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The impact of trust in healthcare and medication, and beliefs about medication on medication adherence in a Dutch medication-using population

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ABSTRACT

Introduction: Trust in healthcare and medication, defined as feelings of reassurance and confidence in the healthcare system or medication, may be a key prerequisite before engaging in the use of medication. However, earlier studies have focussed on beliefs about medication rather than trust as predictors of medication adherence. This study therefore aims to simultaneously explore the relationship of trust in healthcare, medication and beliefs about medication, with medication adherence.

Methods: In a cross-sectional study, an online questionnaire was sent out to 1500 members of the Dutch Health Care Consumer Panel of Nivel in November 2018. Respondents were asked to grade their level of trust in healthcare and medication (scale 1–10). The Beliefs About Medicines Questionnaire (BMQ) for general and specific medication beliefs was used to address beliefs, the Medication Adherence Report Scale (MARS-5) to measure medication adherence. Data were analysed using structural equation modelling (SEM) with a backward stepwise approach. Out of 753 people that completed the questionnaire, 407 people used prescription medication and were included in the analyses.

Results: A positive association between trust in medication and medication adherence was found (0.044, $p < 0.05$). BMQ subscales Overuse (−0.083, $p < 0.05$), Necessity (0.075, $p < 0.05$) and Concerns (−0.134, $p < 0.01$) related with medication adherence. BMQ subscale Harm did not relate to medication adherence.

Conclusion: Trust in medication and beliefs about medication were both individually associated with medication adherence. Healthcare providers should therefore not only focus on patients' medication beliefs, but also on strengthening patients' trust in medication to improve medication adherence.

1. Introduction

Trust in healthcare and medication, defined as feelings of reassurance and confidence in the healthcare system or in medication, is of paramount importance in times of illness [1]. Being ill marks a precarious and uncertain time in peoples' lives. Their health is at stake, inducing vulnerability. This makes people prone to health-related anxiety about the potential risks of their treatment and the efficacy of medication [2,3]. Unknown medication efficacy and outcomes may fuel such uncertainty. It is in this context of vulnerability and adversity that people engage in a dependent relationship with healthcare [1,4]. Notably, trust in healthcare and/or medication, while being in a vulnerable position requires a positive expectation and downplaying of possible negative outcomes [5,6]. Thus, trust in healthcare and medication may be key prerequisites when engaging in medication treatment [7–9].

Regarding medication treatment, adequate adherence is critical to achieve the best possible outcomes. However, suboptimal use of

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medication is highly prevalent across diseases and patient populations [10–12]. Medication non-adherence causes increases in morbidity, mortality and unnecessary healthcare costs [13]. In predicting medication adherence, various studies have emphasized the importance of patients' beliefs about medication [14,15]. Beliefs about medication are patients' psychological viewpoints towards the need for medication, concerns about medication, the harm medication might cause and possible overuse of medication [16]. Up to now, studies concluded that the extent to which patients adhere to their medication is often affected by their beliefs about medication [14,17–19].

Besides patients' beliefs about medication, their trust in healthcare and medication are also expected to impact medication adherence [9,19–28]. Patients who distrust medication or the healthcare system are more prone to non-adhere to their medication [7,8], while interventions that stimulate patients' trust in medication show promising results in improving medication adherence [21]. Although previous research showed that trust in healthcare, in medication, and beliefs about medication are individually associated with medication adherence [20,29], few studies have assessed the relationship between trust in healthcare and/or medication, and beliefs about medication with patients' medication adherence simultaneously. People with low trust in healthcare and/or medication may have lower beliefs in the necessity of their medication and may also have more concerns about taking their medication. Thus, peoples' trust in healthcare and/or medication may underlie their beliefs regarding medication and they may mutually affect their medication adherence. This study, therefore, explores whether trust and beliefs embody a similar mechanism, or whether these are two separate mechanisms affecting medication adherence independently. We hypothesize that trust in healthcare and medication, and beliefs about medication mutually influence each other, and both separately affect medication adherence. We argue that by strengthening peoples' trust in healthcare and medication they will adopt better beliefs about medication, and vice versa, contributing both to higher medication adherence [28]. Our expectations are illustrated in Fig. 1.

1.1. Aim

This study aims to explore the simultaneous relationship between peoples' trust in healthcare and medication, their beliefs about medication, and their medication adherence.

2. Methods

2.1. Study design

A cross-sectional study was conducted to explore the relationship between medication adherence (dependent variable) and trust in healthcare, trust in medication, and beliefs about medication (independent variables).

2.2. Data source

Data were collected from the 22nd of November to the 16th December 2018, through the Dutch Health Care Consumer Panel of Nivel, the Netherlands Institute for Health Services Research [30]. This panel aims to measure the attitudes towards, and knowledge of, healthcare among the Dutch adult population [30,31]. The Dutch Health Care Consumer Panel of Nivel is an access panel that consist of a large number of persons who have agreed to answer questions on a regular basis. Members are recruited through an address file, obtained from an address supplier. Membership can only be attained if they are approached by Nivel, it is not possible to enlist. Upon joining the panel, members can indicate whether they want to receive subsequent questionnaires by post or via email. However, the current questionnaire was only sent out among members who wanted to receive questionnaires by e-mail. There are no explicit exclusion criteria. Inclusion criteria are that people have to be aged 18 years and older, live in the Netherlands, and are able to understand Dutch. From the access-panel, for each study, a sample is drawn that is representative of the Dutch general population. To ensure representativeness of the sample, we compared the composition of the panel with the general population in the Netherlands based on data from Statistics Netherlands [30]. The panel is regularly refreshed to ensure members do not develop specific knowledge of, or interest in, certain healthcare issues, that no questionnaire fatigue occurs, and to ensure that representative samples of the Dutch population can continue to be drawn [32]. Each member receives an invitation to complete a questionnaire roughly three to four times a year and can exit the panel at any time without a statement of reason. Participation is voluntary, panel members do not receive a direct reward (e.g. money) to fill out questionnaires, they only collect points when filling out questionnaires (approximately 150 for each questionnaire, after 3000 points they receive a gift voucher). The privacy of members is guaranteed since people who analyse the data do not have access to the personal information of the members [30]. All panel members have agreed to complete questionnaires regularly. Following Dutch legislation, there is no requirement to obtain informed consent or approval by a medical ethics committee to conduct research with this panel [33]. The panel consisted, at the time of data collection, of approximately 12,000 people aged 18 years and older. Data were assessed and processed pseudonymised in accordance with the panel's privacy policy, which corresponds to the General Data Protection Regulation (GDPR).

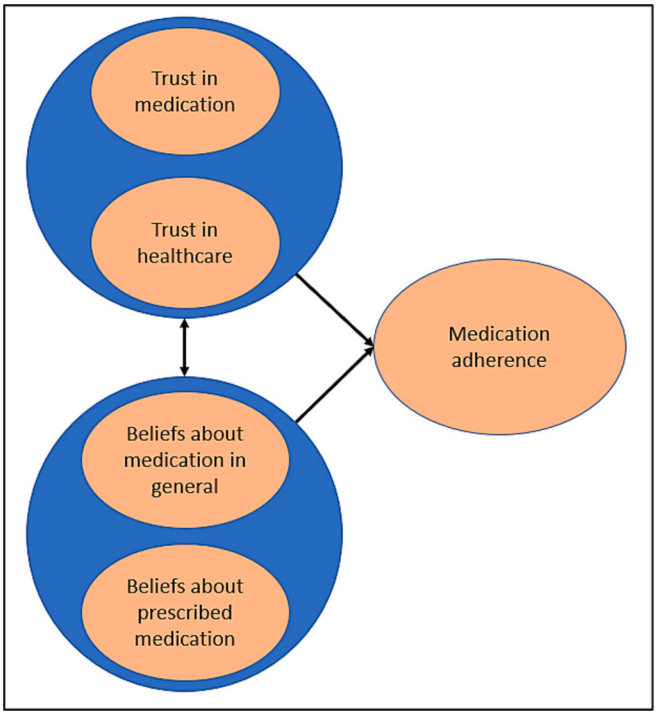

Fig. 1. Conceptual model of the hypothesized relationship between trust in- and beliefs about medication and healthcare, and medication adherence.

2.3. Data collection

The questionnaire was sent out to a sample of 1500 people representative of the Dutch adult population with regard to age and sex. All members received an initial electronic invitation to partake in the questionnaire, followed by two electronic reminders after one and two weeks. Data were collected in three weeks in November and December 2018.

In total, a mix of 27 multiple choice and open questions were asked. The questionnaire covered topics such as trust in healthcare and

medication, beliefs about and attitudes towards medication, and medication use. Demographics, like age, gender and educational level, of the study population were already known.

2.4. Measurements

2.4.1. Trust

Trust in healthcare and medication were both measured using a single item. Patients were asked how they would score their trust in healthcare and medication in general, on a scale from 1 (minimal trust) to 10 (maximum trust).

2.4.2. Beliefs about medication

Beliefs about medication were measured using the validated Beliefs about Medication Questionnaire (BMQ), including both the BMQ-general and the BMQ-specific [16]. Missing values on all BMQ-scales were replaced with estimated means ($n = 28$).

2.4.2.1. BMQ-general. The BMQ-general consists of eight questions comprising two subscales: Harm and Overuse. Each scale consists of four items. The Harm subscale poses statements regarding beliefs about (lack of) harmfulness of medication, such as: '*Medicines do more harm than good*'. The Overuse subscale includes statements of possible over-prescribing of medication by doctors, such as: *'if doctors had more time with patients, they would prescribe fewer medicines'*. Items were scored on a 5-point Likert scale (1 = completely disagree to 5 = completely agree). Sum scores for each subscale were calculated. A higher score on both scales indicates a more negative perception of medication. For robustness analyses, a BMQ-general differential was calculated by subtracting scores on the harm scale from scores on the overuse scale. Higher scores on this differential indicate higher perceived harm of medication and/or lower perceived overuse of medication [16,34].

2.4.2.2. BMQ-specific. The BMQ-specific consists of 10 items that comprise two subscales: Necessity and Concerns, consisting of five items per subscale. Routing within the questionnaire ensured the inclusion of only respondents who were currently using prescribed medication. The Necessity subscale addresses the patient's perceived (lack of) need to take the medication with statements such as: '*my life would be impossible without medicines'*. The Concerns subscale represents patients' perceptions about adverse reactions as a consequence of taking medication with statements such as: '*I sometimes worry about the long-term effects of my medicines'*. The items are scored on a 5-point Likert scale (1 = completely disagree to 5 = completely agree). Sum scores for each subscale were calculated. A higher score on the Necessity scale represents a higher perceived need for the medication treatment. A higher score on the Concerns scale indicates that patients have more concerns about their medication. For sensitivity analyses, a BMQ-specific differential [16] was calculated by subtracting scores on the concerns scale from scores on the necessity scale. Higher scores on this differential indicate higher necessity beliefs and/or lower concerns.

2.4.3. Medication adherence

Medication adherence (focussing on implementation and persistence [35]) was measured by the Medication Adherence Report Scale (MARS-5) [36]. The MARS comprises five items, one asking about unintentional non-adherence (forgetting to take a dose) and four about intentional non-adherence (e.g. changing doses, skipping doses). Respondents were asked to rate the frequency of these events occurring on a 5-point scale (1 = never; 5 = always). A mean sum of scores was calculated. The scale was recoded such that a high score indicated perfect medication adherence, as was originally intended [36]. Missing values were replaced with estimated means ($n = 8$).

2.4.4. Statistical analysis

Data were analysed using Stata 16.1 (descriptive analysis, correlations, and factor analysis) and SPSS AMOS 26 (structural equation modelling (SEM)). Factor analyses were conducted to evaluate the internal consistency of the relevant (sub)scales. Descriptive analyses were conducted to assess the current level of trust and beliefs among the study population. Bivariate tests were conducted to assess associations between population demographics and medication adherence. Correlation analyses were conducted to test for bivariate relationships between all included variables. An online tool was assessed to calculate the sample size required for the anticipated effect size (0.1), number variables in the model (6), the desired statistical power (0.9), and the probability level (0.5) [37]. Finally, SEM was conducted to evaluate the hypothesized conceptual model.

The models were built following a backward step-wise approach. This technique minimalizes suppressor effects, and maximizes the possibility of building a complete model, based on our theoretical expectation [38]. The main advantage of a backward-stepwise approach, within SEM, is that the effects of all variables can be assessed simultaneously. This is especially important in case variables are correlated with each other, which may cause collinearity when using other designs. Using the backward stepwise design, all variables were simultaneously included in the first model. Per step, the variable that contributed least to the model, was deleted. Model satisfaction was achieved when all variables included had a significant contribution to the model. All variables included were assumed to be caused or affected by other variables [39]. In the analysis, the maximum likelihood was estimated with standardized estimates. Model fit was assessed via Cmin: chi2/DF [40]. Direct effects of trust in healthcare, trust in medication, Harm, Overuse, Necessity and Concerns on medication adherence were estimated. Also, co-variances among all aforementioned endogenous variables, except for medication adherence were estimated. Finally, robustness analyses were conducted using the BMQ-General and BMQ-Specific differentials instead of, respectively, the Harm and Overuse subscales, and the Necessity and Concerns subscales. The same procedures of model building were followed in the robustness analyses.

3. Results

3.1. Study population selection

Overall, 753 patients responded to the questionnaire, resulting in a response rate of 50%. In this study, a selection was made of respondents that at the time of the study used prescription medication, or did so in the 12 months before completing the questionnaire. Patients who did not fit these inclusion criteria were deleted from the dataset ($n = 326$). After the deletion of respondents that failed to complete scoring either their trust in healthcare or trust in medication ($n = 19$), 407 respondents remained in the dataset for analysis.

3.2. Study population

Characteristics of the study population, including sex, age, ethnicity, education, general health, type of disease, and the number- and type of medication used, are presented in Table 1. Our study population was balanced regarding gender. The average age of the study population was 62 years (SD = 13.1). Diseases most frequently reported by the respondents were cardiovascular diseases (35%), short-term diseases (29%) and rheumatologic disease (26%). Respondents most frequently indicated to use one (26%) or two (23%) types of medication. The most common types of medication used within our study population were antihypertensive medication (41%) and lipid lowering medicines (31%). No associations between population characteristics and medication adherence were found. Therefore, we deemed correction was not needed.

Table 1
Characteristics of the study population ($n = 407$).

Characteristic	Mean / %	SD	Range (min/max)
Gender			
Male	51.6%		
Female	48.4%		
Age	61.8	13.1	30/89
Educational attainment			
Low (pre-vocational secondary education or lower)	10.8%		
Middle	48.8%		
High (higher professional education or higher)	40.5%		
Ethnicity			
Native	90.8%		
Non-native Western	6.7%		
Non-native Non-western	2.5%		
General health	3.1	0.9	1/5
(chronical) Disease			
Cardiovascular disease	35.4%		
Short-term disease	28.7%		
Rheumatologic disease	25.7%		
Asthma/COPD	15.4%		
Diabetes	14.6%		
Cancer	5.0%		
Other (chronical) disease	38.4%		
No disease(s)	10.9%		
Number of (types of) medication used			
1 type of medication	26.4%		
2 types of medication	23.4%		
3 types of medication	18.5%		
4 types of medication	15.5%		
5 or more types of medication	16.3%		
Type of medication			
Anti-hypertensives	41.4%		
Lipid lowering medication	31.0%		
Gastro-intestinal medication	24.9%		
Painkillers	23.4%		
Anticoagulants	21.7%		
Other medication [a]	146.1%		

[a] An extended view of other medication is presented in Appendix A, Table 4.

3.3. Trust, beliefs and medication adherence

Descriptive results of trust, beliefs and medication adherence within our study population are presented in Table 2. Peoples' trust in healthcare showed to be slightly higher than their trust in medication. Regarding general beliefs about medication, people had more positive beliefs than negative ones. This was the case for both the Harm subscale and the Overuse subscale. Furthermore, peoples' view of the necessity to take their medication showed to be average. Additionally, on average people seemed to have relatively low concerns about taking their medication. Lastly, our study population reported a mean medication adherence of 4.58 (maximum score: 5, SD: 0.5). This indicates relatively high self-reported adherence levels [41].

Confirmatory factor analyses were performed to evaluate the internal consistency of the BMQ-general and BMQ-Specific subscales. The two subscales of the BMQ-G, Harm and Overuse, were identified, as were the subscales of the BMQ-S: Necessity and Concerns. Internal consistency of four (sub)scales varied between Cronbach's alpha of 0.68 for Overuse (lowest) to 0.88 for Necessity (highest). Details are presented in Appendix A, Table 5.

Table 2
The level of trust, beliefs and medication adherence among the study population ($n = 407$).

Characteristic	Mean / %	SD	Range (min/max)
Trust in healthcare	7.5	1.0	2/10
Trust in medication	7.2	1.2	1/10
BMQ-general differential	2.7	0.7	1/4.5
Harm subscale	2.6	0.6	1/4.3
Overuse subscale	2.8	0.7	1/4.7
BMQ-specific differential	2.5	0.7	1/4.8
Necessity subscale	3.1	0.9	1/5
Concerns subscale	2.5	0.8	1/4.6
Medication adherence			
Medication adherence (MARS-5[a])	4.6	0.5	2.2/5

[a] Medication Adherence Report Scale.

3.4. Bivariate relationships between trust, beliefs and medication adherence

A moderate correlation was found between trust in healthcare and trust in medication. Trust in healthcare correlated weakly with the Overuse and Concerns subscales. Trust in medication revealed to weakly correlate with all sub-scales, except for the Necessity subscale that did not correlate with trust in medication at all. This indicates that the necessity to take medication is a separate concept, which is not related to the trust people have in their medication. The analysis furthermore revealed strong correlations within both the BMQ-G (Harm and Overuse) and the BMQ-S (Necessity and Concerns) subscales (see Table 3).

3.5. Testing the model

Power calculations resulted in a recommended sample size of $n = 200$. Our sample size is large enough ($n = 407$) to have sufficient statistical power. The first model that was constructed to explore all relationships, showed no significant contribution of the Harm subscale in relation to medication adherence, and was thus deleted from the model. The second model showed little, and no significant, contribution of trust in healthcare in relation to medication adherence. Trust in healthcare was therefore deleted from the model as well. Estimates and results of the first and second model are presented in Appendix A Table 6. In the third model, all subscales showed significant contributions to medication adherence and model satisfaction was achieved. The results of the

Table 3
Correlation matrix of bivariate relationships between trust, beliefs and medication adherence.

	Trust in Healthcare	Trust in Medication	Harm	Overuse	Necessity	Concerns	Medication adherence
Trust in Healthcare	X						
Trust in Medication	0.57**	X					
Harm	−0.17	−0.33*	X				
Overuse	−0.23*	−0.37*	0.60***	X			
Necessity	−0.03	0.04	−0.10	−0.04	X		
Concerns	−0.23*	−0.25*	0.22*	0.22*	0.61***	X	
Medication adherence	0.11	0.21*	−0.16	−0.20*	0.02	−0.1	X

[a] No correlation 0.00–0.19, *Weak correlation 0.20–0.39, **Moderate correlation 0.40–0.59, ***Strong correlation 0.60–0.79 [42].

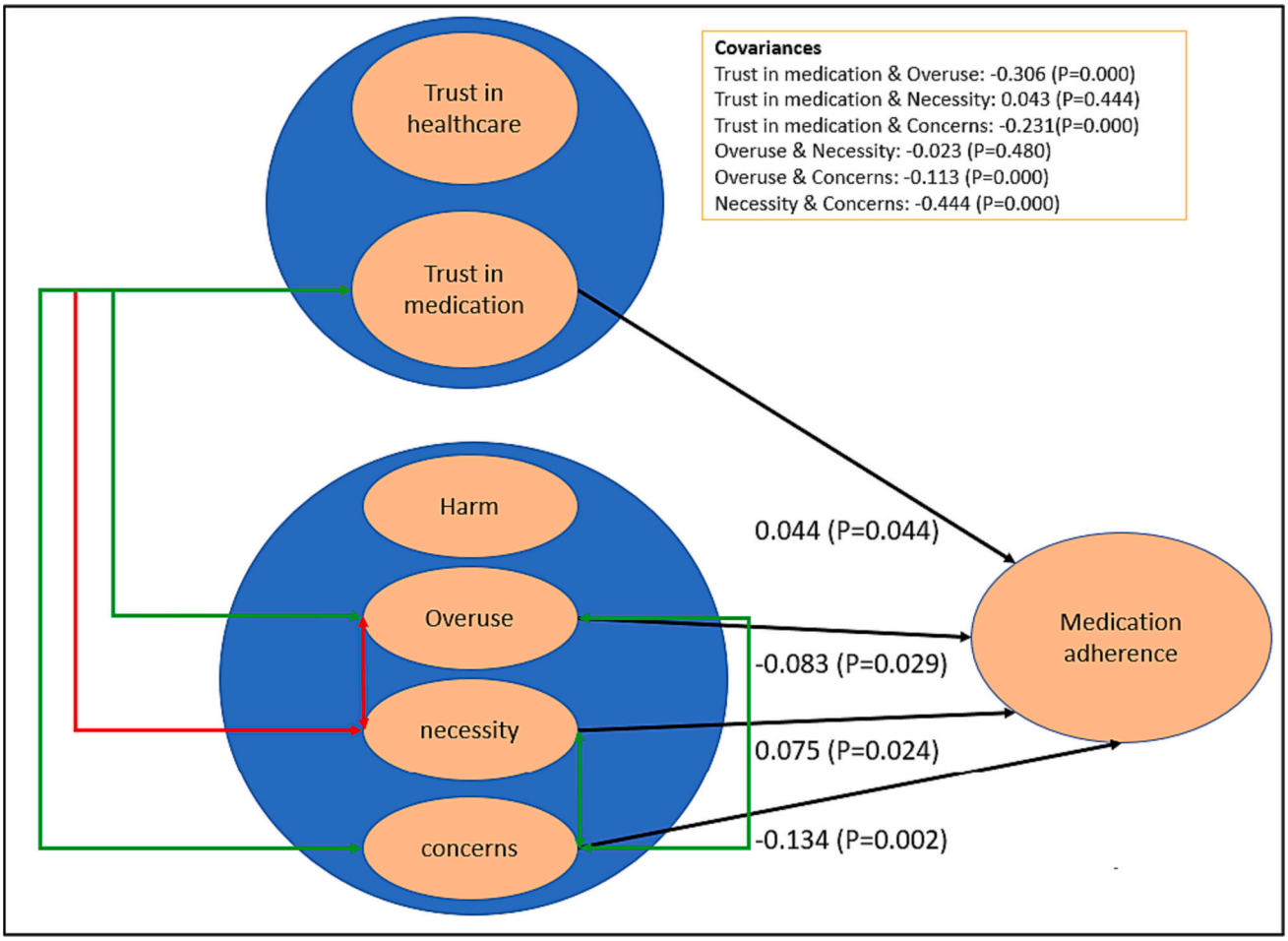

Fig. 2. Results of structural equation modelling assessing the relationships between trust, beliefs, and medication adherence presented in a comprehensive model [a,b].
[a]Green lines indicate significant covariances, red lines indicate not significant covariances, black lines indicate significant effects.
[b]All lines are intended to communicate relationships between the orange ovals.

model, in which the remaining variables simultaneously affect each other, are visualized in Fig. 2. The final model generated a model fit of Cmin/DF; 35.2. Relevant statistics of the constructed models are presented in detail in Appendix A, Table 6. Power calculations, fitness indices and other statistics will be provided upon request via the authors.

The analyses show that the more trust people have in their medication, the more likely they are to adhere to their medication. Necessity and Concerns are also significantly associated with medication adherence in the expected direction. In the case of Necessity, this means that the more people regard their medication as essential, the more likely they are to adhere to their medication. Moreover, the more concerns people have about their medication, the less likely they are to adhere to their medication. Most variables that are included in the final model showed significant covariances, except for Necessity that only had a significant covariance with the Concerns subscale.

3.6. Robustness

Robustness analyses showed significant contributions of trust in medication and beliefs about medication in general (BMQ-General differential) to medication adherence, as shown in Appendix A, Table 7. Trust in healthcare and beliefs about medication (BMQ-Specific differential) showed no or little contribution to medication adherence. Covariances between trust in medication and beliefs about medication in general were significant. Furthermore, the initial analyses showed little contribution of the Necessity subscale to the model. Robustness analysis, using the BMQ-specific differential that includes the Necessity subscale,

indicated a similar substandard contribution to the model. This substandard contribution of the BMQ-specific differential is plausible due to the independent nature of the Necessity subscale. The results of the robustness analyses are presented in Appendix A, Table 7 and Fig. 3.

4. Discussion

4.1. Main findings

This study showed that when people have trust in their medication and they have strong beliefs about the need to take the medication, they are more likely to adequately use their medication. Also, more positive beliefs regarding the overuse of medication, the necessity to take medication, and fewer concerns about medication are associated with better adherence to medication.

4.2. Interpretation

Our findings are in line with previous studies, that addressed the importance of specific necessity beliefs and general overuse beliefs in predicting adherence [43–45].

While beliefs regarding the overuse of- or concerns about medication are related to trust in medication, beliefs about the necessity of medication were not. This might indicate that specific beliefs about the necessity to take medication is a concept that is distinct from trust and perhaps more linked to a sense of obligation a patient is feeling towards the prescriber or the therapy. When people start using medication, there is likely some distrust towards the medication. People do not yet know the medication or what the possible (side)effects will be and may therefore be reluctant to use these medications, as is also concluded in previous studies [46,47]. However, because their healthcare provider(s) may have stressed the importance of taking the medication, people may be willing to take the medication, despite their lack of trust in the medication. Future research could explore the role of the healthcare provider, in light of the relationship between trust in- and beliefs about -medication, and medication adherence.

Current literature concludes that beliefs about the harm caused by medication are strongly related to medication adherence [48]. In our study, these beliefs were not associated with medication adherence when accounting for the influence of trust in medication. This implies that beliefs about harm and trust in medication might be relatively similar concepts, with harm focusing on negative aspects whereas trust in medication highlights a more positive approach. Trusting medication might thus be a prerequisite for believing that medication does little harm.

Using the BMQ-general and BMQ-specific differentials instead of the subscales, produced different results in evaluating the relationship between trust, beliefs and medication adherence. These robustness analyses found strong correlations between trust in medication, general beliefs and medication adherence. The combined influence of beliefs about harm with a general feeling of concerns embodies a concept that strongly relates to trust in medication and adherence. This again indicates that trust in medication and general beliefs are closely related, though somewhat different concepts, and both affect medication adherence. For the differential of specific beliefs about medication no significant associations with medication adherence were found.

4.3. Strengths & limitations

A strength of this study is that it simultaneously assessed the effect of trust in healthcare and medication and general and specific beliefs about medication on medication adherence. Differentiation between trust and beliefs on the one hand, and between general- and specific beliefs on the other hand, contributed to the accuracy of addressing this mechanism. Hitherto, to our best knowledge, such explicit combined evaluation was absent in previous studies. Also we used a large data set that included widely used and validated questionnaires to capture beliefs about medication and adherence.

A limitation of this study was the single item measurement of trust in healthcare and medication in the questionnaire. Since trust is a complex concept, it might be worthwhile to evaluate underlying aspects of trust in either healthcare or medication [49]. However, the 1–10 scale on which level of trust in medication was measured, is well-known and the often used grading system in, for example, in the Dutch school system, and may therefore possess some validity. A second limitation of this study is that the measurements of the BMQ-specific and MARS deviated from their intended use, where the BMQ-specific or MARS should be completed for a specific (type of) medication. In our study, respondents were asked to answer these questions for all their medication, not one in particular. This might have caused the weak relationship between peoples' beliefs about specific medication and their medication adherence, as indicated by the robustness analyses. The third limitation of this study is the high level of self-reported adherence. This is a limitation since with the use of self-reported measures, adherence is often overestimated and therefore may be less reliable [50,51]. Over-estimating often leads to less variation of medication adherence within the study population, which may lead to an under-estimation of effects. Despite under-estimating effects, our study did find an effect in relation to medication adherence. The fourth limitation is the insufficient model fit of the constructed models. However, we believe that regarding the complex nature of adherence, a good model-fit is hard to reach. Ample systematic reviews showed that there are a vast number of factors that affect medication adherence [52–54]. We merely focussed on trust- and beliefs-related items, in relation to medication adherence. Therefore, we were unable to build a model that encompasses the vast complexity of medication adherence. Still, we showed an underexplored relationship in the field of adherence. Therefore, we believe our findings contribute to a better understanding of the complexity of medication adherence.

4.4. Recommendations for future research and practice

Our study implicates that trust in medication and positive beliefs about medication are important to achieve adequate medication adherence. We recommend that future research should aim to develop a thorough measurement of trust in medication, to further explore the concept of trust in medication in relation with medication adherence. Also, future research that touches on the subject of beliefs about medication and medication adherence, ought to take into account trust in medication as a self-contained aspect.

In practice, it is important for healthcare professionals to also address peoples' trust in medication. Educating patients on their understanding of medication (e.g. when effects can be expected, common side effects and how to avoid these) may positively affect their feelings of reassurance and confidence regarding medication, and therefore positively impact their medication adherence. Patient-provider communication may contribute to building peoples' trust in medication. Healthcare professionals therefore play an important role by using the right techniques when discussing medication. Patient-centred consultation techniques such as motivational interviewing (MI) [55] or shared decision making (SDM) [56] contribute to building patient trust [57] and thus may impact adherence via trust building [58]. With these trust-building techniques, patient involvement in their treatment may be bolstered, patient-provider relations improved [57] and therapeutic alliances enhanced [59,60]. Adequate patient involvement and fruitful patient-provider relations thus could enhance patient trust and improve medication adherence [21].

5. Conclusion

Our findings show that trust in medication and beliefs are similar yet separate mechanisms that independently affect medication adherence. Furthermore, trust in medication and beliefs about medication affect

each other. Strengthening trust in medication through patient-provider communication may positively impact beliefs about medication and strengthen patients' adherence to medication.

Declaration of Competing Interest

RtP and **AL** declare to have no conflict of interest. **MV** received funding for research unrelated to this study from Teva, Biogen and AstraZeneca. **AB** received funding for research unrelated to this study from Teva. **JFMvB** received grants and/or consultancy fees from Aardex, AstraZeneca, Chiesi, Lung Alliance Netherlands, European Commission COST (COST Action 19,132), GSK, Novartis, Pfizer, Pill Connect, Teva, Trudell Medical and Vertex, outside the submitted work and all paid to his institution. **LvD** received funding for research unrelated to this study from Teva and Biogen.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jpsychores.2023.111472.

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