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MASTER'S DEGREE IN MEDICINE

TRENDS IN SELF-REPORTED PREVALENCE AND MANAGEMENT OF HYPERTENSION, HYPERCHOLESTEROLEMIA AND DIABETES IN SWISS ADULTS BETWEEN 1992 AND 2007

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ABSTRACT

Purpose: to assess the trends of prevalence of self-reported cardiovascular risk factors (CV RFs: hypertension, hypercholesterolemia, diabetes) and their management for the period of 1992 to 2007 in Switzerland.

Methods: four health interview surveys conducted between 1992 and 2007 in representative samples of the Swiss population (63,782 subjects overall). Self-reported CV RFs prevalence, treatment and control levels were computed after weighting. Weights were calculated by raking ratio such that the marginal distribution of the weighted totals conforms to the marginal distribution of the target population. Multivariate analysis was conducted using logistic regression.

Results: prevalence of all CV RFs increased between 1992 and 2007. Also, the prevalence of self-reported treatment among subjects with CV RFs increased, as confirmed by multivariate analysis: OR for hypolipidemic treatment relative to 1992: 0.64 [0.52-0.78]; 1.39 [1.18-1.65] and 2.00 [1.69-2.36] for 1997, 2002 and 2007, respectively. Still, in 2007, circa 40% of hypertensive, 60% of hypercholesterolemic and 50% of diabetic subjects weren't treated. On the other hand, there is an increase of the prevalence of controlled RFs as reported by treated subjects. This was confirmed by multivariate analysis 12.1 [12.0 - 12.2]; 4.16 [4.1 - 4.23] and 2.85 [2.79 - 2.90] for hypertension, hypercholesterolemia and diabetes, respectively, in 2007, relative to 1992.

Conclusion: the prevalence of self-reported hypertension, hypercholesterolemia and diabetes increased between 1992 and 2007 in the Swiss population. Despite a good control of treated subjects, still a significant percentage of subjects with CV RFs are not treated.

Keywords: hypertension; hypercholesterolemia; diabetes; trends; management; representative sample; Switzerland

INTRODUCTION

Cardiovascular disease is the main cause of premature death in industrialized countries, and its incidence is increasing worldwide (1). In Switzerland, between 1970 and 2004, mortality rates from ischemic heart disease have decreased by circa 50% in men, and by a third by women. Mortality rates from cerebrovascular disease also decreased during this period (www.bfs.admin.ch/bfs/portal/fr/index/news/publikationen.Document.110661.pdf). Whether those decreases are due to a decrease in cardiovascular risk factors prevalence and/or management is currently unknown.

There are few data regarding trends of cardiovascular risk factors in the Swiss population. The MONICA study showed an increase, between 1984 and 1993, in the prevalence of hypertension in men and a decrease in women. For the same time period, a decrease in the prevalence of hypercholesterolemia (defined as a total cholesterol level >6.5 mmol/L) was also reported for both genders (2). More recently, data from Geneva showed a decrease in the prevalence of hypertension for both genders between 1993 and 2000. For the same period, an increase in the prevalence of hypercholesterolemia was also reported for both genders (3). Still, it is not known if the results of this study also apply to the whole country. Thus, we used the data from four National Health Surveys conducted in representative samples of the Swiss population to assess the trends in self-reported prevalence, treatment and control of hypertension, hypercholesterolemia and diabetes in Switzerland, as well as to identify the groups at higher risk.

PARTICIPANTS AND METHODS

Swiss Health Survey

Data for the four Swiss Health Surveys (SHS) were obtained from the Swiss Federal Statistical Office (www.bfs.admin.ch). The SHS is a cross–sectional, nationwide, population–based telephone survey conducted every 5 years since 1992, i.e., four times, in 1992, 1997, 2002 and 2007 (4). The SHS aims to track public health trends in a representative sample of the resident population of Switzerland aged 15 and over.

The study population was chosen by stratified random sampling of a database of all private Swiss households with fixed line telephones. It is currently estimated that over 90% of the Swiss households have fixed telephones. The first sampling stratum consisted of the seven main regions: West “Leman”, West–Central “Mittelland”, Northwest, Zurich, North–Eastern, Central and South. The second stratum consisted of the cantons, and the number of households drawn was proportional to the population of the canton. In some cantons, oversampling of the households was made to obtain accurate cantonal estimates. Extra strata were used for two large cantons of Zurich and Bern.

Overall, 29 strata were used. Within these strata, households were randomly drawn and, within the household, one member was randomly selected within all members aged 15 years and over. A letter inviting this household member to participate in the survey was sent, then contacted by phone and interviewed using computer–assisted software managing both dialling and data collection. Face–to–face interviews were organised for subjects older than 75 years. In the case of long–term absence of a sampled subject, a proxy interviewee was requested to provide answers on behalf of the pre-defined sampled person. The interviews were carried out in German, French or Italian, as appropriate. People who did not speak any of these three languages were excluded from the survey. Other criteria for exclusion were: asylum seeker status, households without a fixed line telephone, very poor health status and living in a nursing home (5). Four sampling waves were performed (Winter, Spring, Summer and Autumn). Participation rate was 71% in 1992, 85% in 1997, 64% in 2002, and 66% in 2007. More details are available at http://www.bfs.admin.ch/bfs/portal/fr/index/infothek/erhebungen__quellen/blank/blank/ess/01.html.

Data collected

Three age categories were considered: 18 to 44, 45 to 64, and ≥65 years. Education was categorized as follows: 1) no education completed, 2) first level (primary school), 3) lower secondary level, 4) upper secondary level and 5) tertiary level, which

included university and other forms of education after the secondary level. We defined "low education" (categories 1 and 2), "middle education" (categories 3 and 4), and "high education" (category 5) groups. Self reported height and weight allowed the calculation of Body Mass Index (BMI). Three BMI categories were considered: normal (<25 kg/m^2), overweight (25-30 kg/m^2) and obese (>30 kg/m^2). Citizenship was defined as Swiss (having a Swiss passport) or foreigner.

The awareness of hypertension, hypercholesterolemia or diabetes was considered positive if the subjects answered positively to the questions: “Did a doctor or a health professional tell you that you have high blood pressure?”, “Did a doctor or a health professional tell you that you have a high cholesterol level?” and “Did a doctor tell you that you have diabetes?”, respectively.

Subjects were considered as treated for hypertension, hypercholesterolemia or diabetes if they answered positively to the questions “Are you treated for blood pressure?”, “Are you treated to decrease your cholesterol levels?” and “Are you treated for diabetes?”, respectively. A further question on doctor-prescribed medicines was asked. All subjects being treated were considered irrespective of the answer to the latter question.

Adequate treatment of hypertension, hypercholesterolemia or diabetes was considered if the subjects answered “normal or too low” to the question: “Currently, how is your blood pressure?”, “Currently, how is your cholesterol level?” and “Currently, how is your glycaemia?”, respectively. As the questionnaires changed slightly between surveys, some questions were missing, i.e., the question on awareness of hypertension wasn’t asked in 1992.

All subjects, irrespective of their status, were asked when they last had their blood pressure, cholesterol or glucose levels measured. An adequate screening was considered if the measurement had been performed during the last 12 months.

Statistical analysis

Statistical analysis was conducted using Stata version 10 (Statacorp, College Station, TX, USA) and SAS Guide version 3.1 (SAS Inc, Cary, NC; USA). Results were expressed as number of subjects and (percentage) or mean ± standard deviation. Comparisons were performed using chi-square for qualitative data or analysis of variance (ANOVA) for quantitative data. A first analysis was conducted using the original data from the surveys. A second analysis was conducted after weighting each subject according to the formula

$$w_i^h = H_i \cdot \frac{N_h}{n_h^n}$$

Where N_h is the average number of telephone numbers in stratum *h* (h=29), H_i is the household size, i.e. the number of subjects aged 15 and over living in household *i*, and n_h^n is the number of telephone numbers in the sample S_h corresponding to stratum *h* to the power *n* (*n*=sample size in stratum *h*). Weights were further corrected taking into account the percentage of nonresponders by raking ratio estimation (6). Briefly, raking is a way to approximate post-stratification on a set of variables when only their marginal population distributions are known. Raking ratio estimation is based on an iterative proportional fitting procedure involving simultaneous ratio adjustments of sample data to two or more marginal distributions of the population counts. With this approach, the weights are calculated such that the marginal distribution of the weighted totals conforms to the marginal distribution of the targeted population. Weighting partly allows the correction for bias, i.e. subjects with given characteristics who are under-represented in the original sample are attributed a higher weight. For simplicity, the weighted results will be presented and commented, as the conclusions arising from the unweighted data are similar.

Finally, a third analysis was conducted using a multivariate logistic regression analysis adjusting for age group, sex, nationality, education and BMI classes to assess trends during the study period, using either the original or the weighted data. The results

were expressed as Odds ratio and [95% confidence interval]. Statistical significance was considered for $p<0.05$.

RESULTS

Characteristics of the subjects

The characteristics of subjects according to survey are summarized in **table 1**. More women included, but this overrepresentation stayed relatively stable during the study period. Mean age increased 2.2 years and mean BMI increased 0.7 kg/m^2 during the study period. The number of foreigners increased by 3.6%. Finally, the percentage of subjects with a low education decreased, with a concomitant increase in the percentage of subjects both wit middle or high education.

Hypertension

The trends in prevalence of hypertension are shown in **table 2**. Between 1997 and 2007, self-reported hypertension in the Swiss general population increased by 2% ($P<0.001$), and this was further confirmed after multivariate adjustment (**table 3**). The prevalence decreased in women (-0.4%) and in the younger age group (18-45 years, -0.3%) but increased in all other groups. Subjects aged over 65 years had a 7.36 higher odds to report being hypertensive, while being obese more than quadrupled the odds; conversely, subjects with university level or foreigners had a lower odds of reporting being hypertensive, while no difference was found between genders. The prevalence of self-reported treatment increased by 8.3%, reaching 60.4% in 2007 (**table 2**). On multivariate analysis, a higher odds of reporting being treated was found for subjects aged over 45 and obese, while men and foreigners had a lower odds of reporting being treated. The others predictors weren't statistically significant (**table 3**). Prevalence of self-reported treatment prescribed by the doctor was 98.1%, 96.0%, 99.4% and 99.6% in 1992, 1997, 2002 and 2007, respectively. The daily taking of an antihypertensive drug was 90.2%, 89.6%, 95.3% and 97.1% in 1992, 1997, 2002 and 2007, respectively.

The prevalence of controlled hypertension increased by 49.5% during the study period (**table 2**), and this was confirmed after multivariate adjustment. Men and subjects over 65 had higher odds of reported control (**table 3**).

Finally, the prevalence of hypertension screening increased by 6.1% between 1992 and 2007, where 94.0% of participants reported having their blood pressure measured in the previous 12 months (**table 2**). On multivariate analysis, a higher odds of being screened was found for women, foreigners, subjects aged over 45, and among overweight or obese subjects (**table 3**).

Hypercholesterolemia

The trends in self-reported hypercholesterolemia increased from 7.2% in 1992 to 17.4% in 2007 (**table 2**) and this increase was further confirmed by multivariate analysis (**table 4**). Prevalence of hypercholesterolemia was found higher among men, subjects over 45 years and subjects with higher education or presenting with overweight or obesity (**table 4**).

Self-reported hypolipidemic drug treatment increased from 22.4% in 1992 to 38.8% in 2007 (**table 2**), and multivariate analysis showed a higher odds of being treated for men, older subjects, subjects with a low education or presenting with overweight or obesity (**table 4**). In 2007, 99.1% of hypolipidemic drug treatment was prescribed by the doctor, and taking the medication daily was reported by 93.5% of the subjects in 2002 and 94.8% in 2007. The prevalence of controlled hypercholesterolemia increased from 56.0% in 1997 to 84.7% in 2007 (**table 2**), and multivariate analysis showed a better control for men, subjects over 45 years, subjects with a medium and high education and a lower control in foreigners (**table 4**). Finally, hypercholesterolemia screening increased from 76.4% in 1992 to 90.3% in 2007 (**table 2**). On multivariate analysis, a higher odds of being screened was found for foreigners, subjects aged over 45, and in overweight or obese subjects, while men, subjects with a medium and a high education had lower odds of being screened (**table 4**).

Diabetes

Prevalence of self-reported diabetes increased from 3.4% in 1997 to 4.7% in 2007 (**table 2**), a finding confirmed by multivariate analysis (**table 5**) which also showed a higher odds of presenting with diabetes in men and subjects with increasing age or BMI, and a lower odds for subjects with middle or high education. The prevalence of self-reported diabetes treatment increased from 50.0% in 1997 to 53.3% in 2007 (**table 2**). Multivariate analysis showed higher odds of being treated for men, subjects aged over 45 and presenting with overweight or obesity, while a lower odds was found for foreigners (**table 5**). Self-reported diabetes control increased from 52.2% in 1997 to 74.6% in 2007 (**table 2**), and multivariate analysis showed a lower odds of being controlled among subjects aged 45-64 years and presenting with overweight or obesity and in foreigners and a higher odds among subjects with a high education (**table 5**). Finally, the prevalence of diabetes screening increased from 74.1% in 1997 to 91.2% in 2007 (**table 2**). On multivariate analysis, a higher odds of being screened was found for foreigners, subjects aged over 45, and for overweight or obese subjects, while a lower odds of being screened was found for men and subjects with medium or high education (table 5).

DISCUSSION

Since the MONICA study in the nineties (2) and the Bus Santé study in Geneva (3), there has been little information on trends of cardiovascular risk factors in Switzerland. The data from the Swiss National Health Surveys thus provide important information regarding the prevalence of hypertension, hypercholesterolemia, diabetes and their management in the Swiss population. As the sampling frame covers about 90% of Swiss households and the participation rate was relatively high for all studies (between 66% in 2007 and 85% in 1997), this study is a good reflect of the Swiss situation. Further, the fact that the weighted and unweighted results were quite similar also suggests the absence of important bias.

Hypertension

Prevalence of self-reported hypertension increased during the study period and were comparable to those reported in similar studies conducted in the USA (7, 8) and Germany (9) (**Figure 1**). This increase could be due either to an increase in the true prevalence of hypertension, or to a more widespread screening, or to both. The second hypothesis might be more likely, as the prevalence of subjects reporting having their blood pressure measured during the previous 12 months also increased during this period, a finding already reported in the literature (10). Further, measured data from an examination survey conducted in Geneva showed a decrease in the prevalence of hypertension in both genders between 1993 and 2000 (3).

Another likely determinant of the increase in the prevalence is the change of the thresholds to define hypertension, which decreased from ≥160/95 mmHg in 1993 (2) to ≥140/90 mmHg afterwards (www.swisshypertension.ch/guidelines.htm).

Nevertheless, it should be noted that self-reported prevalence rates are probably underestimated, as a recent study conducted in Lausanne has shown that less than two thirds of hypertensive subjects are actually aware of their condition (11).

A higher prevalence of reported hypertension was found among subjects aged over 45 years or presenting with overweight or obesity. Those findings are in agreement with the literature (8, 12, 13), and are partly due to an increased screening with age or because of the presence of other hypertension risk factors (14).

Conversely, foreigners had a lower prevalence of reported hypertension, and this could not be attributed to a lower screening frequency or to differences in BMI status. Possible explanations include differences in dietary or genetic background.

The prevalence of hypertension was also inversely related with educational level. Those findings are in agreement with a study conducted in the USA (15) and might be related to a better lifestyle, namely regarding dietary salt intake, although data from the Geneva study showed a similar trend for severe hypertension only (≥160/95 mmHg) (16) and no improvement in salt intake (17).

Self-reported treatment of hypertension increased considerably during the study period, suggesting an improvement in the management of this risk factor. Still, in 2007, only six out of ten self-reported hypertensive subjects indicated they were on antihypertensive treatment. Although the remaining 40% might be under nonpharmacological antihypertensive measures such as diet (18) or specific lifestyle modifications (14), our findings suggest that there is still room for improvement regarding pharmacological management of hypertension, as reported previously (11). Subjects aged over 45 and the obese had higher odds of reporting being treated, the opposite being found for men; this latter finding is in agreement with the literature (7, 19) and suggest that men might be less careful regarding cardiovascular prevention that women, a finding also already reported (8).

A considerable increase in self-reported control of hypertension was found for the period 1997-2007. Similar trends had been reported for US adults and elderly (7, 8, 12, 20) and in France (19). The increase might be related to an improvement in antihypertensive treatment, namely with the appearance of more potent and new classes antihypertensive drugs, and/or an improvement of subject's compliance. Still, our results are probably overestimated because some treated subjects might report being controlled just because they are taking antihypertensive drugs. Indeed, a previous study conducted in Lausanne showed that a consistent fraction of treated hypertensive subjects actually presented with high blood pressure levels (11). Hence, it is likely that the true prevalence of controlled hypertension in Switzerland might actually be lower.

Hypercholesterolemia

Prevalence of self-reported hypercholesterolemia increased during the study period, and this increase was further confirmed by multivariate analysis. This increase is in agreement with the results from another Swiss study, which showed an increase in the prevalence of hypercholesterolemia between 1993 and 2000 (3). A comparison between Switzerland, France (19) and Germany (9) regarding the prevalence of self-reported hypercholesterolemia is summarized in **figure 2**. Again, our findings are within those

reported for other countries, with a general increase of the prevalence of reported hypercholesterolemia over time. As for hypertension, possible explanations include a true increase in the prevalence of hypercholesterolemia, an increase in screening, a decrease in the threshold values to define hypercholesterolemia (www.nhlbi.nih.gov/guidelines/cholesterol) or a mixture of them. Interestingly, cholesterol screening increased considerably during the study period, and the prevalence of subjects reporting having their blood cholesterol levels assessed during the previous 12 months was actually higher than in other studies (10) (**Figure 3**). Still, in 2007, the prevalence of self-reported hypercholesterolemia was lower in Switzerland than in the USA (10) or France (19). Two explanations are possible, i.e. the prevalence of hypercholesterolemia being indeed lower in Switzerland, or a lower screening by Swiss GPs. Indeed, Cornuz & al. have shown that, in Switzerland, only 75% of the physicians considered that screening for high cholesterol was very important, versus 93% for blood pressure (21). Those differences could partly explain the lower percentage of self-reported hypercholesterolemia relative to hypertension.

A higher prevalence of reported hypercholesterolemia was found among men, subjects aged over 45 years, with high education or presenting with overweight or obesity. Those findings are in agreement with other studies (15, 19) but not with others (22), which reported a decrease in hypercholesterolemia with education. Still, our results suggest that, contrary to hypertension, a higher education is related to a higher prevalence of reported hypercholesterolemia. This higher awareness is not due to higher screening rates among highly educated subjects, as their odds of being screened were significantly lower than lower educated subjects (**table 4**). A possible explanation is the fact that highly educated subjects know better their medical situation (23), but further studies are needed to better assess this point.

The self reported hypolipidemic treatment almost doubled during the study period, in line with other studies conducted among US (24), French (19) and German (9) populations. Nevertheless, in 2007, only four out of ten Swiss patients who had been told they presented with hypercholesterolemia reported being treated. Although diet has been

shown to be lower cholesterol levels (18), it is rather unlikely that 60% of the patients diagnosed with hypercholesterolemia are following low cholesterol intake diet alone. Male gender, older age, being overweight or obese increased the odds of being treated, whereas education decreased the odds. The higher odds of being treated for men is in agreement with the literature (19).

As for hypertension, a considerable increase in self-reported control of hypercholesterolemia was found, a finding also reported for other countries (19, 25). Two hypotheses are possible, i.e. an improvement in hypolipidemic drugs and/or subject's compliance. Again, these results are certainly overestimated, either because the subjects believed they were controlled just because they were treated, or because their GP considered them as treated despite borderline high values (26).

Diabetes

The prevalence of self-reported diabetes increased during period 1997-2007, and this increase persisted after multivariate adjustment. Still, in 2007, the prevalence of self-reported diabetes was lower than reported for France (19) or the US (20). Interestingly, the increase in the prevalence of diabetes persisted after adjustment for overweight and obesity, suggesting that other factors might intervene (27), namely a better screening. Indeed, the prevalence of subjects reporting having their blood glucose assessed the previous 12 months increased from 74% in 1997 to 91.1% in 2007, a finding in agreement with other studies (28, 29).

In agreement with the literature (27), a higher prevalence of reported diabetes was found among men, subjects aged over 45 years or presenting with overweight or obesity. Also, and as reported previously (15, 27), educational level seems to be a good diabetes predictor, in contrary for the hypercholesterolemia. High educated subjects could have more financial means to adapt their lifestyle, e.g., to buy higher quality food (30, 31). They could better know their health state despite less screened. Further studies are needed to better assess this point.

Self reported diabetes treatment increased almost two-fold, a trend also reported for France (19) and Italy (32). Still, in 2007, only half of the subjects diagnosed with diabetes reported being treated, and, as for hypercholesterolemia, it is rather unlikely that the remaining half is only on diet. Male gender, older age and subjects with overweight or obesity were associated with increased odds of being treated with a drug, while the opposite was found for educational level. Overall, our data indicate that, in Switzerland, many diabetic subjects are probably undertreated, and that further efforts should be made to implement nonpharmacological and pharmacological treatment.

An increase in self-reported diabetic control was found, a finding also reported elsewhere (25). This improvement is probably due to a change in therapies and/or an improvement of the subject's compliance. Still, in 2007, one quarter of treated diabetic subjects reported having high glycaemia, and this figure is again certainly underestimated because many treated subjects believed they are controlled due to the fact they receive a drug.

The fact that men are less screened for their cardiovascular risk factors might be due to a lower attendance to their general practitioner, as suggested previously. Indeed, women tend to consult their general practitioner more frequently, namely because of their children’s disease, thus increasing the opportunities for screening (33).

This study has some limitations worth indicating. The self-reporting of the cardiovascular risk factors might underestimate the real prevalence in the population. Still, it represents the result of the screening done by doctors and health professionals and has been used in other studies for the assessment of trends (22, 34-37). Some changes over time on how doctors communicate with their patients and inform them of the results might have occurred. For instance, shared decision making is clearly more frequently applied nowadays than it was in 1992. Also, patient awareness has drastically changed during the study period, partly due to CVD prevention campaigns: patients want to know their cholesterol, blood pressure and glucose levels and will ask their doctor for the results. Further, it has been shown that self-reported data on cardiovascular risk factors is valid and can be used to assess prevalence rates in most cases (38-40).

Increased salt or saturated fatty acid intakes have been shown to be related with hypertension and hypercholesterolemia, respectively (41-44), but no information regarding sodium or fatty acid intake was available. Still, data from Geneva suggest that albeit an increase in total salt intake (17), no increase in blood pressure levels was observed. Hence, it can be speculated that the impact of dietary changes on increase in the prevalence of hypertension or hypercholesterolemia in the Swiss population is modest, but more research is needed to better assess this point.

CONCLUSION

During the period from 1992 to 2007, the prevalence of self-reported hypertension, hypercholesterolemia and diabetes increased in the Swiss population. Despite a good control of treated subjects, still a significant percentage of subjects with cardiovascular risk factors are not treated. Our findings thus indicate that continuous efforts are still needed for the clinical prevention of cardiovascular disease in Switzerland.

WEIGHTED DATA

Table 1: characteristics of the samples.

	1992	1997	2002	2007
Women (%)	51.4	51.7	51.6	51.2
Age classes (%)				
18-44 years	53.9	51.5	49.9	49.5
45-64 years	28.6	29.8	30.9	31.9
≥ 65 years	17.5	18.7	19.2	18.7
Swiss nationality (%)	83.1	81.7	80.5	79.5
Educational level (%)				
Low [§]	22.2	22.6	20.4	12.8
Middle [§§]	56.8	60.0	63.2	59.6
High [§§§]	21.0	17.4	16.4	27.6
BMI classes (%)				
Normal	68.6	63.8	61.3	61.0
Overweight	25.8	29.1	30.7	30.4
Obese	5.6	7.1	8.0	8.6
BMI [kg/m^2]	23.7 ± 3.8	24.7 ± 3.9	24.3 ± 4.0	24.4 ± 4.1
Age [years]	45.1 ± 17.3	46.5 ± 17.6	47.2 ± 17.5	47.3 ± 17.6

Results are expressed as weighted percentage and average ± standard deviation. [§] no education completed + first level (primary school). [§§] lower + upper secondary level. [§§§] tertiary level + other education after secondary level.

Table 2: trends in self-reported prevalence and management of hypertension, hypercholesterolemia and diabetes in the Swiss population, 1992 – 2007.

	1992	1997	2002	2007
Hypertension (%)				
Screening	87.9	84.5	94.0	94.0
Prevalence	-	22.1	22.4	24.1
Treatment *	-	52.1	53.8	60.4
Control **	38.5	70.4	-	88.0
Hypercholesterolemia (%)				
Screening	76.4	72.6	91.4	90.3
Prevalence	7.2	11.9	14.7	17.4
Treatment *	22.4	18.5	32.2	38.8
Control **	-	56.0	-	84.7
Diabetes (%)				
Screening	-	74.1	92.0	91.2
Prevalence	-	3.4	3.9	4.7
Treatment (drug) *	-	50.0	-	53.3
Control **	-	52.2	-	74.6

Results are expressed as weighted percentage. * among subjects reporting being hypertensive, dyslipidemic or diabetic; ** among treated subjects. -, data not available.

Table 3: multivariate analysis of the trends in self-reported prevalence and management of hypertension in the Swiss population, 1992 – 2007.

	Prevalence	Treatment *	Control **	Screening
Surveys				
1992	-	-	1 (ref.)	1 (ref.)
1997	1 (ref.)	1 (ref.)	3.95 [3.91 - 3.98]	0.71 [0.70 - 0.72]
2002	0.98 [0.97 - 0.99]	1.01 [1.00 - 1.02]	-	2.09 [2.08 - 2.10]
2007	1.10 [1.09 - 1.11]	1.32 [1.31 - 1.33]	12.1 [12.0 - 12.2]	2.11 [2.10 - 2.12]
Gender				
Woman	1 (ref.)	1 (ref.)	1 (ref.)	1 (ref.)
Man	0.99 [0.99 - 0.99]	0.86 [0.85 - 0.87]	1.24 [1.23 - 1.25]	0.62 [0.61 - 0.63]
Age groups				
18-44	1 (ref.)	1 (ref.)	1 (ref.)	1 (ref.)
45-64	2.79 [2.78 - 2.80]	4.96 [4.93 – 5.00]	0.84 [0.83 - 0.86]	1.48 [1.47 - 1.48]
≥ 65	7.36 [7.34 - 7.39]	15.1 [15.0 - 15.2]	1.13 [1.12 - 1.15]	2.76 [2.75 - 2.78]
Nationality				
Swiss	1 (ref.)	1 (ref.)	1 (ref.)	1 (ref.)
Other	0.90 [0.89 - 0.91]	0.91 [0.90 - 0.92]	0.91 [0.90 - 0.92]	1.20 [1.19 - 1.21]
Education				
Low	1 (ref.)	1 (ref.)	1 (ref.)	1 (ref.)
Medium	0.93 [0.92 - 0.94]	0.98 [0.97 - 0.98]	0.91 [0.90 - 0.92]	1.08 [1.08 - 1.08]
High	0.90 [0.89 - 0.91]	1.03 [1.02 - 1.03]	0.98 [0.96 - 0.99]	0.99 [0.99 - 1.00]
BMI classes				
Normal	1 (ref.)	1 (ref.)	1 (ref.)	1 (ref.)
Overweight	1.94 [1.94 - 1.95]	1.42 [1.41 - 1.43]	0.87 [0.86 - 0.88]	1.28 [1.28 - 1.29]
Obesity	4.23 [4.21 - 4.25]	1.98 [1.96 - 1.99]	0.94 [0.93 - 0.95]	1.71 [1.70 - 1.72]

Results are expressed as multivariate-adjusted odds ratio and [95% confidence interval]. * among subjects with reported hypertension; **, among treated subjects. -, data not available.

Table 4. multivariate analysis of the trends in self-reported prevalence and management of hypercholesterolemia in the Swiss population, 1992 – 2007.

	Prevalence	Treatment *	Control **	Screening
Surveys				
1992	1 (ref.)	1 (ref.)	-	1 (ref.)
1997	1.69 [1.69 - 1.70]	0.67 [0.67 - 0.68]	1 (ref.)	0.79 [0.78 - 0.79]
2002	2.13 [2.12 - 2.14]	1.47 [1.45 - 1.48]	-	3.29 [3.27 - 3.30]
2007	2.57 [2.56 - 2.58]	1.86 [1.85 - 1.88]	4.16 [4.10 - 4.23]	2.95 [2.93 - 2.96]
Gender				
Woman	1 (ref.)	1 (ref.)	1 (ref.)	1 (ref.)
Man	1.25 [1.24 - 1.26]	1.51 [1.50 - 1.52]	1.26 [1.24 - 1.28]	0.90 [0.89 - 0.91]
Age groups				
18-44	1 (ref.)	1 (ref.)	1 (ref.)	1 (ref.)
45-64	3.45 [3.44 - 3.46]	3.37 [3.34 - 3.4]	1.28 [1.24 - 1.32]	1.11 [1.11 - 1.12]
≥ 65	4.69 [4.67 - 4.71]	8.42 [8.34 - 8.5]	1.69 [1.64 - 1.74]	1.82 [1.81 - 1.83]
Nationality				
Swiss	1 (ref.)	1 (ref.)	1 (ref.)	1 (ref.)
Other	1.00 [0.99 - 1.00]	1.11 [1.11 - 1.12]	0.84 [0.82 - 0.86]	1.09 [1.08 - 1.09]
Education				
Low	1 (ref.)	1 (ref.)	1 (ref.)	1 (ref.)
Medium	1.08 [1.08 - 1.09]	0.95 [0.95 - 0.96]	1.11 [1.09 - 1.14]	0.90 [0.89 - 0.91]
High	1.25 [1.25 - 1.26]	0.86 [0.85 - 0.86]	1.40 [1.36 - 1.43]	0.71 [0.71 - 0.71]
BMI classes				
Normal	1 (ref.)	1 (ref.)	1 (ref.)	1 (ref.)
Overweight	1.46 [1.46 - 1.46]	1.36 [1.35 - 1.37]	1.10 [1.09 - 1.12]	1.14 [1.14 - 1.15]
Obesity	1.65 [1.65 - 1.66]	1.74 [1.72 - 1.75]	1.01 [0.99 - 1.00]	1.34 [1.33 - 1.35]

Results are expressed as multivariate-adjusted odds ratio and [95% confidence interval]. * among subjects with reported hypercholesterolemia; **, among treated subjects.-, data not available.

Table 5. multivariate analysis of the trends in self-reported prevalence and management of diabetes in the Swiss population, 1997 – 2007.

	Prevalence	Treatment *	Control **	Screening
Surveys				
1997	1 (ref.)	1 (ref.)	1 (ref.)	1 (ref.)
2002	1.32 [1.31 - 1.33]	-	-	4.17 [4.15 - 4.19]
2007	1.44 [1.44 - 1.45]	1.16 [1.15 - 1.18]	2.85 [2.79 - 2.90]	3.97 [3.95 - 3.99]
Gender				
Woman	1 (ref.)	1 (ref.)	1 (ref.)	1 (ref.)
Man	1.22 [1.21 - 1.22]	1.24 [1.23 - 1.26]	0.97 [0.95 - 0.99]	0.91 [0.91 - 0.92]
Age groups				
18-44	1 (ref.)	1 (ref.)	1 (ref.)	1 (ref.)
45-64	2.82 [2.80 - 2.84]	2.79 [2.73 - 2.85]	0.62 [0.60 - 0.64]	1.18 [1.18 - 1.19]
≥ 65	6.40 [6.36 - 6.45]	5.23 [5.12 - 5.34]	1.01 [0.97 - 1.05]	1.97 [1.96 - 1.98]
Nationality				
Swiss	1 (ref.)	1 (ref.)	1 (ref.)	1 (ref.)
Other	1.00 [0.99 - 1.01]	0.74 [0.73 - 0.76]	0.55 [0.53 - 0.56]	1.04 [1.04 - 1.05]
Education				
Low	1 (ref.)	1 (ref.)	1 (ref.)	1 (ref.)
Medium	0.78 [0.78 - 0.78]	1.45 [1.43 - 1.47]	1.00 [0.98 - 1.03]	0.93 [0.92 - 0.93]
High	0.71 [0.71 - 0.72]	1.00 [0.98 - 1.02]	1.37 [1.33 - 1.42]	0.67 [0.67 - 0.68]
BMI classes				
Normal	1 (ref.)	1 (ref.)	1 (ref.)	1 (ref.)
Overweight	1.58 [1.58 - 1.59]	1.64 [1.62 - 1.66]	0.93 [0.91 - 0.95]	1.10 [1.09 - 1.11]
Obesity	3.53 [3.51 - 3.56]	2.21 [2.17 - 2.25]	0.67 [0.65 - 0.68]	1.31 [1.30 - 1.32]

Results are expressed as multivariate-adjusted odds ratio and [95% confidence interval]. * among subjects with reported diabetes; **, among treated subjects. -, data not available.

ORIGINAL DATA

Table 1: characteristics of the samples.

	1992	1997	2002	2007
Women (%)	54.7	55.6	54.7	55.2
Age classes (%)				
18-44 years	54.7	52.6	45.4	43.6
45-64 years	28.4	27.7	32.2	32.0
≥ 65 years	16.9	19.7	22.5	24.4
Swiss nationality (%)	86.4	84.3	87.9	87.1
Educational level (%)				
Low [§]	21.2	22.0	19.2	13.8
Middle [§§]	57.2	60.7	63.9	58.9
High [§§§]	21.6	17.3	16.9	27.3
BMI classes (%)				
Normal	69.5	65.3	61.2	60.5
Overweight	25.0	27.7	30.4	30.6
Obese	5.5	7.0	8.4	8.9
BMI [kg/m^2]	23.6 ± 3.8	24.0 ± 4.0	24.4 ± 4.1	24.5 ± 4.1
Age [years]	45.3 ± 17.2	46.7 ± 17.6	49.6 ± 17.1	50.4 ± 17.6

Results are expressed as percentage and average ± standard deviation.
[§] no education completed + first level (primary school). [§§] lower + upper secondary level. [§§§] tertiary level + other education after secondary level.

Table 2: trends in self-reported prevalence and management of hypertension, hypercholesterolemia and diabetes in the Swiss population, 1992 – 2007.

	1992	1997	2002	2007
Hypertension (%)				
Screening	88.6	84.6	93.9	94.1
Prevalence	-	22.3	24.4	26.8
Treatment *	-	52.3	54.9	64.0
Control **	40.8	71.2	-	87.8
Hypercholesterolemia (%)				
Screening	77.6	72.5	91.2	90.3
Prevalence	7.4	12.3	16.0	19.5
Treatment *	22.7	18.1	32.7	41.9
Control **	-	55.6	-	85.3
Diabetes (%)				
Screening	-	74.0	91.8	91.1
Prevalence	-	3.4	5.1	5.5
Treatment (drug) *	-	48.9	-	57.1
Control **	-	52.1	-	73.5

Results are expressed as percentage. * among subjects reporting being hypertensive, dyslipidemic or diabetic; ** among treated subjects. -, data not available.

Table 3: multivariate analysis of the trends in self-reported prevalence and management of hypertension in the Swiss population, 1992 – 2007.

	Prevalence	Treatment *	Control **	Screening
Surveys				
1992	-	-	1 (ref.)	1 (ref.)
1997	1 (ref.)	1 (ref.)	3.72 [3.14 - 4.41]	0.68 [0.62 - 0.73]
2002	1.00 [0.94 - 1.06]	0.96 [0.87 - 1.07]	-	1.86 [1.70 - 2.03]
2007	1.11 [1.04 - 1.18]	1.34 [1.20 - 1.49]	10.5 [8.94 - 12.3]	1.88 [1.72 - 2.05]
Gender				
Woman	1 (ref.)	1 (ref.)	1 (ref.)	1 (ref.)
Man	1.02 [0.97 - 1.07]	0.85 [0.78 - 0.93]	1.21 [1.04 - 1.40]	0.64 [0.60 - 0.68]
Age groups				
18-44	1 (ref.)	1 (ref.)	1 (ref.)	1 (ref.)
45-64	2.84 [2.68 - 3.01]	4.92 [4.35 - 5.57]	0.91 [0.71 - 1.17]	1.52 [1.41 - 1.63]
≥ 65	7.25 [6.83 - 7.70]	13.7 [12.0 - 15.5]	1.30 [1.02 - 1.66]	2.69 [2.44 - 2.97]
Nationality				
Swiss	1 (ref.)	1 (ref.)	1 (ref.)	1 (ref.)
Other	0.91 [0.85 - 0.98]	0.89 [0.78 - 1.02]	0.84 [0.66 - 1.07]	1.10 [1.00 - 1.21]
Education				
Low	1 (ref.)	1 (ref.)	1 (ref.)	1 (ref.)
Medium	0.93 [0.87 - 0.98]	0.99 [0.90 - 1.10]	1.05 [0.89 - 1.23]	1.06 [0.97 - 1.16]
High	0.87 [0.81 - 0.94]	1.03 [0.90 - 1.19]	1.08 [0.86 - 1.35]	0.99 [0.90 - 1.10]
BMI classes				
Normal	1 (ref.)	1 (ref.)	1 (ref.)	1 (ref.)
Overweight	1.99 [1.89 - 2.09]	1.39 [1.28 - 1.53]	0.87 [0.75 - 1.01]	1.29 [1.20 - 1.39]
Obesity	4.06 [3.77 - 4.37]	2.00 [1.77 - 2.25]	0.88 [0.73 - 1.07]	1.56 [1.36 - 1.79]

Results are expressed as multivariate-adjusted odds ratio and [95% confidence interval]. * among subjects with reported hypertension; **, among treated subjects. -, data not available.

Table 4. multivariate analysis of the trends in self-reported prevalence and management of hypercholesterolemia in the Swiss population, 1992 – 2007.

	Prevalence	Treatment *	Control **	Screening
Surveys				
1992	1 (ref.)	1 (ref.)	-	1 (ref.)
1997	1.73 [1.59 - 1.88]	0.63 [0.52 - 0.77]	1 (ref.)	0.74 [0.68 - 0.80]
2002	2.14 [1.99 - 2.31]	1.37 [1.16 - 1.63]	-	2.92 [2.67 - 3.19]
2007	2.65 [2.46 - 2.85]	1.95 [1.65 - 2.31]	4.26 [3.17 - 5.73]	2.66 [2.44 - 2.90]
Gender				
Woman	1 (ref.)	1 (ref.)	1 (ref.)	1 (ref.)
Man	1.21 [1.16 - 1.28]	1.45 [1.30 - 1.60]	1.27 [0.95 - 1.69]	0.90 [0.84 - 0.96]
Age groups				
18-44	1 (ref.)	1 (ref.)	1 (ref.)	1 (ref.)
45-64	3.28 [3.09 - 3.48]	3.22 [2.73 - 3.80]	1.68 [1.00 - 2.84]	1.15 [1.08 - 1.23]
≥ 65	4.53 [4.25 - 4.83]	7.61 [6.43 - 9.01]	2.62 [1.55 - 4.42]	1.77 [1.63 - 1.93]
Nationality				
Swiss	1 (ref.)	1 (ref.)	1 (ref.)	1 (ref.)
Other	1.01 [0.94 - 1.09]	1.01 [0.87 - 1.19]	0.90 [0.58 - 1.40]	1.04 [0.95 - 1.14]
Education				
Low	1 (ref.)	1 (ref.)	1 (ref.)	1 (ref.)
Medium	1.04 [0.98 - 1.11]	0.86 [0.76 - 0.97]	1.10 [0.78 - 1.53]	0.92 [0.85 - 1.00]
High	1.20 [1.11 - 1.29]	0.77 [0.66 - 0.90]	1.49 [0.96 - 2.32]	0.77 [0.69 - 0.85]
BMI classes				
Normal	1 (ref.)	1 (ref.)	1 (ref.)	1 (ref.)
Overweight	1.46 [1.39 - 1.54]	1.39 [1.26 - 1.55]	1.05 [0.79 - 1.41]	1.13 [1.06 - 1.21]
Obesity	1.60 [1.48 - 1.73]	1.78 [1.54 - 2.07]	0.97 [0.65 - 1.43]	1.34 [1.19 - 1.51]

Results are expressed as multivariate-adjusted odds ratio and [95% confidence interval]. * among subjects with reported hypercholesterolemia; **, among treated subjects.-, data not available.

Table 5. multivariate analysis of the trends in self-reported prevalence and management of diabetes in the Swiss population, **1997 – 2007**.

	Prevalence	Treatment *	Control **	Screening
Surveys				
1997	1 (ref.)	1 (ref.)	1 (ref.)	1 (ref.)
2002	1.41 [1.24 - 1.59]	-	-	3.98 [3.66 - 4.34]
2007	1.48 [1.31 - 1.67]	1.33 [1.04 - 1.70]	2.56 [1.78 - 3.67]	3.71 [3.41 - 4.05]
Gender				
Woman	1 (ref.)	1 (ref.)	1 (ref.)	1 (ref.)
Man	1.28 [1.17 - 1.40]	1.35 [1.06 - 1.71]	1.11 [0.78 - 1.58]	0.93 [0.86 - 1.00]
Age groups				
18-44	1 (ref.)	1 (ref.)	1 (ref.)	1 (ref.)
45-64	2.80 [2.46 - 3.18]	2.91 [1.96 - 4.31]	0.62 [0.30 - 1.29]	1.22 [1.12 - 1.32]
≥ 65	5.85 [5.15 - 6.66]	4.82 [3.30 - 7.06]	0.95 [0.47 - 1.95]	1.91 [1.73 - 2.11]
Nationality				
Swiss	1 (ref.)	1 (ref.)	1 (ref.)	1 (ref.)
Other	1.02 [0.88 - 1.17]	0.86 [0.60 - 1.22]	0.69 [0.40 - 1.19]	1.01 [0.91 - 1.12]
Education				
Low	1 (ref.)	1 (ref.)	1 (ref.)	1 (ref.)
Medium	0.75 [0.68 - 0.83]	1.11 [0.85 - 1.45]	0.99 [0.67 - 1.47]	0.91 [0.82 - 1.01]
High	0.70 [0.61 - 0.81]	0.98 [0.69 - 1.40]	1.47 [0.84 - 2.57]	0.74 [0.66 - 0.84]
BMI classes				
Normal	1 (ref.)	1 (ref.)	1 (ref.)	1 (ref.)
Overweight	1.55 [1.40 - 1.71]	1.69 [1.30 - 2.19]	0.76 [0.50 - 1.14]	1.10 [1.02 - 1.19]
Obesity	3.58 [3.18 - 4.02]	2.43 [1.79 - 3.29]	0.75 [0.47 - 1.18]	1.39 [1.21 - 1.59]

Results are expressed as multivariate-adjusted odds ratio and [95% confidence interval]. * among subjects with reported diabetes; **, among treated subjects. -, data not available.

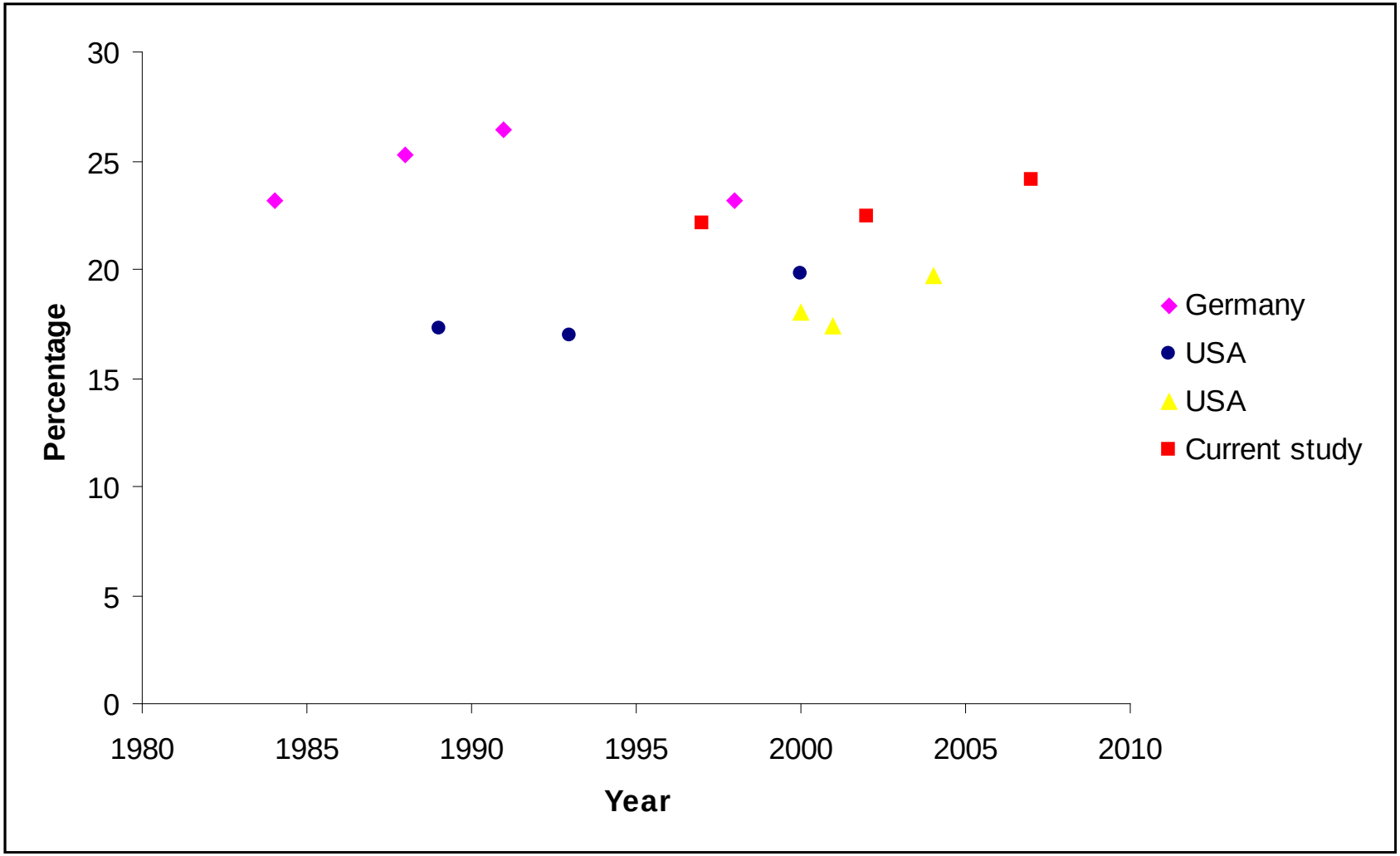
FIGURE LEGENDS

Figure 1: trends in hypertension awareness, by country. Data for subjects aged 25-69 years living in West Germany and West Berlin (9), for USA (7, 8) and Swiss (current study) adults (18+ years).

Figure 2: trends in hypercholesterolemia awareness, by country. Data are presented for subjects aged 25-69 years living in West Germany and West Berlin (9), for subjects aged 35-64 years in France (19) and for Swiss adults (current study).

Figure 3: trends in the prevalence of subjects reporting having their blood cholesterol levels, by country. Data are presented for USA (10) and Swiss (current study) adults.

FIGURE 1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Percentage
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1985
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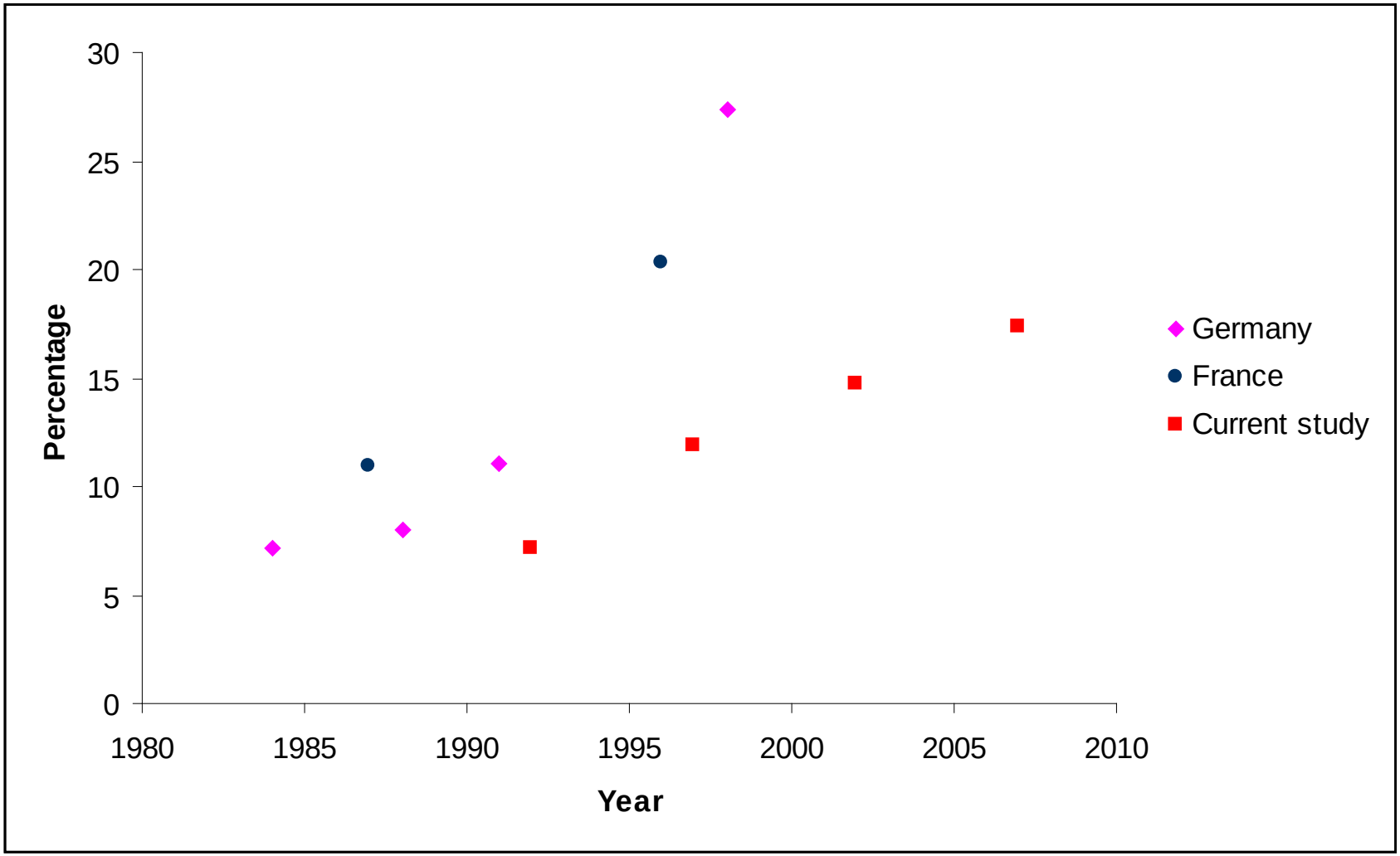
Germany
USA
USA
Current study

FIGURE 2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25
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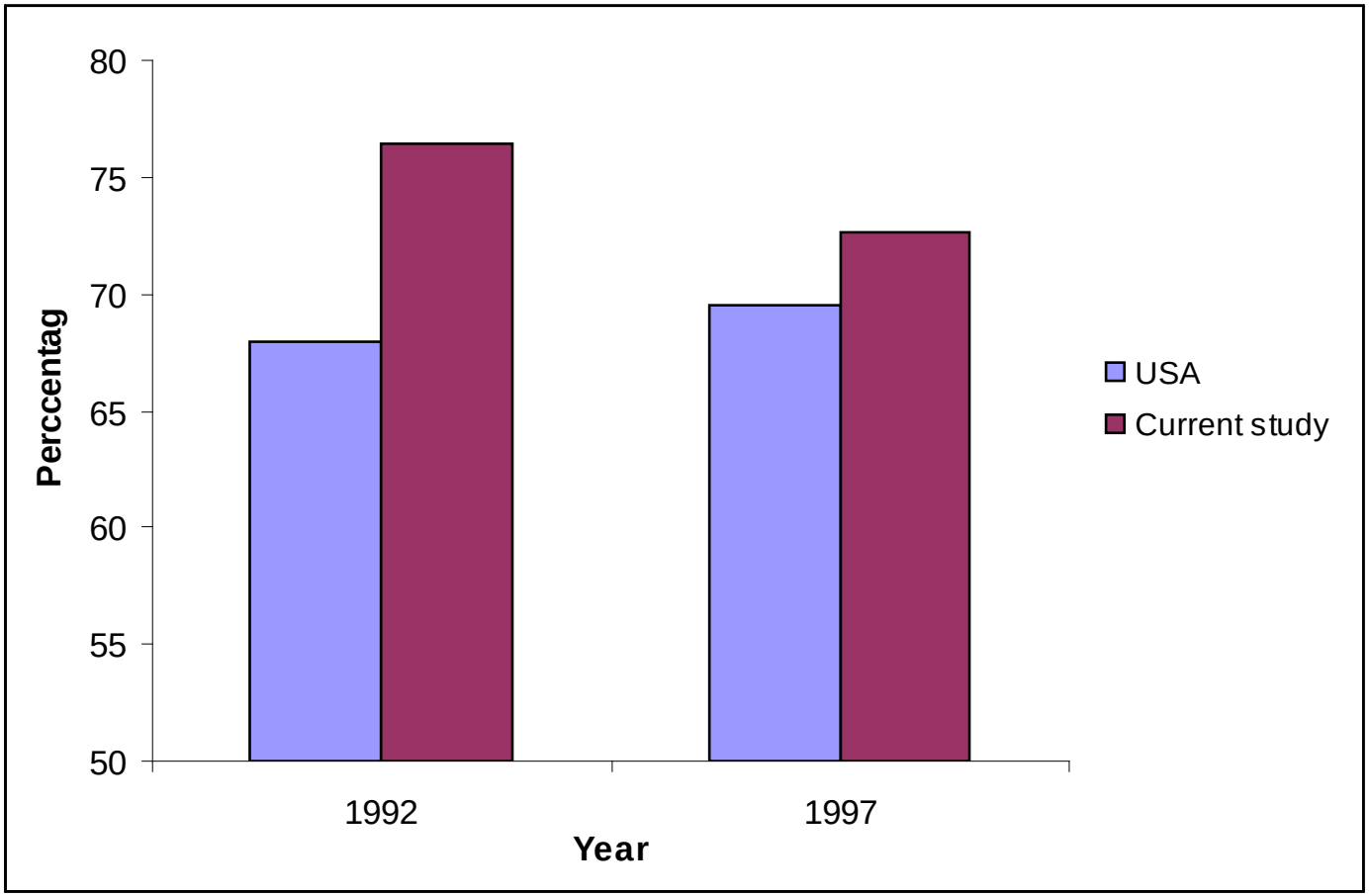
Current study

FIGURE 3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Current study

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