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# Opportunities for improved indicator-based HIV testing in the hospital setting: a structural equation model analysis

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**ABSTRACT**

Indicator condition (IC)-guided HIV testing, i.e., testing when diagnosing a condition associated with HIV, is a feasible and cost-effective testing strategy to identify undiagnosed individuals. Assessing determinants for IC-guided testing may identify opportunities for improvement. A survey study based on the Theory of Planned Behaviour (TPB) was conducted among 163 hospital physicians from five specialties in Amsterdam, the Netherlands. Structural equation models were used to determine the association between the TPB domains (i.e., attitude, belief, norms, self-efficacy and behavioural control) and (1) the intention to test as a mediator for HIV testing behaviour (intentional model) and (2) actual HIV testing behaviour (direct model). Both models accounted for the effect of guideline recommendations. Behaviour scored lower than intention on a five-point scale (mean score of 2.8, SD = 1.6 versus 3.8, SD = 1.1; $p<0.0001$). The direct model had a better fit than the intentional model based on fit statistics. Discrepancies between the determinants most important for intention versus those for behaviour led to the following recommendations: interventions to improve IC-guided testing in hospitals should primarily focus on implementation of guideline recommendations, followed by improving physicians' attitude towards IC-guided HIV testing and self-efficacy, as these were the most important correlates of actual HIV testing behaviour.

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## Introduction

The number of reported HIV diagnoses in the European Union (EU) has been steadily declining over the past decade, with the strongest decline among men who have sex with men (MSM) and people who inject(ed) drugs (European Centre for Disease Prevention and Control, 2021). Additionally, the rate of reported cases of acquired immunodeficiency syndrome (AIDS) has more than halved in the past decade, declining from 1.3 to 0.5 cases per 100,000 individuals. Biomedical innovations, such as pre-exposure prophylaxis (PrEP) to prevent HIV transmission, alongside the treatment as prevention (TasP) strategy and promotion of the undetectable equals untransmittable message (U = U; the scientific notion that an individual with undetectable levels of HIV viral load cannot sexually transmit HIV to others), have greatly accelerated efforts to end the HIV epidemic (Cohen et al., 2016; McCormack et al., 2016; Molina et al., 2015; Rodger et al., 2019).

However, an estimated 22% of people living with HIV (PLHIV) in the EU are not aware of their status and over half of individuals newly diagnosed are at a late-stage of HIV infection (i.e., CD4 cell count below 350 cells/mm$^3$), including nearly a third with advanced HIV (i.e., CD4 cell count below 200 cells/mm$^3$) (European Centre for Disease Prevention and Control, 2021). These data indicate that access to and uptake of HIV testing needs to be improved, as early diagnosis and treatment has individual health benefits and reduces onward transmission (INSIGHT START Study Group et al., 2015; Marks et al., 2006; Rodger et al., 2019). A feasible and cost-effective strategy for routine HIV testing is testing in patients diagnosed with health conditions associated with HIV. This strategy is known as indicator condition

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(IC)-guided testing (HIV in Europe, 2014). While routine IC-guided testing has the advantage of bypassing several barriers to HIV testing (Sullivan et al., 2013), its implementation varies widely across high-income countries and is oftentimes poor (Bogers et al., 2021a). Reasons for lacking implementation may include the absence of IC-guided testing recommendations in local clinical guidelines, insufficient awareness of these recommendations, or no routine to offer testing (Bogers et al., 2021a; Lin et al., 2020; Lord et al., 2017).

In the Netherlands, about 53% of individuals are diagnosed with late-stage HIV infection, while this percentage is 81% among individuals diagnosed at a hospital (van Sighem et al., 2022). Missed opportunities for earlier HIV diagnosis through IC-guided testing have been reported in the primary care setting (Joore et al., 2016), but adoption of IC-guided testing in the hospital setting, as well as its determinants, have been studied less. We performed a survey among physicians actively working at hospitals in the region of Amsterdam, the Netherlands, to examine pathways predicting IC-guided testing for HIV. This information could then be used to identify opportunities for improved IC-guided HIV testing in the hospital setting.

## Materials and methods

### Design and setting

This study was a cross-sectional survey with the aim of assessing determinants for IC-guided HIV testing in selected ICs among healthcare providers in the hospital setting. This study was conducted as part of a larger intervention study (PROTEST 2.0), which was designed to assess the implementation and improvement of IC-guided testing (Bogers et al., 2021b). Five hospitals in the region of Amsterdam, the Netherlands participated, including two university hospitals, two teaching hospitals, and one non-teaching hospital. Within these hospitals, we selected five medical specialities, responsible for managing care for individuals presenting with the seven ICs studied (Table 1).

### Recruitment of participants

From the selected specialty departments, all medical specialists and residents were invited to anonymously participate in an online survey by email in June 2020. Reminders were sent out 2–4 weeks after the first invitation. Specialist and residents from each specialty received a link to the survey with questions that were similar across specialties, yet tailored to the ICs relevant for their specialty as listed in Table 1. Individuals were required to provide consent before study participation.

**Table 1.** Selected indicator conditions and associated medical specialties, PROTEST 2.0 study, Amsterdam region, 2020.

| Indicator condition | Primary managing specialty |
|---|---|
| Tuberculosis | Pulmonology |
| Hepatitis B virus infection | Gastroenterology |
| Hepatitis C virus infection | Gastroenterology |
| Malignant lymphoma | Haematology |
| Cervical cancer or CIN III+ | Gynaecology |
| Vulvar cancer or VIN III+ | Gynaecology |
| Peripheral neuropathy | Neurology |

CIN: cervical intraepithelial neoplasia; VIN: vulvar intraepithelial neoplasia.

Data from these surveys were collected using Limesurvey (LimeSurvey GmbH, Hamburg, Germany).

### Survey design, theoretical framework and assessment tools

The survey items were developed based on the Theory of Planned Behaviour (TPB) model (Ajzen, 1991, 2005, 2019a; Bosnjak et al., 2020). This is a theoretical model evaluating the influence of factors for behavioural intention in three determinant domains: personal attitude and beliefs, social/professional/interpersonal influence or norms, and self-efficacy (i.e., personal effectiveness or capability; perceived behavioural control), Figure 1 (Ajzen, 2019b). In turn, intention is the direct predictor of behaviour. Recent advancements in the application of TPB have allowed researchers to explore the roles of social identity, the concept of willingness, behavioural habits and the mediating role of self-efficacy for attitudes and subjective norms in the public health setting (Bosnjak et al., 2020). In the context of our study, the components of the TPB model used can be interpreted as follows: *behaviour* is the self-reported IC-guided testing behaviour, and *intention* is the self-reported intention to apply IC-guided testing in the future. Through intention, behaviour is determined by the respondent's *attitude* and *belief* regarding the need for IC-guided testing, the *professional norms* of the respondent's environment, including colleagues and patients, and the respondent's *self-efficacy*, or

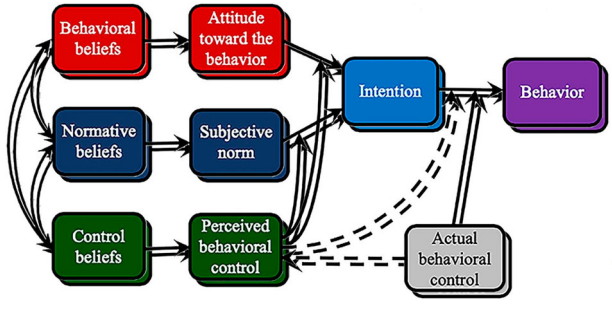


**Figure 1.** Diagram depicting the theory of planned behaviour. Copyright Icek Ajzen, 2019 (Ajzen, 2019b).

their confidence in their ability to successfully apply IC-guided testing. The survey contained twelve 5-point Likert-scale statement questions on attitudes, beliefs, professional norms and self-efficacy towards IC-guided testing, as well as three 5-point Likert-scale statement questions assessing behaviour and intention to test (1 = lowest score; 5 = highest score, Supplemental Table 1). Based on the theoretical model, the twelve questions were categorised into the four determinant domains (i.e., attitudes, beliefs, professional norms and self-efficacy). Cronbach's alpha ($\alpha$) was used to confirm internal consistency between items within domains, while items were combined when $\alpha$ was greater than 0.7 (Bland & Altman, 1997; Nunnally & Bernstein, 1994; Tavakol & Dennick, 2011).

The *attitude* domain included items on the perceived importance and positivity of testing for HIV in patients diagnosed with the indicator condition of interest. This domain is influenced by individual's *beliefs*. The *beliefs* domain included items on respondents' perceptions regarding the prevalence of HIV in patients diagnosed with the indicator condition of interest, and whether testing for HIV in these patients would improve health outcomes.

The *professional norms* domain included items on the respondent's perceptions regarding how important colleagues and patients find IC-guided HIV testing and whether it is discussed between colleagues within the specialty. We additionally assessed whether HIV testing was recommended in the *guidelines* of the IC of interest according to the respondent. This item was considered as a determinant of professional norms as well as a direct predictor of intention to test or testing behaviour. It was therefore added as a separate co-determinant.

The *self-efficacy* domain included items on whether respondents were comfortable offering HIV testing to patients diagnosed with the indicator condition of interest, whether they considered themselves capable to do so, and whether it was easy for them to do so. We also asked whether respondents found that HIV testing was *easily arranged in their hospital*. As the response to this last item was likely a reflection of an external factor, rather than internal self-efficacy, we analysed this item as a separate co-determinant of the self-efficacy domain.

## Statistical analysis

Data on participant characteristics and outcomes were analysed descriptively. All surveys were included for descriptive analysis and observations with missing data were excluded.

We utilised structural equation models (SEMs), which allowed us to explore the pathways that contributed most to behaviour. We developed an initial SEM based on the classic TPB model, in which certain determinants influence behavioural intention, while intention is the most proximal predictor of actual behaviour (i.e., intentional model) (Ajzen, 1991). To this end, we estimated a model with the variable "testing behaviour" as an outcome of the independent variables whether testing was in the "guidelines", whether testing was "easily arranged", and importantly, the variable "intention to test". The variable "intention to test" was the result of (1) the domain "attitude", which was directly linked to the domain "belief"; (2) the domain "self-efficacy", which was modelled as the outcome of whether a test was "easily arranged"; and (3) the domain "professional norms", which was modelled as a latent variable of responses on questions related to HIV testing norms and was directly linked to the variable "guidelines". We averaged the scores of variables within the "attitude", "beliefs" and "self-efficacy" domains. The rationale for including "professional norms" as a latent variable (i.e., as a measurement model) was because this domain involved items that did not measure perceived self-norms directly, but were rather a proxy of norms. Parameter estimates ($\beta$) were standardised and estimated with their 95% confidence intervals (CI). We tested whether the estimates were greater than null using a Wald $\chi^2$ test.

An important constraint to the intentional model was that, in our cross-sectional survey, behaviour was measured retrospectively. In contrast, intention was measured in relation to the near future, which more closely aligns with the principles of the TPB. As a result, the relation between intention and behaviour might not be appropriately represented. We then estimated an SEM in which the variable "intention to test" was removed and the domains "attitude", "self-efficacy", and "professional norms" were directly linked to the variable "testing behaviour" (i.e., direct model).

We compared the Bayesian information criteria (BIC) between models to determine which model had the best fit. To assess the fit of each individual model, the likelihood ratio (LR) test was used to compare goodness of fit of the model compared to a model with perfectly fitting covariances. Additionally, we calculated the root mean squared error of approximation (RMSEA), the standardised root mean squared residual (SRMR) and the coefficient of determination (CD; Supplemental Table 2).

A $p < 0.05$ was considered statistically significant. All analyses were performed using Stata v15.1 (College Station, Texas, U.S.A.).

## Ethics approval and consent to participate

The Medical Ethics Committee of the Amsterdam University Medical Centres, University of Amsterdam

(Amsterdam UMC-AMC) determined that this study does not meet the definition of medical research involving human subjects under Dutch law. All participants consented to study participation through written consent.

## Results

### Study population

Overall, requests to participate were sent to 378 individuals, of whom 163 responded to the questionnaire (response rate 43%; overall range by specialty: 23%–58%). The characteristics of respondents are reported in Table 2. There was no response from any neurologist at university hospitals or from any gastroenterologist at non-teaching hospitals.

### Perceived behaviour, intention and domain outcomes

Of the surveys from the 163 individuals who responded, 149 completed the questionnaire with no missing items and were included in descriptive analysis. Overall, the mean score for frequency of testing behaviour was 2.8 (SD = 1.6) and was distributed as follows: 45 of 149 (30%) respondents reported never testing for HIV in patients diagnosed with an indicator condition of interest, 47/149 (32%) reported rarely or sometimes testing for HIV, and 57/149 (38%) reported testing for HIV often or very often (Table 3). For intention, the mean score was higher than the score for behaviour (mean score = 3.8, SD = 1.1, $p < 0.0001$). Fifteen of 149 (10%) reported low or very low intention to test for HIV in patients diagnosed with the indicator condition of interest, 34/149 (23%) reported to be neutral in their intention, and 100/149 (67%) reported having high or very high intention to test for HIV (Table 3). Intention to test was significantly correlated with perceived behaviour (Kendall's tau-b = 0.63, $p < 0.0001$). The overall Cronbach alpha for the latent variable "professional norms" was 0.701 (with individual item alphas at: colleagues = 0.550, patients = 0.703, and often discussed = 0.546). This suggests high internal consistency. Mean scores and distributions of the measured determinants are reported in Table 3.

### Associations between perceived behaviour, intention and domains

To ensure meaningful interpretation of covariates, any response given as "do not know" was considered missing and observations with this response were removed from analysis. This exclusion resulted in 123 surveys analysed using SEMs. Modelled pathways in the final SEM models are displayed in Figure 2. We compared the associations between each domain and intention to test for HIV (intentional model; panel A) or perceived behaviour (direct model; panel B). The direct model had a better fit than the intentional model (Supplemental Table 2). Nevertheless, the fit indices suggested that the fit for both models was not close and that the models were prone to a high degree of error.

In the intentional model (Figure 2(A), Supplemental Table 3), intention to test for HIV was associated with the *professional norms* domain ($\beta = 0.59$, 95% CI = 0.46, 0.71, $p < 0.001$), and the *attitude* domain ($\beta = 0.52$, 95% CI = 0.40, 0.65, $p < 0.001$). Intention was not associated with *self-efficacy* ($\beta = -0.02$, 95% CI = −0.12, 0.08, $p = 0.67$). Reported HIV testing behaviour was associated with intention to test ($\beta = 0.44$, 95% CI = −0.28, 0.60, $p < 0.001$) and with whether HIV testing was recommended in the *guidelines* ($\beta = 0.39$, 95% CI = −0.22, 0.55, $p < 0.001$), and, to a lesser extent, with

**Table 2.** Characteristics of 163 respondents to an online survey on indicator condition-guided HIV in the hospital setting in the region of Amsterdam, the Netherlands, 2020.

| | Pulmonology *n* = 23 | Gastroenterology *n* = 20 | Haematology *n* = 43 | Gynaecology *n* = 45 | Neurology *n* = 32 | Overall *n* = 163 |
|---|---|---|---|---|---|---|
| Age in years (median, IQR) | 42 (36–58) | 45 (36–55) | 36 (31–43) | 40 (34–48) | 38 (31–45) | 40 (33–48) |
| Sex (*n*, %) | | | | | | |
| Male | 12 (52%) | 7 (35%) | 16 (37%) | 5 (11%) | 15 (47%) | 55 (34%) |
| Female | 11 (48%) | 13 (65%) | 27 (63%) | 40 (89%) | 17 (53%) | 108 (66%) |
| Job type (*n*, %) | | | | | | |
| Resident | 15 (65%) | 12 (60%) | 26 (61%) | 28 (62%) | 20 (63%) | 101 (62%) |
| Specialist | 8 (35%) | 5 (25%) | 17 (40%) | 16 (36%) | 12 (38%) | 58 (36%) |
| Other | 0 (0%) | 3 (15%) | 0 (0%) | 1 (2%) | 0 (0%) | 4 (2%) |
| Work experience in years (median, IQR) | 7 (4–20) | 14 (4–18) | 3 (1–10) | 10 (7–16) | 7 (3–11) | 8 (3–15) |
| Type of hospital (*n*, %) | | | | | | |
| University hospital | 13 (57%) | 7 (35%) | 21 (49%) | 1 (2%) | 0 (0%) | 42 (26%) |
| Teaching hospital | 7 (31%) | 13 (65%) | 6 (14%) | 39 (87%) | 27 (84%) | 92 (56%) |
| Non-teaching hospital | 3 (13%) | 0 (0%) | 16 (37%) | 5 (11%) | 5 (16%) | 29 (18%) |

**Table 3.** Mean scores and distributions of reported HIV testing behaviour, intention to test for HIV, and their determinants of 163 respondents to an online survey on indicator condition-guided HIV in the hospital setting in the region of Amsterdam, the Netherlands, 2020.

| | Responses (*n*) | Mean score (SD)* | Likert score 1 *n* (%)* | Likert score 2 *n* (%)* | Likert score 3 *n* (%)* | Likert score 4 *n* (%)* | Likert score 5 *n* (%)* | Don't know *n* (%)* |
|---|---|---|---|---|---|---|---|---|
| Outcomes | | | | | | | | |
| Testing behaviour | 149 | 2.8 (1.6) | 45 (30%) | 29 (20%) | 18 (12%) | 20 (13%) | 37 (25%) | 0 (0%) |
| Intention to test | 149 | 3.8 (1.1) | 4 (3%) | 11 (7%) | 34 (23%) | 42 (28%) | 58 (39%) | 0 (0%) |
| Determinants | | | | | | | | |
| Attitude | 149 | 3.8 (0.8) | 0 (0%) | 3 (2%) | 40 (27%) | 71 (48%) | 35 (23%) | 0 (0%) |
| Beliefs | 163 | 3.5 (1.0) | 3 (2%) | 18 (11%) | 43 (26%) | 61 (37%) | 38 (23%) | 0 (0%) |
| Professional norms | 149 | 2.9 (0.8) | 1 (1%) | 60 (40%) | 56 (38%) | 28 (19%) | 4 (3%) | 0 (0%) |
| Guidelines | 149 | 3.7 (1.3) | 7 (5%) | 27 (18%) | 15 (10%) | 25 (17%) | 57 (38%) | 18 (12%) |
| Self-efficacy | 149 | 3.7 (0.6) | 0 (0%) | 3 (2%) | 54 (36%) | 82 (55%) | 10 (7%) | 0 (0%) |
| Easily arranged | 149 | 4.4 (0.6) | 0 (0%) | 1 (1%) | 7 (5%) | 74 (50%) | 67 (45%) | 0 (0%) |

*Items were assessed using 5-point Likert-scales, where 1 represented the lowest score (e.g., strongly disagree, never, definitely not) and 5 represented the highest score (e.g., strongly agree, always, definitely yes).

whether it was *easily arranged* ($\beta = 0.16$, 95% CI = 0.05, 0.27, $p = 0.003$) in this model.

In the direct model (Figure 2(B), Supplemental Table 3), reported HIV testing was associated with whether testing was recommended in the IC's *guidelines* ($\beta = 0.46$, 95% CI = 0.26, 0.67; $p < 0.001$), with the *attitude* domain ($\beta = 0.28$, 95% CI = 0.12, 0.43, $p = 0.001$) and with *self-efficacy* ($\beta = 0.17$, 95% CI = 0.03, 0.30, $p = 0.02$). HIV testing was not significantly associated with *professional norms* ($\beta = 0.16$, 95% CI = −0.09, 0.42, $p = 0.21$) and only marginally by whether HIV testing was *easily arranged* ($\beta = 0.11$, 95% CI = 0.00, 0.22, $p = 0.06$) in this model.

## Discussion

In this study, we examined associations that could be linked to IC-guided HIV testing among 163 physicians

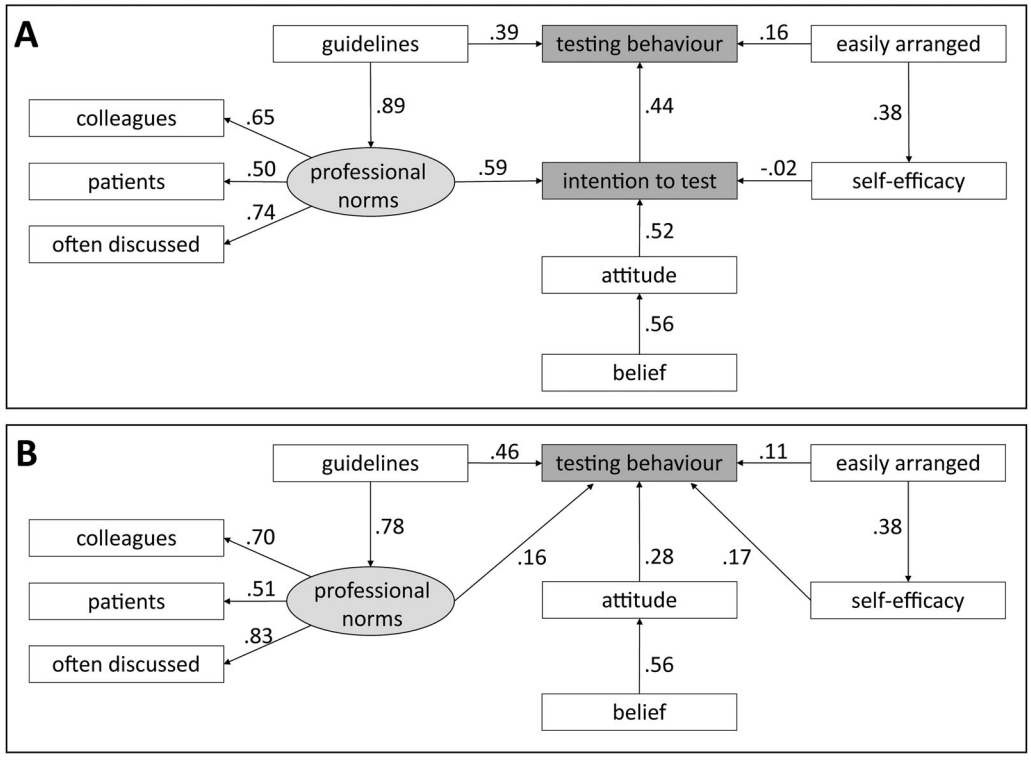


**Figure 2.** Structural equations models on associations between determinants for behaviour and self-reported HIV testing behaviour in patients diagnosed with indicator conditions among 163 physicians in the hospital setting in the region of Amsterdam, the Netherlands, 2020. (Panel A) Depiction of structural equations for the intentional model. (Panel B) Depiction of structural equations for the direct model. The numbers next to the pathways are the parameter estimates ($\beta$), representing the change in modelled outcomes per standardised unit increase of the determinant. Dark grey items represent the outcomes of interest, light grey items represent latent variables.

in the region of Amsterdam. We found that in the intentional model, reported HIV testing was strongly associated with intention to test, as suggested in the classic TPB model. In turn, the domains predicting intention to test were professional norms and physician's attitudes, while self-efficacy played no role. However, when looking at the effect of the domains on reported testing behaviour in the direct model, guideline recommendations, physician's attitudes and self-efficacy were determinants for IC-guided HIV testing behaviour, while professional norms and whether testing is easily arranged played a marginal role in the direct model. It should be noted that this model had a better statistical fit than the model representing IC-guided HIV testing behaviour consequent to testing intention.

Generally, the TPB model assumes that the most proximal predictor of behaviour is behavioural intention (Ajzen, 1991), and there was indeed a strong and significant association between intent to HIV testing and HIV testing behaviour. However, the observed association between intention and behaviour was smaller than expected. This may be explained by the fact that behaviour was measured retrospectively, instead of through a prospective assessment. We therefore explored whether a direct model would better predict testing behaviour in our data. Indeed, the direct model had a better fit than the intentional model.

We were surprised to find that professional norms and attitude had a weakened association with behaviour in the direct model, while we expected them to retain, if not increase, their effect size, as intention is often known to serve as a mediator between these determinants and behaviour (Jemmott et al., 2015; Mafabi et al., 2017; Thorhauge et al., 2019). The weaker effect of norms and attitudes in the direct model highlights that the factors predicting intention are somewhat different to those influencing behaviour. One explanation could be that healthcare providers generally perceive their care, or at least the care needing to be provided, as full-scale and high-quality. These perceptions of "professional desirability" lead them to have a high intention to test for HIV in the presence of an IC. However, actual implementation of such intentions might require the involvement of additional factors that influence actual behavioural control. Challenges in care delivery, restricted time for consultations, HIV related stigma and other barriers might prevent healthcare providers with high intention from actually conducting IC-guided HIV testing (Deblonde et al., 2010; Stutterheim et al., 2022). The observed score for self-reported testing behaviour is in line with observed IC-guided HIV test rates from the same hospitals, where less than half of patients with IC were tested for HIV (Bogers et al., 2022).

Factors such as self-efficacy, which had no effect on intention in the intentional model, might play a larger role in the actual implementation of behaviour. The direct effect of self-efficacy on behaviour has been proposed in the past by those who developed the TPB model (Ajzen, 1991, 2005).

We observed similar findings to other studies applying the TPB model to understand physicians' intentions and behaviour in various clinical settings. In these studies, as in our findings, physicians' attitude was frequently and significantly associated with behavioural intention, whereas self-efficacy was inconsistently associated (Kortteisto et al., 2010; Wang et al., 2022). In contrast, one systematic review evaluating shared decision-making behaviour by healthcare providers observed that norms were most influential in predicting intention and behaviour (Thompson-Leduc et al., 2015), while we observed a key role for this domain on intention, but a weaker correlation between this domain and HIV testing behaviour in the direct model.

Based on our findings, we recommend the following to improve indicator based testing in the clinical setting. Targeting testing norms will not be sufficient unless IC-specific guidelines are developed and promoted, and providers' attitudes and self-efficacy regarding HIV testing are addressed. Therefore, interventions should focus on addressing the lack of IC-guided HIV testing recommendations in guidelines and establish clear-cut and feasible recommendations (Jordans et al., 2022). In our study, HIV testing recommendations were provided in some, but not all IC treatment guidelines (i.e., present in the tuberculosis and viral hepatitis guidelines, present in some, but not all malignant lymphoma guidelines, and insufficiently mentioned in the peripheral neuropathy, vulvar cancer and cervical cancer guidelines), possibly affecting our findings (Bogers et al., 2022). Interventions should additionally focus on improving providers' self-efficacy in implementing IC-guided testing and their attitudes towards this strategy. In turn, self-efficacy can be supported by elements that increase actual behavioural control, such as the factual easiness of arranging an HIV test in the hospital, while providers' attitudes can be improved by raising healthcare providers' beliefs that HIV testing benefits patients' health outcomes, and that IC-guided testing is a cost-effective strategy (Desai et al., 2020; Elmahdi et al., 2014; Lin et al., 2020; Lord et al., 2017; Raben & Sullivan, 2021).

We recognise some limitations to our study. First, we measured behaviour retrospectively in the survey, and not prospectively. This may have biased its

association with behaviour, e.g., through recall bias (Blome & Augustin, 2015). We aimed to mitigate this limitation by comparing the outcomes of our intentional model with the outcomes of a model assessing the determinants for behaviour directly. Second, we only sampled physicians from certain specialty departments, and were unable to receive responses from all sampled specialty departments in all hospital types. Our findings may therefore not be representative of all settings involved with IC-guiding testing, and could have potentially biased the factors influencing HIV testing behaviour. Third, the response rate was low, which could indicate selection bias. We did not collect data on non-responders, thus the extent of this bias is unknown. The low response rate also led to fewer numbers of participants for analysis, which made it difficult to have sufficient power for more refined analysis, such as stratification by specialty and other respondent characteristics. Such stratification could have provided additional understanding in how the effect of domains on HIV testing intention and behaviour could vary by specialty. Since large variation in the implementation of routine HIV testing by IC has been observed (Bogers et al., 2021a), stratification would have led to further insight in how to develop tailored interventions to improve HIV testing by specialty. Fourth, fits for both the intentional and direct models were not close and could be prone to error. Improvements in fit could have been made by reconfiguring the model components; however, we constructed the model based on *a priori* assumptions from the TPB and thus such a strategy would not be in line with this approach. The poor fit of the model could be due to the high variability in responses between physicians. Finally, some of the associations identified in our study may have been the result of specific clinical circumstances at the regional level, and generalisation to other settings, therefore, warrants caution.

## Conclusions

Our findings highlight discrepancies between determinants for physicians' intention to apply IC-guided HIV testing and determinants for actual HIV testing behaviour. Interventions to improve IC-guided HIV testing in the hospital setting should focus primarily on implementation of guideline recommendations where these are lacking, followed by improving physicians' beliefs towards IC-guided HIV testing, self-efficacy and actual behavioural control, as these were strong determinants of actual HIV testing behaviour.

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## Data availability statement

The data that support the findings of this study are available from the corresponding author, S. B., upon reasonable request.

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