

# WORK PRODUCTIVITY LOSS DUE TO HYPOGLYCEMIA AND DIABETES COMPLICATIONS

## RESULTS OF POLISH CROSS-SECTIONAL MULTICENTER STUDY

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## Background

In the long term, uncontrolled T2DM leads to deterioration of kidneys, eyes, nerves and cardiovascular system functions, consequently affecting health, daily activity and finally work ability. Complications of T2DM impact also work productivity of professionally active population.

We asked patients who had an episode of severe hypoglycemia or one of the selected 18 diabetic complications up to three years prior to the study to estimate the productivity loss they experienced at the time of the study caused directly by these events, regardless of other complications they might have. Productivity loss was defined in terms of absenteeism and presenteeism rates among working patients.

### Objective of the study

To determine the long term loss of productivity due to severe hypoglycemic episodes and micro- and macrovascular T2DM complications i.e.: myocardial infarction, angina pectoris, chronic heart failure, stroke, neuropathy, peripheral vascular disease, end-stage chronic renal disease, significant vision loss, cataract and foot ulcer in Poland.

## Materials and Methods

### Study design

A multicenter, cross-sectional study was conducted in 18 separate subgroups of patients with T2DM in working age (18-60 years for women, 18-65 years for men). Respondents were selected to represent the population of T2DM patients with a 'chronic' diabetic complication (e.g. depression, chronic heart failure, diabetic foot) or convalescents recovering from an 'acute' diabetic complication (severe hypoglycemia, stroke or amputation caused by diabetic foot). The study was carried out in patients who, up to three years prior to the study, experienced at least one of the complications. A total of 920 respondents in working age participated in the study in November 2014, 640 of them were employed and were included in the analysis. Each of the 18 subgroups estimated productivity loss due to only one type of diabetes complication.

### Specialist's questionnaire

182 specialists from diabetology, cardiology, neurology, ophthalmology, vascular surgery, psychiatry, nephrology ambulatory centers and dialysis units, sampled from all 16 regions of Poland, participated in patients' recruitment. Specialist could recruit patients, who came to them for a planned check-up visits, only to selected groups that were related to their area of expertise (e.g. stroke group was recruited by neurologists, while renal failure group – at dialysis units). Specialists were also asked about the average length of sick leave associated with occurrence or surgical treatment of a specific complication.

### Patient's questionnaire

The first part of the survey consisted of questions about patient characteristics, economic activity (education, form of employment and work time) and comorbidities. The second part contained the Work Productivity and Activity Impairment Specific Health Problem Questionnaire (WPAI-SHP) [1], which was used to measure absenteeism and presenteeism related to a specific diabetes complication (number of hours lost per week) among working respondents. The recall period of the WPAI questionnaire is one week [1]. In case of severe hypoglycemia, which occurs as sudden episodes, the number of work days lost due to the latest episode was collected instead of usual number of hours per week lost due to a chronic diagnosis or related to a past acute event. Only patients with a severe hypoglycemia episode (requiring help from another person) treated in emergency care, ambulatory centers or outside the health care system were included into the severe hypoglycemia subgroup.

## Methodology of work productivity loss and indirect cost estimation

Productivity loss was defined in terms of absenteeism and presenteeism rates among working patients. Other categories such as early retirement, premature death or work productivity loss of informal caretaker were not included.

The absenteeism rate was calculated as the percent of work time (the period during which respondent was expected or required to work) lost due to respondent's absence caused by a specific health problem. The analysis was conducted only for working patients or patients who were expected to work at the time of the survey.

The presenteeism rate was measured as the percent of man-hours (out of time spent at work) lost due to lower work efficacy caused by a specific health problem.

Overall work productivity loss represented the total percent of work time lost due to presenteeism and absenteeism. OWP was measured as the sum of absenteeism rate and presenteeism rate multiplied by the percent of time spent working.

Work productivity loss was converted into mean annual indirect cost per working patient. Indirect costs were estimated using a human capital approach, the social perspective was adopted. The 2013 gross average income (3 650.06 PLN/month) [2] was used to estimate the unit cost of productivity loss. All analyses were conducted according to the recommendations presented in the report on indirect costs by Infarma [3].

## Results

### Patients' characteristics

The characteristics of 18 subgroups of working patients (total N=640) were presented in Table 1.

**Table 1. Characteristics of working patients with T2DM by complication subgroup**

Complication	N*	Men*	Age* (SD)
Renal failure – peritoneal dialysis	17	64.7%	52.2 (8.4)
Renal failure – hemodialysis	10	50.0%	54.9 (6.9)
Renal transplant	15	66.7%	52.9 (8.6)
Chronic heart failure	57**	77.2%	57.1 (4.7)
Angina pectoris	58**	62.2%	55.8 (4.9)
Myocardial infarction	40**	82.5%	55.8 (4.5)
Stroke	36**	52.8%	56.7 (5.1)
Depression	59**	54.2%	51.0 (6.5)
Peripheral vascular disease	51**	68.6%	53.5 (7.4)
Neuropathy	55**	61.8%	56.1 (5.3)
Diabetic foot	36	72.2%	53.9 (6.4)
Foot ulcer without infection	42	73.8%	54.6 (7.3)
Foot ulcer with infection	25	68.0%	55.4 (7.4)
Foot gangrene	20	90.0%	57.7 (5.1)
Foot amputation	11	63.6%	54.9 (6.2)
Significant vision loss	18	55.6%	53.3 (8.7)
Cataract removal	30	56.7%	54.6 (5.6)
Severe hypoglycemia	60	66.7%	52.2 (7.6)

\*Among workers; \*\*Employment was a requirement to participate in the study

### Loss of work productivity

The absenteeism rates varied from 7.8% to 70.6%. An episode of severe hypoglycemia not requiring hospitalization caused on average 4.2 days absence at work up to 3 months after the episode.

The lowest presenteeism rate (10.8%) had patients with history of renal transplant and the highest (66.5%) patients with infected foot ulcer. For most complications the rate of presenteeism was noticeably higher than the rate of absenteeism.

The average overall work productivity loss was the highest for foot ulcer with infection (85.6%). The lowest average OWP was reported for angina pectoris (32.3%) (Figure 1, Table 2).

The employment rate was estimated additionally for selected diagnoses in a broader population of respondents in working age (N=920). The highest employment rate was observed in patients with non-infected foot ulcer (74%) and the lowest in patients with renal failure treated with hemodialysis (26%) (Table 2).

### Indirect costs estimates

The highest mean annual indirect cost (per working patient) was related to foot problems: infected foot ulcer (37 488 PLN) and gangrene (37 247 PLN) and the lowest indirect cost (per working patient) (9 887 PLN) was attributed to working patients with history of a renal transplant (Table 3). The average cost of severe hypoglycemia event not requiring hospitalization was 815 PLN per episode for a working patient.

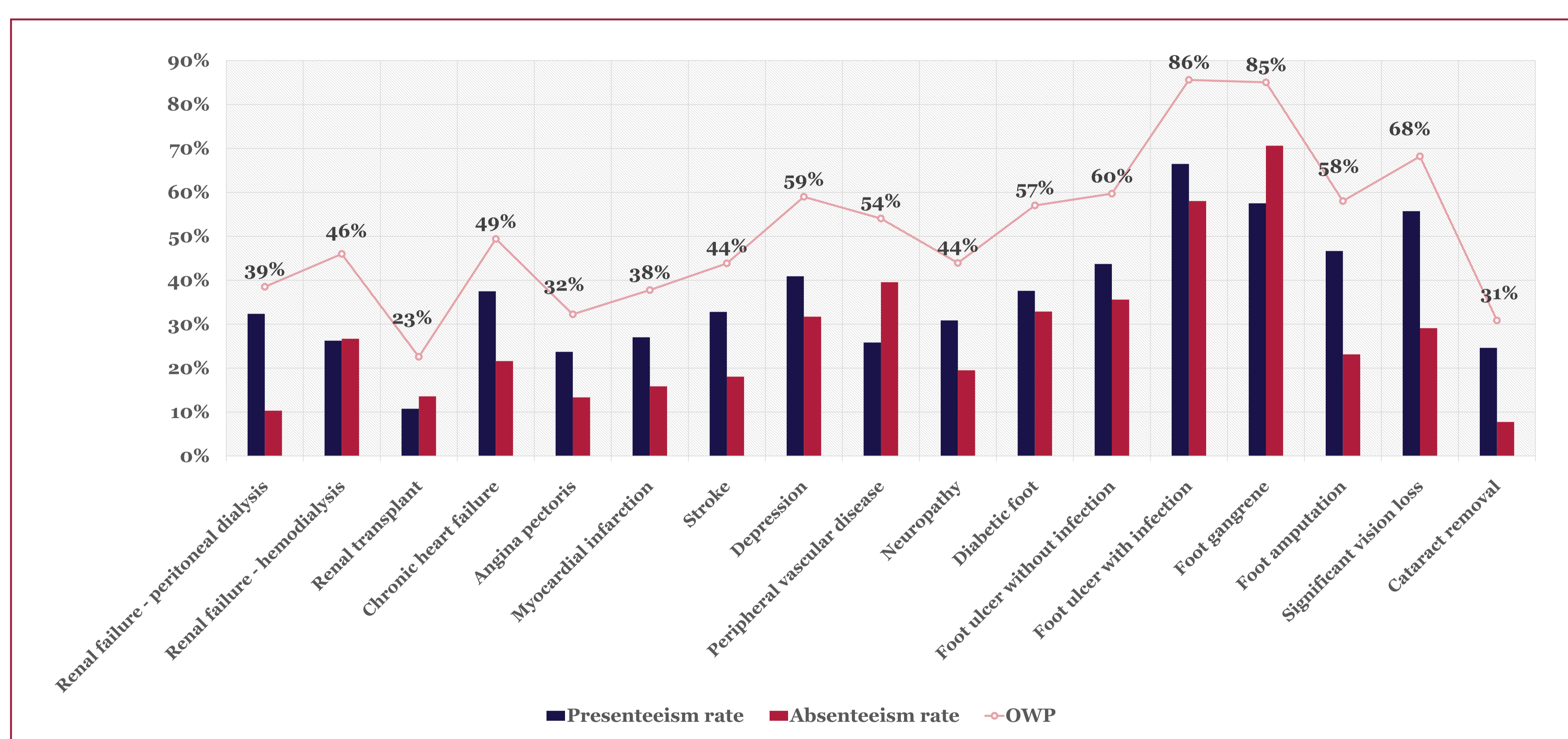
**Table 2. Loss of work productivity due to T2DM complications**

Complication	Absenteeism (mean)	Presenteeism (mean)	OWP (mean)	Employment rate (%)
Renal failure – peritoneal dialysis	10.3%	32.4%	38.5%	43.6
Renal failure – hemodialysis	26.7%	26.3%	46.0%	25.6
Renal transplant	13.6%	10.8%	22.6%	40.5
Chronic heart failure	21.6%	37.5%	49.4%	-
Angina pectoris	13.4%	23.7%	32.3%	-
Myocardial infarction	15.9%	27.0%	37.8%	-
Stroke	18.1%	32.8%	43.8%	-
Depression	31.7%	40.9%	59.0%	-
Peripheral vascular disease	39.6%	25.8%	54.0%	-
Neuropathy	19.5%	30.9%	43.9%	-
Diabetic foot	32.9%	37.6%	57.0%	66.7
Foot ulcer without infection	35.6%	43.7%	59.7%	73.7
Foot ulcer with infection	58.0%	66.5%	85.6%	45.5
Foot gangrene	70.6%	57.5%	85.0%	54.1
Foot amputation	23.1%	46.7%	58.0%	27.5
Significant vision loss	29.1%	55.7%	68.2%	46.2
Cataract removal	7.8%	24.6%	30.9%	51.7

**Table 3. Mean annual indirect cost of T2DM complications per working patient [PLN]**

Complication	Absenteeism cost	Presenteeism cost	Total indirect cost
Renal failure – peritoneal dialysis	4 523	12 341	16 864
Renal failure – hemodialysis	11 684	8 460	20 144
Renal transplant	5 944	3 942	9 886
Chronic heart failure	9 467	12 168	21 637
Angina pectoris	5 849	8 278	14 126
Myocardial infarction	6 952	9 590	16 542
Stroke	7 914	11 289	19 204
Depression	13 894	11 947	25 841
Peripheral vascular disease	17 330	6 341	23 672
Neuropathy	8 546	10 699	19 245
Diabetic foot	14 402	10 576	24 977
Foot ulcer without infection	15 593	10 560	26 153
Foot ulcer with infection	25 415	12 074	37 488
Foot gangrene	30 935	6 312	37 247
Foot amputation	10 134	15 277	25 414
Significant vision loss	12 746	17 123	29 868
Cataract removal	3 400	10 115	13 515

**Figure 1. Loss of work productivity due to T2DM complications**



## Discussion and Conclusion

The study results showed that a noticeable work productivity loss due to T2DM complications was reported even after a long period from the onset of an acute event or the diagnosis of a chronic complication. The study can be used in pharmacoeconomics to complement the data from public databases (NHF, PSII). Presented study results can be used in economic analyses for calculating the total indirect costs of diabetes, which poses an additional advantage.

### Abbreviations

AP	Angina pectoris	PVD	Peripheral vascular disease
MI	Myocardial infarction	PSII	Polish Social Insurance Institution
NHF	National Healthcare Fund	SVL	Significant vision loss
OWP	Overall work productivity loss	T2DM	Type 2 diabetes mellitus

## References

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