BMJ Open

Physical activity advice from general practitioners in Germany: findings from a cross-sectional population survey of individuals with chronic ischaemic heart disease (OptiCor study)

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To cite: Hoppe S, Prinz A, Kotz D, *et al*. Physical activity advice from general practitioners in Germany: findings from a cross-sectional population survey of individuals with chronic ischaemic heart disease (OptiCor study). *BMJ Open* 2026;**16**:e101017. doi:10.1136/bmjopen-2025-101017

► Prepublication history and additional supplemental material for this paper are available online. To view these files, please visit the journal online (https://doi.org/10.1136/bmjopen-2025-101017).

Received 20 February 2025
Accepted 30 January 2026

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ABSTRACT

Objectives The current German treatment guideline for chronic ischaemic heart disease (IHD) recommends that general practitioners (GPs) deliver brief advice on physical activity (PA) to patients with IHD. Such advice consists of at least three elements (ie, 3As): (1) assessing the PA level, (2) advising on PA and (3) assisting with recommendations. This study examined the extent to which individuals with self-reported IHD in Germany reported the receipt of such advice.

Design Cross-sectional population-based face-to-face survey (from June 2023 to August 2024).

Setting Households across Germany.

Participants 1004 individuals aged 35+ years with self-reported IHD and GP contact.

Outcome measures Primary outcome: self-reported proportions of receipt of GP-delivered PA advice according to the 3As. Main secondary outcome: associations between person characteristics and the likelihood of receiving PA advice.

Results Among individuals with self-reported IHD, 36.4% (95% CI 33.4% to 39.4%) received all 3As of PA advice, 42.1% (95% CI 39.1% to 45.2%) received one or two elements, 9.9% (95% CI 8.1% to 11.8%) received no advice at all and 3.8% (95% CI 2.7% to 5.1%) were advised to avoid PA (7.9% did not remember/refused to answer). Women (vs men) were more likely to receive no advice (OR=1.74, 95% CI 1.11% to 2.72%), while middle (vs younger) aged individuals (OR=0.46, 95% CI 0.22% to 0.99%), those with PA levels of 1–149 min/week (vs no PA; OR=0.16, 95% CI 0.08% to 0.31%) and of 150+ min/week (vs no PA; OR=0.13, 95% CI 0.07% to 0.23%) and those with higher (vs lower) education (OR=0.39, 95% CI 0.20% to 0.76%) were less likely to receive no advice. Individuals living in urban (vs rural) areas (OR=0.65, 95% CI 0.46% to 0.88%) and those with PA levels of 1–149 min/week (vs no PA; OR=0.59, 95% CI 0.37% to 0.95%) and of 150+ min/week (vs no PA; OR=0.55, 95% CI 0.36% to 0.84%) were less likely to receive only one or two (vs all) of the 3As. Of those who received at least one element of advice (n=788), 72.5% reported they were more active afterwards, with a higher proportion when all 3As (vs only some elements) were provided (86.8% vs 59.6%).

Conclusions Only one-third of individuals with self-reported IHD in Germany received comprehensive PA advice. Specific person characteristics, such as female gender and lower education, were associated with lower proportions of received PA advice. Efforts are needed to improve GP-led PA guidance, particularly for underserved groups.

Trial registration number German Clinical Trials Register (DRKS00031304).

STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ Data were collected from a large population sample of >1000 individuals with self-reported ischaemic heart disease (IHD), based on a combined sampling strategy using random probability sampling (50%) and quota sampling (50%).
⇒ Computer-assisted personal interviews were used to improve sample representativeness and data quality.
⇒ IHD status was self-reported, and no clinical information (eg, disease severity or stability) was available, which limits the ability to judge the clinical appropriateness of physical activity (PA) advice in individual cases.
⇒ Assessing whether individuals had received general practitioner advice on PA is complex and susceptible to recall bias, which we addressed by adjusting for 'years since the last IHD event or diagnosis' in a sensitivity analysis.
⇒ Due to an opt-in screening question, the prevalence of self-reported IHD may be underestimated, and non-response was higher among individuals with lower education and income.

INTRODUCTION

Background

Regular physical activity (PA) is an effective measure in the management of prevalent chronic ischaemic heart disease (IHD),[1 2] as it reduces the risks of cardiovascular mortality, recurrent cardiac events as

well as hospitalisation, and can improve the quality of life in individuals with IHD.[2] However, only about 21% of the affected population in Germany is sufficiently physically active, when applying the current WHO recommendations on PA.[3] About half of the population with IHD is physically inactive[4] and the same is true for the general population in Germany.[5]

IHD is one of the most commonly treated diseases in general practice.[6] General practitioners (GPs) are well placed to offer advice on PA as they regularly see their patients with IHD,[6] including elderly individuals who have a higher probability of being diagnosed with IHD,[7] as well as socially isolated and disadvantaged groups.[8] GPs are also a trusted source of health information from the patients' perspective.[6 9] The German IHD treatment guideline recommends GPs and other health professionals (HPs) to offer advice on and support with PA to their patients with IHD.[10]

Previous systematic reviews suggest GP advice can effectively increase patients' PA level[11–14] (with a number needed to treat of 12 (95% CI 7% to 33%) for long-term behaviour change[13]). However, a recent meta-analysis[15] found no clear effect, potentially due to the inclusion of heterogeneous counselling approaches, including different modes of delivery, different number of follow-up contacts and time-intensive motivational interviewing. While the German IHD guideline advocates motivational interviewing for advising on health behaviour, the UK's National Institute for Health and Care Excellence (NICE) guideline recommends brief advice (or brief intervention), including 'advice, discussion, negotiation or encouragement, with/without written or other support or follow-up'.[16] A recent systematic review showed brief advice, as defined by NICE and delivered in healthcare settings, effectively increases self-reported and measured PA for at least 6 months.[17] The WHO also endorses brief advice as a cost-effective intervention for managing and preventing non-communicable diseases.[18]

The 3As approach (Ask/Assess: assessing the PA level, Advise: advising on PA, Assist: assisting with recommendations to increase PA) is a quick method for providing PA advice, commonly used for smoking cessation, but adaptable for PA.[19] This approach, taking only a few minutes, is easier to integrate into routine primary care than longer interventions and still enables GPs to consider patients' preferences, activity level, goals and barriers.[6] Population survey evidence shows delivering all 3As is more effective for health behaviour change than providing single elements,[20] with the Assist step seeming particularly associated with positive outcomes.[21] However, international data show all elements are rarely implemented together, and GP consultations often consist only of Ask/Assess.[20 21]

German studies not focusing on individuals with IHD suggest that the implementation of GP advice on PA is insufficient.[9 22–24] Moreover, there is little nationally representative evidence on how GPs deliver advice on PA to patients with IHD or whether individual characteristics (eg, age, gender, body mass index (BMI) or PA level) influence its receipt. Although the NICE guideline[16] advises against relying on visual cues like body weight for identifying patients to counsel, such factors may still influence GPs' decisions in practice. Understanding the prevalence of and factors associated with GP-delivered PA advice could identify treatment gaps in primary care for individuals with IHD in Germany.

Study aim and research questions

This study aims to determine the proportion of individuals aged 35+ years in Germany with self-reported IHD who report the receipt of GP advice on PA since their most recent IHD event or diagnosis. Our research questions are:

1. What proportion of individuals with self-reported IHD report having received elements of the 3As of GP-delivered PA advice?
2. How does the prevalence of receiving the 3As of PA advice vary across sociodemographic, socioeconomic and health-related characteristics (age, gender, education, income, urbanisation, migration background, BMI, PA level)? Furthermore, which of these characteristics are independently associated with receiving no advice versus all 3As, and with receiving one/two of the 3As versus all 3As?
3. Among those who report having received at least one 3As element, what proportion report being more or more regularly physically active afterwards, stratified by the specific elements received?

METHODS

This study is reported in accordance with the 'Strengthening the Reporting of Observational Studies in Epidemiology' Statement.[25]

Study design and setting

Data were collected using a cross-sectional population-based household survey of the German population. By means of computer-assisted personal interviews (CAPI), data were collected between June 2023 and August 2024 from individuals aged 35+ years living in private households (rented or owned) across Germany. The fieldwork was conducted as an omnibus survey by the market research institute 'Oracle Life Science'. The study has been preregistered at the German Clinical Trials Register (https://www.drks.de/DRKS00031304). The study protocol, including an analysis plan, was developed together with a statistician (OK) and published prior to the analyses on the Open Science Framework (OSF) platform (https://osf.io/7adf2). A preprint version of this manuscript is available on ResearchSquare (https://doi.org/10.21203/rs.3.rs-6030336/v1).

The study questionnaire was developed by a multidisciplinary research team with expertise in public health, psychology, sociology, epidemiology and general practice. Although no psychometric analyses were conducted on the instrument before its implementation, its structure and content were informed by thematically related

questionnaires previously used successfully on GP advice for other health behaviours (eg, hazardous alcohol consumption[26] and tobacco smoking[27]). The questionnaire underwent several rounds of revision and was cognitively pre-tested with four individuals diagnosed with IHD (all male, aged 65+ years) in a GP practice over two separate days. Findings from the pretests informed further refinements to the questionnaire prior to the main study. The questionnaire was published on the OSF platform (https://osf.io/kvfnb) in its original German version and translated into English.

Study population

Study participants were selected using a dual-frame design: a random probability sample (50%) and a quota sample (50%). Data were collected over nine survey waves, reaching approximately 1800 individuals aged 35+ years per wave (n=16 576). As the probability of IHD increases with age,[7] individuals under the age of 35 were not included, while no upper age limit was set. About 80% of the individuals aged 35+ years (n=12 827) opted in to answer questions about heart health and PA, as required by our ethics committee. Self-reported IHD was identified using four established, plain-language questions on IHD-related events/interventions, commonly used in national health surveys (eg, Gößwald *et al*,[7] see online supplemental table 1), resulting in a sample of n=1139 participants aged 35+ years with self-reported IHD. The final study population included participants aged 35+ years with self-reported IHD who also reported at least one GP visit after their most recent IHD-related event (n=1004).

Outcome measures

GP advice on PA (research questions 1 and 2)

Participants of the final study sample were asked two questions about the receipt of the GP-delivered PA advice according to the 3As (see online supplemental table 1). For further analysis, we categorised the response patterns into:

A. 'Receipt of all three elements (Ask/Assess, Advise, Assist)' (question 1: option b AND question 2: option a).
B. 'Receipt of one or two elements (only Ask/Assess or Advise, Ask/Assess and Advise, or Advise and Assist)' (question 1: option a) OR (question 1: option b AND question 2: option b OR c OR d) OR (question 1: option c AND question 2: option a OR b OR c OR d).
C. 'No PA advice received' (question 1: options e OR f).
D. 'Advised to avoid PA' (question 1: option d).
E. 'Unable to remember/refused to answer' (question 1: options g OR h).

PA behaviour after the receipt of PA advice (research question 3)

Individuals with self-reported IHD who reported receiving at least one element (categories A or B) were asked whether these conversations led to increased or more regular PA (see online supplemental table 1). Responses were categorised as 'more regularly active' (options a or b) or 'not more active' (option c).

Exposure variables

Sociodemographic and health-related characteristics were prespecified in the analysis protocol. They were selected based on their availability in the survey dataset and prior evidence suggesting their relevance for inequalities in the receipt of GP advice on other lifestyle behaviours.[28–30]

The following characteristics were used: *Gender*: female/male; *age*: 35–54/55–74/75+ years; *level of education*: low (no graduation or 9 years of education)/middle (≥10 years)/high (≥12 years); *monthly net household income* per person in the household: as a continuous variable for regression analyses and in categories for descriptive analyses: low (<20th income percentile)/middle (20th–80th income percentiles)/high (>80th income percentile). These categories reflect the distribution of income in Germany.[31–33] The calculation was based on an equalisation technique provided by the Organisation for Economic Co-operation and Development-modified equivalence scale,[34] adjusting total net household income (after tax and other deductions) for household size and composition. *Migration background*: yes/no. Applied if at least one parent of the study participant was not born in Germany. *Degree of urbanisation*: assessed by using the administrative municipality district size ('politische Gemeindegrößenklassen') based on the population size, consisting of seven categories which were summarised into three categories: rural (<20 000 residents)/urban (20 000–500 000 residents)/metropolitan (>500 000 residents). *BMI*: as a continuous variable for regression analyses in categories for descriptive analyses: underweight (BMI<18.5)/normal weight (BMI 18.5–24.9)/overweight (BMI 25.0–29.9)/obesity (BMI ≥30.0).[35] Calculation was based on weight (in kilograms) and height (in metres) of the target population using the formula *weight in kg/height in* m^2.[35] Self-reported *PA level in minutes/week*: assessed by a modified version of a single-item question of Milton *et al*.[36] The question does not involve intensity or muscle strength, and PA at work or housework is excluded. In approximation to the current WHO recommendation on weekly PA levels for adults with and without chronic conditions (75–150 min/week of vigorous PA or 150–300 min/week of moderate PA),[3] weekly PA level was categorised for descriptive analyses into 0/1–74/75–149/150–299/≥300 min/week. For regression analyses, PA categories were collapsed to 0/1–149/150+ min/week. *Years since the most recent IHD-related event or diagnosis*: as a continuous variable for regression analyses (sensitivity analyses). Individuals were asked about the timing of their last event or diagnosis, and this information was used to calculate the variable.

To examine potential non-linear associations, we conducted exploratory natural cubic splines with four df (three internal knots), placed at quantiles of the observed distribution (see online supplemental figure 1). For BMI, spline plots were truncated at the upper tail of the distribution to improve visual interpretability, as estimates at extreme values were based on sparse data. Likelihood ratio tests indicated non-linear associations for age (p=0.028) and PA level (p<0.001), while no evidence

of non-linearity was observed for net household income (p=0.097), BMI (p=0.085) and years since the most recent IHD-related event or diagnosis (p=0.191). Based on these findings, age and PA level were used as categorical variables throughout the analyses, whereas net household income, BMI and years since the most recent IHD-related event or diagnosis were used as continuous variables.

Statistical analysis

Analyses were performed with IBM SPSS Statistics for Windows, V.29.0.[37] The statistical analysis code is publicly available on the OSF platform (https://osf.io/u3hfy). All data were analysed and reported unweighted.

To address *research question 1*, we report proportions of individuals with self-reported IHD aged 35+ years who report the receipt of GP advice on PA according to the 3As (categories A: all 3As, B: one or two elements, C: no advice). Since particularly the third element, Assist, seems to be associated with behavioural change,[21] the proportion of those who received Assist is presented separately. Data are presented as absolute and relative frequencies with 95% CIs.

To address *research question 2*, we report the proportions of individuals aged 35+ with self-reported IHD who report the receipt of GP advice according to the 3As by person characteristics (eg, gender, BMI) as absolute and relative frequencies with 95% CIs.

We tested the proportional odds assumption for an ordinal logistic regression model and found it to be violated. Therefore, univariate multinomial logistic regression models were applied to examine the associations between person characteristics and the receipt of the 3As (outcome variable) with the three categories: Receipt of no elements (category C) versus receipt of all 3As (category A) (reference) and receipt of one or two elements (category B) versus receipt of all 3As (category A) (reference). Individuals who fell into categories D (advised to avoid PA) and E (did not remember/refused to answer) were excluded. In addition, for completeness, we estimated a single multivariable multinomial logistic regression model including all person characteristics. As BMI and PA level may have changed after receiving GP advice on PA, we estimated a second additional model for exploratory purposes, excluding these person characteristics. To explore a potential influence of recall bias, we fitted analogous multinomial logistic regression models for each person characteristic; however, we adjusted for the 'years since the last IHD event or diagnosis' as a sensitivity analysis.

To address *research question 3*, we report proportions of individuals with self-reported IHD who reported being more active (temporarily or permanently) following GP advice; overall and stratified by received elements (one or two elements vs all 3As). Data are presented as absolute and relative frequencies with 95% CIs.

Dealing with missing data and non-response

A total of 22.6% (n=3749) of the market research survey participants beforehand decided to opt-out and not answer study questions on heart health and PA. By means of a non-response analysis, we compared distributions of person characteristics of responders and non-responders.

Online supplemental table 2 presents the basic characteristics of the total sample of all respondents aged 35+ (n=16 576) stratified by non-responders (n=3749; 22.6%) and responders (n=12 827; 77.4%) to our study survey.

Proportions of individuals with low educational qualification, low household income and of individuals living in a rural area were higher among non-responders, whereas the proportion of individuals with a migration background was lower in this group. No relevant differences in gender and age were found.

Missing data on dependent and independent variables in responders were sparse: household income: 0.2%, migration background: 1.3%, BMI: 4.2%, PA level: 4.8%. We assumed that excluding cases with missing data would not meaningfully affect our results and used complete cases for the final analysis.

Patient and public involvement

As described above, the study questionnaire was pretested with individuals with a clinical IHD diagnosis. Their feedback was accommodated in the questionnaire design. Beyond this, patients or the public were not involved in the design, conduct, reporting or dissemination plans of this research.

RESULTS

The final sample consisted of 1004 individuals aged 35+ years with self-reported IHD and a GP contact since the most recent IHD-related event or diagnosis. Sample characteristics are presented in table 1. The mean age of this group was 70.0 years (SD=11) and 37.7% of the sample (n=379) were female.

Research question 1: GP advice on PA

Among individuals aged 35+ years with self-reported IHD, 36.4% (95% CI 33.4% to 39.4%) reported the receipt of all 3As, 42.1% (95% CI 39.1% to 45.2%) reported the receipt of one or two elements and 9.9% (95% CI 8.1% to 11.8%) reported receiving no advice since their most recent IHD-related event or diagnosis. A total of 3.8% (95% CI 2.7% to 5.1%) reported the advice to avoid PA (see figure 1) and 7.9% (95% CI 6.3% to 9.7%) could not remember or refused to answer.

Among individuals who reported the receipt of at least one 3As element (n=788), around half (53.3%; 95% CI 49.8% to 56.8%, n=420) reported the receipt of Assist.

Table 1 Characteristics of all individuals aged 35+ years with self-reported IHD and at least one GP contact since the last remembered IHD-related event or diagnosis (n=1004)

	% (n)
Total sample	100 (1004)
Gender	
Male	62.3 (625)
Female	37.7 (379)
Diverse	0.0 (0)
Age group (years)	
35–54	8.2 (82)
55–74	53.1 (533)
75+	38.7 (389)
Educational qualification*	
Low	42.4 (426)
Medium	33.5 (336)
High	24.1 (242)
Household income†	
Low	9.6 (96)
Medium	67.9 (682)
High	22.3 (242)
Migration background	
No	88.5 (877)
Yes	11.5 (114)
Degree of urbanisation‡	
Rural	31.5 (316)
Urban	49.1 (493)
Metropolitan	19.4 (195)
BMI category§	
Underweight	0.7 (7)
Normal weight	32.2 (323)
Overweight	43.4 (436)
Obese	19.5 (196)
PA level category (min/week)¶	
0	20.8 (209)
1–74	11.0 (110)
75–149	12.2 (122)
150–299	18.1 (182)
300+	33.2 (333)

Data are presented as column percentages (number).
Variables with missing data: household income: 0.2%, migration background: 1.3%, BMI: 4.2%, PA level: 4.8%.
*German educational qualification levels: low (9 years of education, or no graduation), medium (10-11 years of education), high (≥12 years of education).
†Monthly net household income per individual in the household, based on the Organisation for Economic Co-operation and Developmentmodified equivalence scale.[34] The variable was categorised into three levels: low (<20th income percentile), medium (20th–80th income percentiles) and high (>80th income percentile), approximately describing the income distribution in the German population.[31–33]
‡The variable was assessed by using the administrative municipality district size ('politische Gemeindegrößenklassen'), consisting of seven categories which were summarised into three categories: rural (<20 000 residents), urban (20 000–500 000 residents) and metropolitan (>500 000 residents).
§BMI based on weight (in kilograms) and height (in metres) of the target population using the formula weight (in kg)/height^2 (in m^2).[35] The variable was categorised into four categories: underweight (BMI<18.5), normal weight (BMI 18.5–24.9), overweight (BMI 25.0–29.9) and obese (BMI≥30.0).
¶The level of PA is based on the WHO recommendations for adults and adults with chronic conditions (75–150 min/week of vigorous PA or 150–300 min/week of moderate PA),[3] although for pragmatic reasons there was no assessment of intensity.
BMI, body mass index; GP, general practitioner; IHD, chronic ischemic heart disease; PA, physical activity.

Research question 2: GP advice on PA by person characteristics (proportions and associations)

Proportions of receipt of GP advice, based on the 3As, stratified by person characteristics are presented in table 2.

Receipt of all 3As was reported more frequently by men (42.5% vs 38.8% among women), individuals with a migration background (44.9% vs 40.7% without) and those living in urban regions (45.7% vs 35.6% in rural and 38.3% in metropolitan areas). Higher proportions were also observed among individuals with overweight (45.1%) or obesity (41.4%) compared with those of normal weight (38.3%) and among those achieving ≥75 min/week of PA (44.4%–49.1%) compared with individuals performing <75 min/week (37.6%) or 0 min (25.2%).

Conversely, reporting no GP advice on PA was more common among women (14.6% vs 9.2% among men), younger adults aged 35–54 years (17.4%) and older adults aged 75+ years (13.9%) compared with those aged 55–74 years (8.4%). Higher proportions were also observed among individuals with low (14.9%) or medium (10.4%) versus high (6.0%) educational levels, those with medium (12.5%) or high (9.5%) versus low (5.1%) household income, individuals with normal weight (BMI 18.5–24.9; 13.8%) compared with those of overweight (BMI 25.0–29.9; 9.6%) or obesity (BMI≥30.0; 9.5%) and physically inactive individuals (27.7%) compared with those who were physically active (6.1%–8.9%).

Results of the univariate multinomial logistic regression analyses are presented in table 3.

Compared with the receipt of all elements of the 3As, female gender was associated with higher odds of reporting no GP advice received (OR=1.74, 95% CI 1.11% to 2.72%). A middle (vs younger) age (OR=0.46, 95% CI 0.22% to 0.99%), a higher (vs lower) educational qualification (OR=0.39, 95% CI 0.20% to 0.76%) and—compared with no PA at all—a PA level of 1–149 min/week (OR=0.16, 95% CI 0.08% to 0.32%) and of 150+ min/week (OR=0.13, 95% CI 0.07% to 0.23%) were associated with lower odds of reporting no advice received. No relevant associations were found with income, migration background, degree of urbanisation and BMI in this regard.

Compared with the receipt of all elements of the 3As, individuals living in an urban (vs rural) region had lower odds of receiving only one or two elements of the 3As (OR=0.65, 95% CI 0.46% to 0.88%). A PA level of 1–149 min/week (vs no PA; OR=0.59, 95% CI 0.37% to 0.95%) and of 150+ min/week (vs no PA; OR=0.55, 95% CI 0.36% to 0.84%) were also associated with lower odds of reporting one or two elements received. For gender, age, level of education, income, migration background and BMI, no clear associations with the receipt of one or two elements were observed.

Results for the additional, exploratory multivariable regression model including all person characteristics are presented in online supplemental table 3, while results from the model excluding BMI and PA level (see statistical

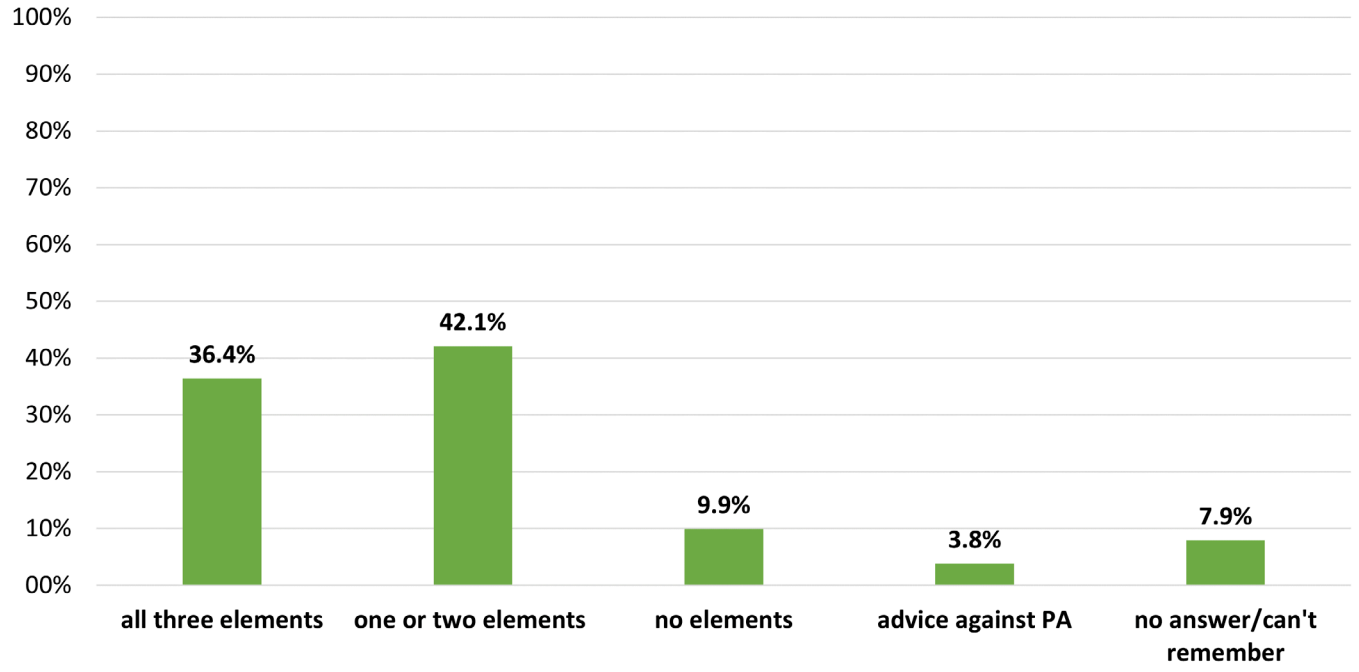

Figure 1 Prevalence estimates on the various levels of general practitioners (GP) advice, based on the 3As method (Ask/Assess, Advise, Assist; self-reported) among the total sample of individuals with self-reported ischaemic heart disease (IHD) and at least one GP contact since the last remembered IHD-related event or diagnosis (n=1004). PA, physical activity.

analysis) are shown in online supplemental table 4. Compared with the univariate regression model (table 3), associations showed largely similar directions and magnitudes across the primary and additional models for most characteristics, whereas some estimates were attenuated (gender, age) or showed a change in direction (education, income).

The results of the sensitivity analysis (see online supplemental table 5) indicate that the observed associations become smaller after adjustment for the time between our survey and the most recent IHD-related event or diagnosis. However, the directions of the associations remain largely unchanged.

Research question 3: PA level after the receipt of at least one element of PA advice

Among individuals who reported receiving at least one element of GP advice according to the 3As (n=788), 72.5% (n=555) stated that they became more active following this advice. The proportion was markedly higher in individuals who reported receiving all 3As (n=315 (86.8%; 95% CI 83.0% to 90.0%)) compared with those who received only one or two elements (n=240 (59.6%; 95% CI 54.7% to 64.3%)) (see figure 2).

DISCUSSION

In this cross-sectional study of individuals aged 35+years with self-reported IHD in Germany, we provide the first nationwide insights into the delivery of GP-led PA advice based on the 3As method (Ask/Assess, Advise, Assist). While just under 80% reported receiving at least one of the 3As components, only about one-third received comprehensive advice, including all three elements. Our findings offer important indications regarding the implementation of clinical guideline recommendations on PA advice in general practice for individuals with IHD. The few existing previous German studies did not focus on individuals with IHD. For example, one cross-sectional survey of patients aged 70+ years in GP practices in Rhineland-Palatinate reported that approximately 48% received GP advice on PA, with 39% receiving Assist.[9] An analysis of time trends from two representative cross-sectional surveys of the general population in Germany found that between 2008 and 2011, less than 9% of individuals younger than 65 years received GP advice on PA within the last 12 months.[22] A cross-sectional study of adults aged 18+ years reported that about one-third received GP advice on PA within a year.[23]

Our findings suggest that individuals with self-reported IHD receive PA advice more frequently than other groups in Germany, which appears promising at first glance. This also aligns with a cross-sectional survey in GP practices from 2011 showing that individuals with (vs without) IHD aged 65+ years in Germany had substantially higher odds (unadjusted OR 1.93, 95% CI 1.53% to 2.43%) of reporting GP advice on PA within a year.[24] One explanation could be that individuals with IHD have more regular GP contact (eg, through Disease Management Programmes (DMPs)). which likely increases opportunities for Ask/Assess and Advise. However, despite these frequent contacts, Assist—providing concrete, actionable recommendations—remained comparatively uncommon

Table 2 Prevalence estimates on categories of self-reported receipt of GP advice on PA, based on the 3As among the subsample of individuals with self-reported IHD and at least one GP contact since the last remembered IHD-related event or diagnosis, stratified by person characteristics (n=887*)

	No advice, N=99, % (n, 95% CI)	One or two elements, N=423, % (n, 95% CI)	All three elements, N=365, % (n, 95% CI)
Gender			
Male	9.2 (52, 7.0 to 11.8)	48.3 (273, 44.2 to 52.4)	42.5 (240, 38.4 to 46.6)
Female	14.6 (47, 11.1 to 18.8)	46.6 (150, 41.2 to 52.0)	38.8 (125, 33.6 to 44.2)
Age group (years)			
35–54	17.4 (12, 9.9 to 27.6)	42.0 (29, 30.9 to 53.8)	40.6 (28, 29.6 to 52.4)
55–74	8.4 (41, 6.2 to 11.1)	49.3 (240, 44.9 to 53.7)	42.3 (206, 38.0 to 46.7)
75+	13.9 (46, 10.5 to 17.9)	46.5 (154, 41.2 to 51.9)	39.6 (131, 34.4 to 44.9)
Educational qualification†			
Low	14.9 (54, 11.5 to 18.9)	44.8 (162, 39.7 to 49.9)	40.3 (146, 35.4 to 45.4)
Medium	10.4 (32, 7.4 to 14.2)	47.6 (146, 42.0 to 53.1)	42.0 (129, 36.6 to 47.6)
High	6.0 (13, 3.4 to 9.7)	52.8 (115, 46.1 to 59.3)	41.3 (90, 34.9 to 47.9)
Household income‡			
Low	5.1 (4, 1.7 to 11.6)	54.4 (43, 43.5 to 65.1)	40.5 (32, 30.2 to 51.5)
Medium	12.5 (76, 10.1 to 15.3)	45.6 (277, 41.7 to 49.6)	41.8 (254, 38.0 to 45.8)
High	9.5 (19, 6.0 to 14.2)	50.8 (101, 43.8 to 57.6)	39.7 (79, 33.1 to 46.6)
Migration background			
No	11.6 (90, 9.5 to 14.0)	47.7 (371, 44.2 to 51.2)	40.7 (317, 37.3 to 44.2)
Yes	8.2 (8, 3.9 to 14.8)	46.9 (46, 37.3 to 56.8)	44.9 (44, 35.3 to 54.8)
Degree of urbanisation§			
Rural	10.9 (29, 7.6 to 15.0)	53.6 (143, 47.6 to 59.5)	35.6 (95, 30.0 to 41.5)
Urban	10.7 (47, 8.1 to 13.8)	43.6 (192, 39.1 to 48.3)	45.7 (201, 41.1 to 50.4)
Metropolitan	12.8 (23, 8.5 to 18.2)	48.9 (88, 41.7 to 56.2)	38.3 (69, 31.5 to 45.6)
BMI category¶			
Underweight	16.7 (1, 1.9 to 55.8)	83.3 (5, 44.2 to 98.1)	0.0 (0)
Normal weight	13.8 (40, 10.2 to 18.1)	47.9 (139, 42.2 to 53.7)	38.3 (111, 32.8 to 44.0)
Overweight	9.6 (37, 7.0 to 12.8)	45.3 (175, 40.4 to 50.3)	45.1 (174, 40.2 to 50.1)
Obese	9.5 (16, 5.7 to 14.6)	49.1 (83, 41.6 to 56.6)	41.4 (70, 34.2 to 48.9)
PA level category (min/week)**			
0	27.7 (43, 21.2 to 35.2)	47.1 (73, 39.4 to 54.9)	25.2 (39, 18.8 to 32.4)
1–74	8.9 (9, 4.5 to 15.6)	53.5 (54, 43.8 to 63.0)	37.6 (38, 28.6 to 47.3)
75–149	7.0 (8, 3.4 to 12.8)	43.9 (50, 35.0 to 53.0)	49.1 (56, 40.1 to 58.2)
150–299	7.1 (12, 4.0 to 11.8)	43.5 (73, 36.1 to 51.0)	49.4 (83, 41.9 to 56.9)
300+	6.1 (19, 3.8 to 9.1)	49.5 (155, 44.0 to 55.0)	44.4 (139, 39.0 to 49.9)

Data are presented as row percentages (number).
Variables with missing data (total sample): household income: 0.2%, migration background: 1.3%, body mass index: 4.2%, physical activity level: 4.8%.
*Participants who were advised to avoid PA or were unable to remember/refused to answer were excluded (answer categories D/E), leaving n=887.
†German educational qualification levels: low (9 years of education, or no graduation), medium (10–11 years of education) and high (≥12 years of education).
‡Monthly net household income per individual in the household, based on the Organisation for Economic Co-operation and Development-modified equivalence scale.[34] The variable was categorised into three levels: low (<20th income percentile), medium (20th–80th income percentiles) and high (>80th income percentile), approximately describing the income distribution in the German population.[31–33]
§The variable was assessed by using the administrative municipality district size ('politische Gemeindegrößenklassen'), consisting of seven categories which were summarised into three categories: rural (<20 000 residents), urban (20 000 to 500 000 residents) and metropolitan (>500 000 residents).
¶BMI based on weight (in kilograms) and height (in metres) of the target population using the formula weight (in kg)/height^2 (in m^2).[35] The variable was categorised into four categories: underweight (BMI <18.5), normal weight (BMI 18.5–24.9), overweight (BMI 25.0–29.9) and obesity (BMI ≥30.0).
**The level of PA is based on the WHO recommendations for adults and adults with chronic conditions (75–150 min/week of vigorous PA or 150–300 min/week of moderate PA),[3] although for pragmatic reasons there is no categorisation according to intensity.
BMI, body mass index; GP, general practitioner; IHD, chronic ischemic heart disease; PA, physical activity.

Table 3 Results of a univariate multinomial logistic regression analysis: associations between the receipt of GP advice on PA (no advice/one or two elements/all three elements (reference)) and person characteristics (n=887*)

	OR (95% CI)	
	No advice versus all three elements	One or two elements versus all three elements
Gender		
Male (reference)	1	1
Female	1.74 (1.11 to 2.72)	1.06 (0.79 to 1.42)
Age group (years)		
35–54 (ref.)	1	1
55–74	0.46 (0.22 to 0.99)	1.13 (0.65 to 1.95)
75+	0.82 (0.39 to 1.74)	1.14 (0.63 to 2.01)
Educational qualification†		
Low (ref.)	1	1
Medium	0.67 (0.41 to 1.10)	1.02 (0.74 to 1.41)
High	0.39 (0.20 to 0.76)	1.15 (0.81 to 1.64)
Household income‡	0.86 (0.65 to 1.13)	1.04 (0.88 to 1.23)
Migration background		
No (ref.)	1	1
Yes	1.56 (0.71 to 3.44)	1.12 (0.72 to 1.74)
Degree of urbanisation§		
Rural (ref.)	1	1
Urban	0.77 (0.45 to 1.29)	0.65 (0.46 to 0.88)
Metropolitan	1.09 (0.58 to 2.05)	0.85 (0.56 to 1.27)
BMI¶	0.95 (0.91 to 1.00)	0.98 (0.96 to 1.01)
PA level category (min/week)**		
0	1	1
1–149	0.16 (0.08 to 0.32)	0.59 (0.37 to 0.95)
150+	0.13 (0.07 to 0.23)	0.55 (0.36 to 0.84)

Unadjusted analyses. Data are presented as ORs together with a 95% CI. Household income and BMI were treated as continuous variables for regression analyses.
*Participants who were advised to avoid PA or were unable to remember/refused to answer were excluded (answer categories D/E), leaving n=887.
†German educational qualification levels: low (9 years of education, or no graduation), medium (10–11 years of education) and high (≥12 years of education).
‡Monthly net household income per individual in the household, based on the Organisation for Economic Co-operation and Development-modified equivalence scale.[34]
§The variable was assessed by using the administrative municipality district size ('politische Gemeindegrößenklassen'), consisting of seven categories which were summarised into three categories: rural (<20 000 residents), urban (20 000–500 000 residents), metropolitan (>500 000 residents).
¶BMI based on weight (in kilograms) and height (in metres) of the target population using the formula weight (in kg)/height^2 (in m^2).[35]
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BMI, body mass index; GP, general practitioner; PA, physical activity.

in our study. This gap is noteworthy, as several studies suggest that all elements combined, but particularly the Assist element, seem to be decisive to health behaviour change.[20 21] Moreover, definitions of PA advice and its specific components varied across studies, which limits comparability.

Although women with self-reported IHD are generally less physically active than men,[4] our findings revealed that women had higher odds of reporting that PA was not discussed with them, or not comprehensively. This aligns with national and international studies, showing that women—irrespective of age or chronic conditions—receive less GP advice not only on PA,[22 24 38] but also on other health behaviours such as hazardous alcohol consumption[26] and smoking.[39] One speculation could be that men generally have riskier health behaviour and

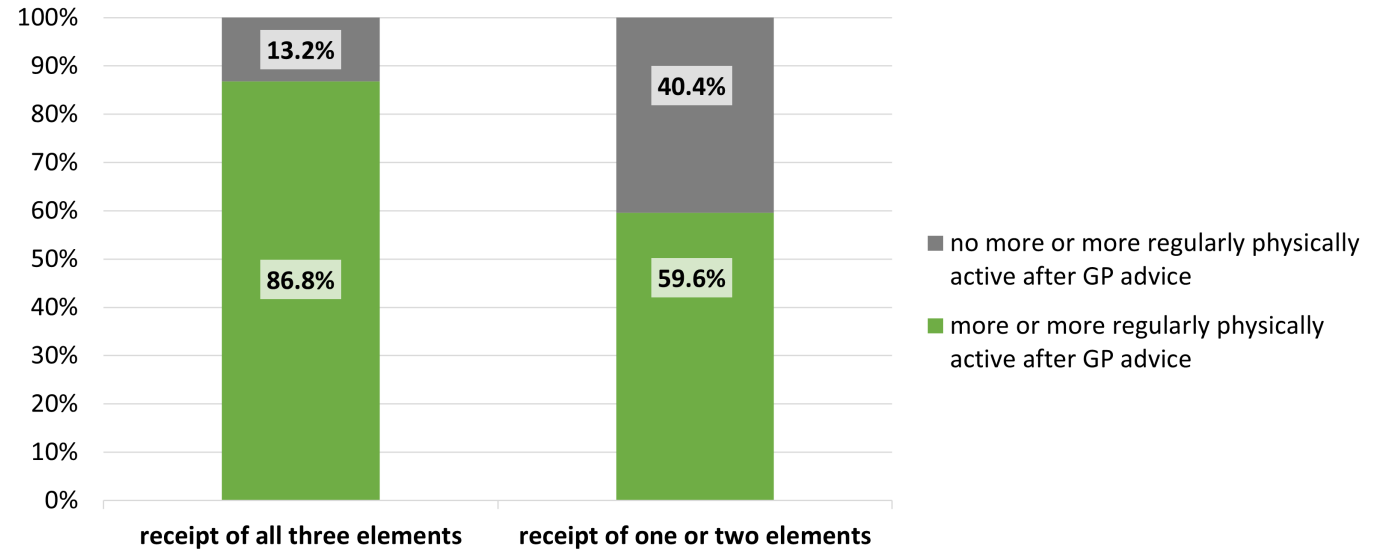

Figure 2 Proportion of individuals with self-reported ischaemic heart disease who reported the effects of the receipt of at least one element regarding the physical activity level (n=788). GP, general practitioner.

are less likely to use preventive services,[40] prompting GPs to prioritise advice to male patients. However, women may also be systematically disadvantaged in healthcare, and potential mechanisms (eg, stigmatisation) warrant further investigation.

Our study indicated that middle-aged and older-aged individuals are more likely to receive GP advice on PA. Given that older individuals face higher risks of comorbidities and frailty[41] and tend to be less physically active with increasing age,[42] it is reasonable to hypothesise that GPs may more frequently deliver advice in older individuals.

Our results suggest that individuals who are overweight or obese (vs normal weight) are more likely to receive GP advice. A possible explanation is that visual weight-related cues may influence advice delivery. Individuals of normal weight may be perceived as already physically active or not in need of PA—regardless of their actual PA levels.

Our study found that individuals with higher educational qualifications were less likely to receive no PA advice than those with lower qualifications, perhaps due to differences in communication patterns or perceived receptiveness. This contrasts with a previous German study from 2011 that observed no differences by educational attainment.[24] However, methodological differences between studies may account for this discrepancy.

Some characteristics were associated with receiving one or two elements of GP advice but not all three. This may be plausible given that certain components (eg, 'Assist') are implemented less consistently. For example, rural (vs urban) residents were less likely to receive all three elements and more likely to receive only one or two, consistent with previous studies.[22 43 44] This may reflect challenges such as limited exercise opportunities[22] and weaker networks with cardiovascular prevention services.[44]

Although less active individuals would theoretically have a greater need for GP advice on PA, our findings indicate that the odds of reporting no advice decrease as PA levels increase. One possible explanation is that active individuals may be more receptive to GP advice on PA and thus more likely to recall it, or that inactive individuals may have received advice in the past and subsequently increased their PA levels. It is also possible that GPs avoid advising patients with severe impairments (eg, comorbidities, mobility impairments), who are less physically active. Due to the cross-sectional design, we cannot determine the direction of this association.

Our study found that over 70% of individuals with self-reported IHD who reported receiving at least one element of the 3As engaged in PA following their GP's advice, rising to 86% among those who received all 3As. Similarly, a German study found that 85% of individuals aged 70+ reported that they had tried PA offers recommended by their GP.[24] These findings align with national and international studies showing a positive association between GP advice and subsequent PA engagement.[6 17 45]

Strengths and limitations

A key strength of this study is that it represents the first nationwide population-based survey focusing on individuals with self-reported IHD and their receipt of GP-delivered PA advice, offering valuable insights into the implementation of clinical guideline recommendations. A second strength is that data were collected from a large sample (>1000 individuals with self-reported IHD), with participants selected using a combination of random probability sampling (50%) and quota sampling (50%), and face-to-face data collection was employed to enhance data quality and maximise representativeness.

Our study also has limitations. First, IHD was self-reported and clinical details such as severity or stability of

the disease were not available. Thus, we could not assess the clinical appropriateness of PA advice in individual cases. However, our aim was to examine population-level prevalence of GP-delivered PA advice in line with the 3As, rather than individual clinical decision-making. We used an established self-report measure for IHD also employed in national health surveys.[7] Additionally, in an ongoing clinical study in GP practices we are conducting, self-reported IHD—assessed using the same instrument as in the present study—matches the confirmed diagnosis of IHD according to the International Statistical Classification of Diseases and Related Health Problems (10th revision, ICD-10) in more than 95% of cases. Second, recall bias is a concern, as participants may not accurately remember receiving GP advice. Although a sensitivity analysis based on the timing of the most recent IHD event or diagnosis showed little impact on the associations, recall bias may still be present, as it may not only depend on the time since the event but also on the general difficulty of recalling the content of a GP consultation.

Third, among all 12 827 respondents aged 35+ years who participated in the population-based survey, about 8.9% self-reported having IHD. This proportion is similar to the approximately 9% estimated in another national survey.[7] However, only 77.4% of participants opted in to the IHD question and individuals with lower education and income—groups with higher IHD prevalence[46]—were overrepresented among non-responders to the opt-in question, which may have influenced the proportion of IHD cases in our study.

Fourth, the complexity of our main study outcome question could have led to comprehension difficulties, though the CAPI survey allowed interviewers to assist. Fifth, some person-related and health-related characteristics (eg, BMI and PA levels) were collected at the time of the survey, but may have changed since the last GP visit.

Finally, the findings on BMI and PA levels following GP advice do not allow conclusions about causality, although they are consistent with studies showing positive effects of brief interventions on PA[6 17] and other health behaviours such as smoking cessation.[47]

Implications

Currently, only about one-third of individuals with self-reported IHD reported having received comprehensive PA advice including all three elements (Ask, Advise, Assist) that could support them to change their health behaviour.[20 21] While this is a meaningful proportion, the PA-related guideline recommendation could still be implemented more consistently in the care of individuals with IHD.

In Germany, long-term IHD management is routinely coordinated in general practice, including within the DMP IHD, which mandates lifestyle counselling such as PA advice. The German IHD treatment guideline[10] recommends that GPs routinely encourage PA and support patients in integrating movement into daily life.

Strengthening referral pathways (eg, to cardiac rehabilitation or community-based PA services) and improving coordination with specialist care (eg, physiotherapists, exercise therapists) may help ensure safe and appropriately tailored PA support and may promote sustained behaviour change among patients.

Another major barrier seems to be insufficient training for GPs in providing PA advice.[48–51] To address this, international guidelines recommend training for HPs[16 52] to promote understanding of PA as a preventive measure in primary care, provide practical PA recommendations (eg, local sports programmes) and raise awareness of at-risk groups.[16] However, in Germany, such training is not adequately integrated into the medical curriculum and continuing medical education. To bridge this gap, brief PA counselling competencies should be incorporated into the medical curriculum, and tailored training programmes for GPs should be developed and implemented.

CONCLUSION

Our results indicate that GP advice on PA in Germany is not yet sufficiently implemented in line with the clinical guideline recommendations on the treatment of individuals with IHD. Only one in three received all 3As, which is critical for facilitating health behaviour change. Moreover, women, individuals with lower educational qualifications, those living in rural areas and physically inactive individuals are even less likely to receive PA advice. Potential strategies to enhance PA advice in primary care include strengthening referral pathways (eg, to cardiac rehabilitation or exercise programmes), integrating brief PA counselling into medical training, and supporting PA promotion within routine chronic care pathways such as the DMP IHD.

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Acknowledgements We would like to thank Constanze Cholmakow-Bodechtel and Marvin Kraemer from the market research institute ‘Oracle Life Science’ for data collection.

Contributors SH drafted the analysis protocol and the manuscript and analysed and interpreted the data. SK (guarantor) conceived the study, acquired funding,

co-wrote the manuscript and supervised all preparatory work and the analyses. AP, DK, UM, OK and RC provided advice on the study protocol and critically revised the analysis protocol and the manuscript. OK also advised on the statistical analysis. All named authors contributed substantially to the manuscript, were actively involved in the revision process in response to reviewer feedback and agreed on its final version. Language editing assistance was provided by ChatGPT (OpenAI); the authors alone are responsible for all conceptualisation, scientific work and interpretations.

Funding The cross-sectional population survey is part of the OptiCor study (https://www.opticor-study.info/). The OptiCor study has been funded as a junior research group in health services research by the German Ministry of Education and Research (funding period: May 2022 to April 2027, grant number: 01GY2103).

Competing interests None declared.

Patient and public involvement Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

Patient consent for publication Not applicable.

Ethics approval This study involves human participants. This study was approved by the ethics committee of the Medical Faculty of the Heinrich Heine University Duesseldorf, Germany (2023-2321). Participants gave informed consent to participate in the study before taking part.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement Data are available upon reasonable request. The statistical analysis code is publicly available on the OSF platform: https://osf.io/u3hfy. The deidentified dataset is available to researchers on reasonable request from the corresponding author (Sabrina.Kastaun@med.uni-duesseldorf.de). All proposals requesting data access must specify the intended use and will require approval from the study team before any data can be shared. At the time of this manuscript's publication, additional analyses by our research group using the same dataset are still planned. Upon completion of the study and these remaining analyses, the fully deidentified dataset will be released as an open scientific use file. The data will be shared transparently as open data while ensuring full participant confidentiality.

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