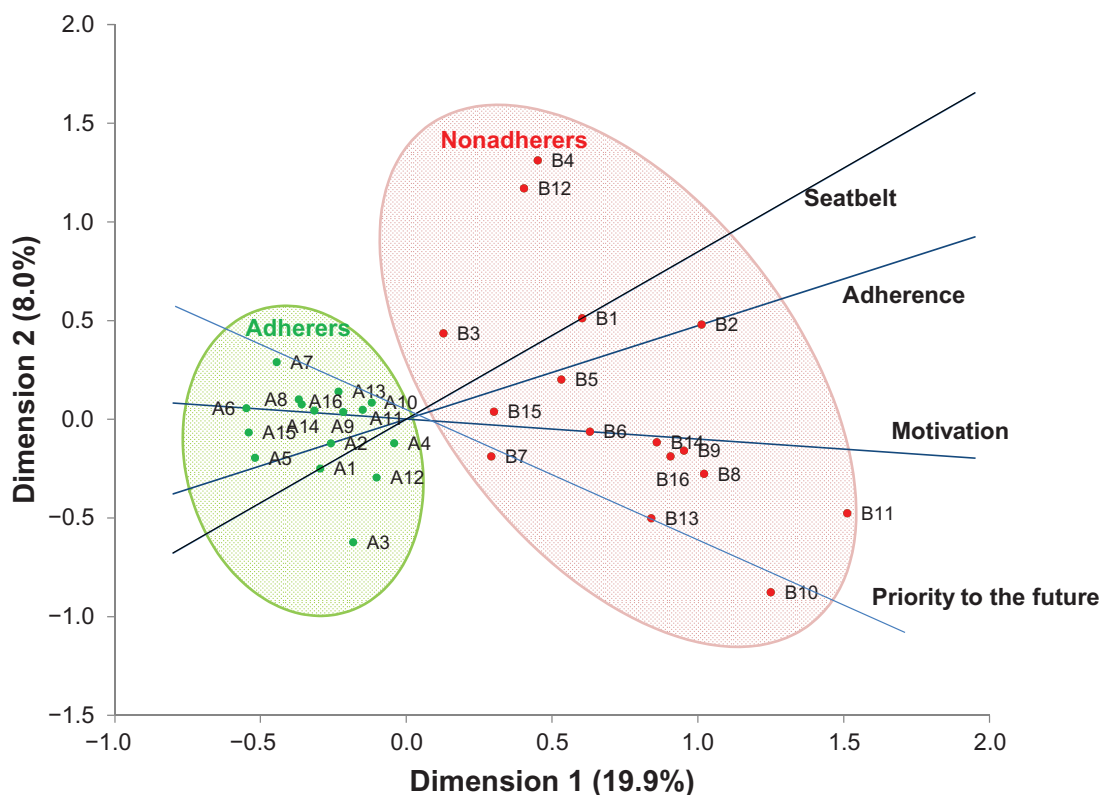
Figure 1 Multiple correspondence analysis. A1, seatbelt fasteners; B1, seatbelt nonfasteners; A2, adherers; B2, nonadherers; A3, $HbA_{1c} \leq 7\%$; B3, $HbA_{1c} > 7\%$; A4, nonsmoker; B4, ex-smoker/current smoker; A5, follows weight on a regular basis; B5, does not follow weight; A6, motivated; B6, not motivated; A7, priority to the future: yes; B7, priority to the future: no; A8, ready to make efforts to improve diabetes control; B8, not ready to make efforts to improve diabetes control; A9, recommendations are too strict: disagree; B9, recommendations are too strict: agree; A10, not interested in changing lifestyle: disagree; B10, not interested in changing lifestyle: agree; A11, not a priority: disagree; B11, not a priority: agree; A12, have no time: disagree; B12, have no time: agree; A13, your health depends on you: agree; B13, your health depends on you: disagree; A14, your health is very important: agree; B14, your health is very important: disagree; A15, the opinion of your family is very important: agree; B15, the opinion of your family is very important: disagree; A16, following doctor's recommendations is very good: agree; B16, following doctor's recommendations is very good: disagree.

Discussion

In this study, an unexpected strong association was observed between the adherence to medication and seatbelt fastening when seated in the rear of a car: fastening the seatbelt was found to be a highly significant determinant (OR 2.3, 95% CI 1.4–3.6, $P < 0.001$) of adherence to medication by multivariate analysis in a model with good accuracy (area under the ROC curve 0.774), with the same OR as the motivation to adhere to medical prescriptions (OR 2.2, 95% CI 1.3–3.6, $P = 0.003$). Furthermore, the same pattern of answers to questions on feelings concerning health and treatment and recommendations provided by the GPs was observed when patients were classified as adherers or nonadherers and as seatbelt fasteners or nonfasteners. This striking similarity between apparently distinct behaviors, illustrated by the closeness of the adherence and seatbelt axes in the multiple correspondence analysis (Figure 1), suggests that the adherence to medication, on the one hand, and the fastening of the seatbelt in the rear of a car, on the other, represent "homologous" (not only analogous) behaviors, with homology between

the phenomena defined by the fact that they share a common etiology, as explained by Wise and Bozarth:[15]

> "In biology, there are examples of superficially similar behaviors or organs that have evolved independently for these "analogous" behaviors or organs look similar, but one cannot draw further conclusion from their similarity. In each case, the analogous details are striking, but there is no commonality of origin, and thus no necessary commonality of mechanism. By contrast, "homologous" organs or behaviors derive from common ancestral origin and, in biology, from common embryonic tissue, whereas analogies do not. Here knowledge of one of a set of homologous organs or behaviors almost necessarily has some degree of heuristic value for the study of the others, even if the organs or behaviors are superficially dissimilar." (Copyright © 1987 by the American Psychological Association. Reproduced with permission.)

In other words, discovering a homology between phenomena has a heuristic value because, as stated by Elster,[16] in the case

of homologous phenomena, their definition becomes ipso facto inseparable from their explanation.

Thus, understanding why people fasten their seatbelt in the rear of a car may present a clue to the mental mechanisms behind adherence to medication. Langlie[17] and Williams and Wechsler[18] observed an association between seatbelt use and the practices of medical check-ups, dental care, immunizations, miscellaneous medical examinations, exercise, and diet. Here, seatbelt use was seen as another health behavior intended to indirectly protect physical well-being.[17] However, seatbelt behavior may have another meaning. A recent study in Malaysia investigated various factors associated with the behavior of not wearing a rear seatbelt. The experience of being stopped by an enforcement officer yielded the highest OR, followed by factors such as self-consciousness, attitude, knowledge, age, and the perception of being caught by an enforcement officer.[19] Another study in the Midwest United States[20] showed that drivers from secondary seatbelt legislation states, where drivers are ticketed only when there is another citable traffic offense, wore their seatbelts significantly less often. This finding reinforces the idea that obedience to the law is the primary cause of this behavior rather than the real wish to protect oneself. On the contrary, some people may refuse to fasten their seatbelt as a typical manifestation of reactance,[21] defined as a defensive reaction to social pressure that results in rejection of the norm and movement in a negative direction.[22]

Therefore, if there is, as indicated in this study, a "homology" between behavior relating to seatbelt fastening and adherence to medication, we suggest that obedience may also represent a mechanism of patient adherence. Indeed, agreeing that it is good to follow the doctor's prescription was also an independent determinant of adherence to medication in the multivariate analysis of this study. In contrast, reactance has been proposed as a cause of nonadherence to medication.[23]

Interestingly, in this study, the axis linking the answers concerning smoking (dots A4–B4 on Figure 1) was closer to the "seatbelt" axis than to the "motivation" axis, similarly suggesting that nonsmoking behavior may involve a dimension of obedience. On the other hand, the "motivation" and "priority given to the future" axes seemed close in Figure 1. These data are consistent with the role of "patience" in motivation concerning health behaviors,[24,25] with patience defined as the ability to prioritize the future, preferring a larger, long-term reward (for instance, the beneficial health improvement of tobacco abstinence) rather than a smaller, short-term one (in this example, the pleasure of smoking a cigarette). These speculations call for further investigation.

Dots representing the answers characterizing adherence in Figure 1 clustered in a tight area. It is tempting to hypothesize that patients giving answers that express this "adherent typology" represent the "healthy adherers" who adhere to any recommendation, and this general behavior can explain the puzzling lower mortality rate of patients adhering to a placebo in clinical trials.[26] Inversely, nonadherence is very frequent in teenagers[27] and may simply represent one of the manifestations of disobedience that is a normal characteristic of this period of life, together with teenagers' difficulty projecting themselves in the future.[28] In an even more speculative mode, in the same way that the patience of individuals that leads to adherence[24] may be, in part, genetically determined[29] and only fully developed in adulthood[30] (which may explain why adherence improves with age),[13,31–37] similar hypotheses may be proposed for obedience.

This study has three limitations. First, there was the unavoidable potential bias because the question concerning seatbelt behavior was asked in the framework of a health questionnaire. Second, this study relied only on the answers to a self-reported questionnaire. Third, it is a cross-sectional study, with the general limitations of such investigations. For instance, both adherence and seatbelt fastening were self-reported. There might be differences between this subjective view and respondents' actual behaviors. It is difficult to determine whether the sample was representative of the population of patients managed by GPs or was a biased sample. Furthermore, the median age of the population was 60 years. Younger people may be more prone to fasten their seatbelt because they were asked from childhood to follow this recommendation. In this framework, we did not observe the association (described in some studies,[13,31–37] but not all studies[38,39]) between age and adherence to medication ($P = 0.34$, no significance), possibly because 75% of our population was older than 53 years. Further studies are needed to construct and validate a questionnaire to assess obedience in an attempt to evaluate its implications for adherence or nonadherence to medical prescriptions.

Conclusion

These data suggest that some individuals might adhere to medical prescriptions not because they are motivated to do so but simply because, in general, they agree to conform to rules such as fastening their seatbelt when seated in the rear of a car. Others may have both reasons for being adherent. We therefore propose a typological model of adherence to medication (and possibly of adherence in general) with two components: active (motivation) and passive (obedience).

This model is consistent with the typological distinction between "critical" and "traditional" adherers proposed by Bader et al for people living with human immunodeficiency virus/acquired immune deficiency syndrome, in which traditional ("unquestioning") adherers have the ability and willingness to follow a therapeutic regimen exactly as prescribed by a medical authority, based on a traditional, asymmetric doctor-patient relationship (paternalistic model). Among "traditional" adherers, Bader et al described a subtype of "faithful" patients who are "obedient and yield readily in a subservient way to doctors' orders."[40] This attitude may reflect a more general behavior.

Proposing room for obedience in patient behavior may seem provocative because the switch from the word "compliance" to "adherence," as a means to avoid a connotation that may seem to be in contradiction to the autonomy of the patient, has been presented as a paradigm shift in the understanding of the concept.[41] The French word used to describe compliance with medical recommendations is "observance." This word originally had a religious meaning: "observance de la règle," obedience to the rule. This is why the word "adhésion," the translation of the English word adherence, is currently preferred. We suggest that these semantic moves might represent a denial of a reality: as shown, adherence to medication might involve a dimension of obedience in some patients.

Practically, a typological description of adherence, with its two components, motivation and obedience, may help to establish tailored patient-physician relationships able to prevent nonadherence. If nonadherence is the consequence of an inability to prioritize the future while patients manage a chronic disease, it may be helpful to stress the short-term advantages of long-term therapies.[24,42] If patients' behaviors are caused by an innate tendency toward disobedience, a way to reduce the risk of nonadherence would be to avoid presenting the medical prescription in an authoritative way that would lead to reactance.[43]

From a more theoretical point of view, leaving room for obedience in the mental mechanisms leading to adherence should not be seen as a breach in the concept of patient autonomy but rather as the recognition of the complexity of what is at stake in the patient-physician relationship. Specifically, "empowerment" through patient education[44] can be understood as a process that replaces obedience-driven actions with motivated choices. This conclusion may provide insight into the very meaning of the word "patient" in the framework of this definition. If adherence has two dimensions, active and (as suggested in this study) passive, empowerment would lead the "patient" to become an "agent," recalling the classical distinction given by Descartes in *Passions of the Soul*:[45] a patient is a subject to whom events happen, whereas an agent is a subject who brings about that they happen:

> "To start with, anything that happens is generally labeled by philosophers as a "passion" with regard to the subject to which it happens and an "action" with regard to whatever brings it about that it happens. Thus, although the agent and patient – the maker and the undergoer – are often quite different, an action and passion are always a single thing that has these two names because of the two different subjects to which it may be related."

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Disclosure

The author reports no conflicts of interest in this work.

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Appendix I
The questionnaire
Your health in general
1. Physically, how do you feel?

   In very good health   In rather good health   In poor health   In very poor health

2. What do you think that your health generally depends on?

   You   Other people   Chance

3. Do you think that your health is important?

   In no way   A little bit   Rather   A lot

4. Does the opinion of your family count?

   In no way   A little bit   Rather   A lot

5. Do you think that following the recommendations of your physician is good for you?

   In no way   A little bit   Rather   A lot

6. Do you smoke?

   No   Yes   I stopped

7. Generally speaking, what do you give priority to?

   To the present   To the future

8. Are you used to fastening your seatbelt when you sit in the rear of a car?

   No   Yes

9. Do you weigh yourself on a regular basis?

   No   Yes

Your medication (from reference[13])
1. This morning, did you forget to take your medication?

   No   Yes

2. Since the last consultation, did you run out of medication?

   No   Yes

3. Do you sometimes delay taking your treatment with regard to the usual hour?

   No   Yes

4. Do you sometimes omit your treatment because, on some days, you forget?

   No   Yes

5. Do you sometimes omit your treatment because, on some days, you have the feeling that it does more harm than good?

   No   Yes

6. Do you think that you have too many tablets to take?

   No   Yes

Your diabetes
1. What is your last HbA_{1c} level?

   _____%   I do not know

2. Are you satisfied with the control of your diabetes?

   In no way   A little bit   Rather   Completely

3. Would you like to improve the control of your diabetes?

   In no way   A little bit   Rather   A lot

4. Would you be ready to make efforts to improve the control of your diabetes?

   In no way   A little bit   Rather   A lot

Your blood pressure
1. What is your blood pressure?

   _____mmHg   I do not know

2. Are you satisfied with the control of your blood pressure?

   In no way   A little bit   Rather   Completely

3. Would you like to improve the control of your blood pressure?

   In no way   A little bit   Enough   A lot

4. Would you be ready to make efforts to improve the control of your blood pressure?

   In no way   A little bit   Enough   A lot

Your weight

1. What is your weight?

   _____kg   I do not know

2. What is your waist measurement?

   _____cm   I do not know

3. Are you satisfied with your weight?

   In no way   A little bit   Rather   Completely

4. Are you satisfied with your waist measurement?

   In no way   A little bit   Rather   Completely

5. Would you like to improve your weight?

   In no way   A little bit   Enough   A lot

6. Would you be ready to make efforts to improve your weight?

   In no way   A little bit   Enough   A lot

7. What weight would you like to have?

   _____kg   I do not know

8. How many centimeters of waist measurement would you like to lose?

   _____cm   I do not know

9. Do you feel hampered in your daily activities because of your weight or your stomach?

   In no way   A little bit   Enough   A lot

Your motivation

1. Are you motivated to follow the recommendations of your physician?

   a. With regard to the prescribed medication

      Not motivated   Little motivated   Motivated enough   Very motivated

   b. With regard to the practice of a physical activity

      Not motivated   Little motivated   Motivated enough   Very motivated

   c. With regard to the dietary advice

      Not motivated   Little motivated   Motivated enough   Very motivated

2. What are the main reasons that motivate you to follow the recommendations of your physician (several answers are possible):

   Feel at ease in my clothes, feel more attractive, be able to buy clothes that I want, to have more energy, to be more active

   Move better, feel better

   Better control of my diabetes, my blood pressure, my cholesterol, and my risk factors for heart disease

   The chance to live longer

   I trust my doctor