

## Validity of Peripheral Arterial Disease Diagnoses in the Danish National Patient Registry

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### WHAT THIS PAPER ADDS

The validation of diagnoses of peripheral arterial disease (PAD) from the Danish National Patient Registry has not been published before. In this study of 1435 registered cases of PAD the diagnosis was valid in less than 70% of the cases. Furthermore, Danish databases and registers are usually considered of high quality, but the relatively poor validity of a PAD diagnosis from this study suggests that there might be similar problems in other registers as well. Therefore, to avoid misinterpretations, validation of register data is necessary when data are used for scientific purposes.

**Objectives/Background:** The objective was to validate the diagnoses of peripheral arterial disease (PAD) in the legs, obtained from national registers in Denmark.

**Methods:** In total, 1435 registered cases of PAD were identified in the Danish National Patient Registry among 57,053 middle aged participants from the Danish Diet, Cancer and Health cohort study. Validation was performed by reviewing all medical records using pre-specified criteria for a diagnosis of PAD.

**Results:** The overall positive predictive value (PPV) of PAD diagnoses was 69.4% [95% confidence interval (CI) 67.0–71.7]. The PPV of diagnoses given in departments of vascular surgery was significantly higher than diagnoses given in other departments: 71.9% (95% CI 69.2–74.4) versus 58.3% (95% CI 52.2–64.2), respectively. In a sub-study, 141 potential cases of PAD also registered in the Danish National Vascular Registry were evaluated, and a PPV of 87.9% (95% CI 81.4–92.4) was found for these diagnoses.

**Conclusion:** More than 30% of the diagnoses of PAD notified in the Danish National Patient Registry were not valid, stressing the importance of validation when using register information for research purposes. In contrast, diagnoses obtained from the Danish National Vascular Registry had a high validity ready for use without further validation.

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### INTRODUCTION

The term peripheral arterial disease (PAD) is generally used for atherosclerosis in the lower limb, as it is uncommon in the upper limb. The development of PAD is dependent on age, and the number of people affected is increasing. In the North American population the overall prevalence of PAD is 3–10% and increases to 20% for subjects older than 70 years.<sup>1</sup> Patients with severe PAD are at risk of developing critical limb ischaemia leading to ulcers or amputation if

vascular intervention is not undertaken. Furthermore, individuals with PAD have a higher risk of death from cardiovascular events, in particular coronary events.<sup>2</sup>

Since 1977, all hospital inpatients in Denmark have been registered with a discharge diagnosis in the Danish National Patient Registry, and since 1995, information on emergency room patients and outpatient activities has also been recorded.<sup>3,4</sup>

The validity of cardiovascular diagnoses from the Danish National Patient Registry varies with different disorders. Thus, previous studies found a positive predictive value (PPV) of 65% for acute coronary syndrome and 93% for atrial fibrillation.<sup>4,5</sup> Likewise, in an American study, billing code algorithms for identifying patients with PAD were validated,<sup>6</sup> with a PPV varying between 72% and 93%. It is

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essential that diagnoses are registered correctly to ensure validity otherwise invalid diagnoses might flaw epidemiological studies and lead to misconceptions.

The aim of this study was to examine the validity of diagnoses of PAD in the Danish National Patient Registry. Furthermore, in a sub-study the validity of the diagnoses for patients registered in the Danish National Vascular Registry was evaluated.

## MATERIAL AND METHODS

### Subjects

The Danish Diet, Cancer and Health study investigated a prospectively enrolled cohort of subjects aged between 50 and 64 years at inclusion.<sup>7</sup> The cohort was established between November 1993 and May 1997, when a total of 160,725 people were invited to participate in the study and 57,053 accepted the invitation (Fig. 1). At the time of inclusion, the participants were living in Aarhus and Copenhagen, including their suburbs. The aim of the Danish Diet, Cancer and Health study was to investigate the relationship between lifestyle and dietary components and the incidence of cancer and chronic diseases. A cancer diagnosis before inclusion in the study was an exclusion criterion. The cohort was followed until December 2009. Participants in the Danish Diet, Cancer and Health study who had been discharged with diagnoses of PAD and therefore registered in the Danish National Patient Registry during the period of 1993–2009 were identified ( $n = 1516$ ) (Fig. 1).

In Denmark, the International Classification of Disease (ICD) system changed from ICD-8 to ICD-10 in 1994, and therefore diagnoses from both systems were used (Table 1).

**Table 1.** Diagnoses used for peripheral arterial disease (PAD) in the legs from the Danish National Patient Registry.

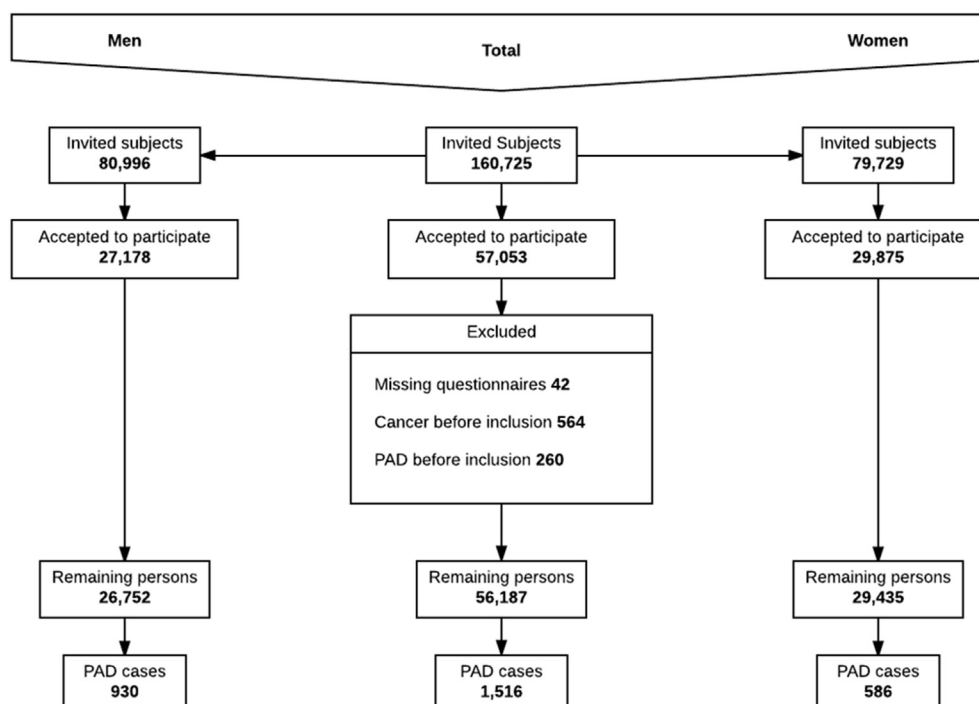
PAD diagnoses	ICD-8	ICD-10
Intermittent claudication	DIA 44390	DI 73.9A
Rest pain		DI 73.9C
Arterial gangrene of the lower extremity	DIA 44500	DI 73.9B
Arterial gangrene	DIA 44509	DI 702A
Arterial gangrene	DIA 44590	
Gangrene without specification	DIA 44599	
Arteriosclerosis in the legs	DIA 44020	DI 702
Arteriosclerosis of the iliac artery	DIA 44030	

Note. The ICD-8 codes from the registry were matched with the cohort but none was used.

The patients operated on for PAD by open or endovascular surgery were further registered in the Danish National Vascular Registry and were considered valid by definition. Furthermore, in a sub-study, 141 patients in the cohort who were also registered in the Danish National Vascular Registry were validated (Fig. 2), to explore whether the validity of the diagnoses was as high as assumed.

### Validation

To ensure the diagnoses of PAD were correct, the medical records were scrutinised for information, using a predefined procedure (Table 2). Patient identification, the date of first contact, admission to hospital, and type of department were registered. The patient was categorised as an outpatient or hospitalised patient, depending on the first contact. Presence of clinical symptoms included walking related pain (intermittent claudication), rest pain in the foot (verified by



**Figure 1.** Flowchart of the participants of the Danish Diet, Cancer and Health cohort and matching cases of peripheral arterial disease (PAD) from the Danish National Patient Registry.

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