

Health Care and Patient-Reported Outcomes

Results of the cross-national Diabetes Attitudes, Wishes and Needs (DAWN) study

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OBJECTIVE — The purpose of this study was to assess the relationship of patients' self-reported well-being, self-management, and diabetes control with factors related to the patient's health care.

RESEARCH DESIGN AND METHODS — This was a cross-sectional survey of national samples of patients with diabetes ($n = 5,104$) from the multinational study of Diabetes Attitudes, Wishes and Needs (DAWN). Patients from 13 countries in Asia, Australia, Europe, and North America reported their level of well-being, self-management, and diabetes control. Hierarchical multiple regression analysis (blocks are countries, respondent characteristics, and health care features) was used to examine predictors of diabetes-related distress and general well-being, adherence to lifestyle and medical treatment recommendations, and perceived diabetes control and hyperglycemic symptoms.

RESULTS — Country, respondent demographic and disease characteristics, and health care features were all associated with patient-reported outcomes. Better patient-provider collaboration was associated with more favorable ratings on all outcomes, and better access to the provider and availability of team care were associated with some positive outcomes. Country differences were only partly accounted for by patient and health care factors. Relationships between health care factors and outcomes varied across countries.

CONCLUSIONS — Patients' reports of well-being, self-management, and diabetes control were related to the countries in which they live, their demographic and disease characteristics, and features of their health care. Opportunities to enhance patient-provider collaboration, access to care, and availability of team care should be pursued.

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Patients who receive team diabetes care (provided by primary care physicians collaborating with nurses and other specialists) have better well-being, self-care, and diabetes control (1–3), as do patients who report more involvement in making treatment deci-

sions (4–8). Assigning large responsibilities to nonphysician team members, and incorporating patients as active participants in setting treatment goals are key elements of the Chronic Care Model, a framework for implementing evidence-based interventions to improve care for

chronic illnesses (9). Patients with diabetes who report easier access to their providers (10–13) and a better relationship with their providers (4,5) also have better outcomes.

We have found that patient reports of team diabetes care availability and of patient-provider communication differ by country (14), as do patient-reported diabetes outcomes (15). Country differences in outcomes are probably due at least partly to country differences in care.

In examining this possibility, one must account for country differences in patient demographic and disease characteristics (type and duration of diabetes and number of complications), because some patient characteristics have been associated with differences in patient outcomes (16–21).

We propose to examine a set of intertwined patient-reported outcomes (well-being, self-management, and diabetes control) that are the targets for most diabetes interventions, in part because these outcomes appear to be associated with critical longer-term outcomes, including functional capacity (22–24), complications (25–30), mortality (31,32), health care costs (33–35), and quality of life (36,37).

The current study includes a large population of patients from many different countries and measures of individual demographic and disease characteristics, health care factors, and several key patient-reported outcomes (well-being, diabetes self-management, and diabetes control). Thus, we can assess how much country, health care factors, and individual characteristics each contribute to patient-reported outcomes, if the factors have similar relationships with each outcome, and whether the associations vary across countries.

We hypothesize that patients who report easier access to providers, a better relationship with providers, and greater availability of team care will report higher levels of well-being (assessed in this study by self-reported diabetes-related distress and general well-being), self-manage-

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Abbreviations: DAWN, Diabetes Attitudes, Wishes and Needs.

A table elsewhere in this issue shows conventional and Système International (SI) units and conversion factors for many substances.

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ment (assessed in this study by self-reported lifestyle and medical regimen adherence), and diabetes control (assessed in this study by self-reported diabetes control and hyperglycemic symptoms).

We hypothesize that outcomes will differ by country and that country differences will be partially mediated by health care factor differences and by individual patient demographic and disease characteristics. So, for example, self-management would be better in countries where team diabetes care is more available, and diabetes distress would be lower in countries where patient-provider communication is better.

RESEARCH DESIGN AND METHODS

— Data from the multinational Diabetes Attitudes, Wishes and Needs (DAWN) study (38) were utilized here. Earlier publications contain more detailed descriptions of the study design (14,15,39). The DAWN study was intended to increase understanding of the role that psychosocial factors play in diabetes outcomes and to find ways to improve psychosocial management of diabetes.

The DAWN data are self-reports obtained through structured telephone or face-to-face interviews (30–50 min in length) conducted in 13 countries representing 11 regions: Australia, France, Germany, India, Japan, the Netherlands, Poland, Scandinavia (Sweden, Denmark, Norway), Spain, the U.K., and the U.S. Respondents included physicians, nurses, and 5,104 adults with diabetes (~500 per region). Sampling quotas were established so that approximately half of the patients used insulin; almost one-third of patients had type 1 diabetes, and more than one-quarter had type 2 diabetes treated by insulin. In this article, we examine data only from the patient sample. The study design was cross-sectional.

The DAWN study was conducted according to the Joint Guidelines on Pharmaceutical Research Practice of the British Healthcare Business Intelligence Alliance and the Association of the British Pharmaceutical Industry. Verbal informed consent was obtained from all respondents, and participation was voluntary. Ethical approval for use of these data were obtained from the institutional review board at Loyola College in Maryland (the Human Subjects Research Committee).

Outcomes

There were two measures for each main study outcome (well-being, self-management, and diabetes control) (Table 1). Measures of well-being were diabetes-related distress and general well-being. Diabetes-related distress was assessed with four questions (“I feel stressed because of my diabetes,” “I am constantly afraid of my diabetes getting worse,” “Coping with diabetes is more difficult than it used to be,” and “I feel burned out from having to cope with diabetes”) (α for scale reliability = 0.70). General well-being was assessed using the World Health Organization-Five measure of psychological well-being (α for scale reliability = 0.83) (40).

Measures of self-management were lifestyle regimen adherence and medical regimen adherence. Lifestyle regimen adherence was assessed with two questions (“How successful have you been in following the [diet, exercise] recommendations given by your doctor or nurse for managing your diabetes?”; α for scale reliability = 0.55). Medical regimen adherence was assessed with three questions (“How successful have you been in following the [self-monitoring of blood glucose, medication, appointment keeping] recommendations given by your doctor or nurse for managing your diabetes?”) (α for scale reliability = 0.82).

Measures of diabetes control were perceived diabetes control and hyperglycemic symptoms. Perceived diabetes control was assessed with one question (“To what extent do you feel your diabetes is in control?”). Hyperglycemic symptoms were also assessed with one question (“Do you currently have the following symptoms of your diabetes [frequent urination, itching, thirst]?”).

National and individual predictors

We also included as potential predictors of patient-reported outcomes the patient’s country of residence and individual characteristics including sex, age, education, marital status, employment status, diabetes duration, type of diabetes, whether the patient was taking insulin, and the number of diabetes-related complications the patient had.

Health care predictors

We measured health care factors hypothesized to predict patient-reported outcomes. Health care factors were access to care, quality of patient provider collaboration, and team care. The measure of ac-

Table 1—Sample profile

Country or region (%)	
Australia	9.3
France	9.1
Germany	9.7
India	7.9
Japan	7.6
The Netherlands	9.9
Poland	8.5
Scandinavia	9.5
Spain	9.3
U.K.	9.5
U.S.	9.7
Respondent	
Sex (female) (%)	54.1
Age (years)	52.3 ± 16.0
Married (%)	66.9
Employed (%)	66.8
Age completed education (years)	20.6 ± 15.5
Population density (%)	
Large city	40.2
Other urban	18.0
Suburban	19.9
Rural	21.8
Diabetes duration (years)	13.8 ± 11.4
Type of diabetes (%)	
Type 1	32.7
Type 2 (no insulin)	40.4
Type 2 (with insulin)	26.9
No. of complications	1.5 ± 0.9
Health care factors	
Provider access*	3.31 ± 0.66
Relationship with provider†	3.42 ± 0.54
Team same location (yes) (%)	60.4
Team communication (yes) (%)	51.3
Nurse on premises (yes) (%)	40.8
Outcome	
Diabetes-related distress‡	1.99 ± 0.73
General well-being§	54.7 ± 23.0
Lifestyle regimen adherence¶	3.06 ± 0.77
Medical regimen adherence¶	3.48 ± 0.83
Perceived diabetes control	3.34 ± 0.72
Hyperglycemic symptoms (% any)	52.9

Data are means ± SD unless otherwise indicated. *Four-point scale: very difficult = 1 to very easy = 4. †Four-point scale: fully disagree = 1 to fully agree = 4, except one item very difficult = 1 to very easy = 4. ‡Four-point scale: fully disagree = 1 to fully agree = 4. §0 to 100. ¶Four-point scale: never = 1 to completely = 4. ||Four-point scale: not at all = 1 to to a great extent = 4.

cess to care was ease of access to providers. This was the mean of three questions (“How easy is it for you to get to

see your [doctor, specialist, nurse] when you need to") (α for scale reliability = 0.78). The measure of patient-provider collaboration was quality of the patient-provider collaboration. This was the mean of four questions ("I have a good relationship with the people I see about my diabetes," "My doctor spends enough time with me," "I feel that I am fully involved in the treatment decisions," and "How easy do you find it to talk to your main doctor?") (α for scale reliability = 0.62).

Measures of team care were team at same location, quality of provider team collaboration, and nurse on premises. Team at same location was assessed by one question ("Do you usually go to a clinic or practice where all the health care providers you need to see are under one roof, or do you have to go to separate places?"). Quality of provider team collaboration was assessed by one question ("Do you think all the people involved in your diabetes treatment talk with each other about your diabetes problems?") Nurse on premises was assessed by one question ("Does your general practitioner have a nurse on the premises whom you see for your diabetes?").

Statistical analysis

Hierarchical multiple regression analysis (blocks are countries, respondent characteristics, and health care factors) was used to examine these predictors of patient-reported well-being, self-management, and diabetes control. Country differences were examined as dummy variables in which the U.S. was the reference category and each other country was compared with the U.S. Health care differences were assessed when we controlled for country and individual respondent characteristics.

Because the measure of hyperglycemic symptoms was a binary (yes/no) measure, we conducted a logistic regression of this outcome. Significance levels for all factors remained the same as those obtained for the multiple regression analysis. Therefore, we present the results of the latter analysis for this outcome to facilitate comparison of the results for different outcomes.

To determine whether patient and health care factors mediated the relationship between country and outcome, we assessed the variance accounted for by country when it was the only factor in the model, compared with when patient and health care factors were included.

To determine whether outcomes

were related to health care factors consistently across countries, we added interactions between country and each of the health care factors to the models for each outcome. We assessed the increments to r^2 for the interactions, the number of significant interactions, and the change in variance explained by country. To further explore country differences in relationships, we analyzed each outcome separately for each country and then calculated the average increment that health care factors contributed to explained variance in patient-reported outcomes, after accounting for individual factors.

The criterion for statistical significance was set at $P < 0.001$, two-tailed for all analyses, because we chose to focus on the strongest relationships for this article. All analyses were conducted using SPSS 13.0 (SPSS, Chicago, IL).

RESULTS— Table 1 presents data on the study sample, including the proportion of patients from each country, individual respondent characteristics, health care factors, and patient-reported outcomes. The sample had slightly more women than men, and most respondents were middle-aged, married, employed, and fairly highly educated. Most had diabetes for more than a decade. The average respondent had 1.5 diabetes-related complications.

Access to providers was good (mean 3.31 ± 0.66 on scale of 1–4), and relationship with providers was even better (mean 3.42 ± 0.54 on scale of 1–4). Most patients (60.4%) reported that all providers practiced under the same roof, and just over one-half (51.3%) said their providers communicated with each other; 40% said a nurse was available at their physician's office.

Most respondents reported moderately low levels of diabetes-related distress (mean approximately "somewhat disagree" that coping with diabetes is difficult) and moderate levels of general well-being (mean $54.7 \pm 23.0\%$ on scale of 1–100). Reported adherence to medical recommendations was high (mean 3.48 ± 0.83 on scale of 1–4); adherence to lifestyle recommendations was lower (mean 3.06 ± 0.77 on scale of 1–4). Perceived diabetes control was good (mean 3.34 ± 0.72 on scale of 1–4), although more than half of the participants (52.9%) reported current symptoms of hyperglycemia.

Table 2 presents the regression analysis of patient-reported outcomes. Both measures of reported well-being were as-

sociated with country, with diabetes complications, and with provider access and relationship. Country accounted for much of the variance in regimen adherence (one-quarter for lifestyle and one-half for medical). Perceived diabetes control was associated with country, complications, and provider access and relationship.

Patient and health care factors mediated the relationship between country and outcome for five of six outcomes; reduction in the strength of the relationships ranged from 4 to 16%, with a median of 7%. Thus, the majority of the differences in outcomes among countries were not mediated by the other factors in our model.

Country differences in patient-reported outcomes

Reports from patients in the U.S. were significantly worse than those in most other countries surveyed for several outcomes. Patients in the U.S. reported high levels of diabetes-related distress (six countries lower and none higher), poor lifestyle regimen adherence (seven countries better, two worse), poor diabetes control (five countries better, none worse), and more hyperglycemic symptoms (four countries symptoms less common, one country symptoms more common). In contrast, in no country was reported medical regimen adherence significantly higher than in the U.S. and it was lower in several countries/regions (India, Japan, Poland, Scandinavia).

Compared with patients in the U.S., those in Germany, Spain, and the Netherlands generally reported outcomes that were significantly more positive, whereas those in India reported significantly worse general well-being and lifestyle and medical regimen adherence than patients in the U.S. U.S. and Scandinavian patients differed significantly on every outcome; in three cases U.S. patients reported better outcomes (general well-being and lifestyle and medical regimen adherence and in the other three cases outcomes were better for Scandinavia (diabetes-related distress and diabetes control and hyperglycemic symptoms).

Association of health care factors and patient-reported outcomes

Among health care factors, the quality of collaboration with the provider was the strongest predictor of patient-reported outcomes: patients reporting better collaboration had more positive ratings on all six outcome measures. Patients report-

Table 2—Regression analysis of patient-reported outcomes (standardized regression coefficients)

Independent variable	Diabetes-related distress	General well-being	Lifestyle regimen adherence	Medical regimen adherence	Perceived diabetes control	Hyperglycemic symptoms
Country or region						
Australia	-0.089*	0.017	0.102*	0.011	0.036	-0.029
France	0.016	0.044	0.039	-0.033	0.170*	-0.001
Germany	-0.159*	0.133*	0.142*	0.014	0.240*	-0.188*
India	-0.004	-0.132*	-0.356*	-0.581*	0.008	-0.024
Japan	-0.046	0.130*	0.169*	-0.091*	0.012	-0.213*
The Netherlands	-0.143*	0.081*	0.080*	-0.011	0.010	-0.051
Poland	-0.013	-0.023	0.054	-0.049*	0.078*	-0.055
Scandinavia	-0.130*	-0.062*	-0.205*	-0.482*	0.125*	-0.064*
Spain	-0.158*	0.165*	0.067*	-0.015	0.074*	0.053
U.K.	-0.122*	-0.001	0.008	-0.013	0.030	-0.097*
Respondent						
Sex (female)	0.070*	-0.045*	0.002	0.010	-0.040	0.008
Age	-0.061*	0.026	0.016	0.030	0.080*	0.023
Age completed education	-0.048*	0.038	0.019	-0.007	0.016	-0.024
Working	-0.036	0.019	-0.012	-0.021	0.038	-0.072*
Married	0.011	-0.023	0.019	0.002	0.027	-0.018
Population density	0.016	0.007	0.030	0.022	-0.003	0.003
Diabetes duration	-0.032	0.013	0.027	0.031	0.012	-0.110*
Type 2 diabetes (no insulin)	-0.049	0.032	-0.026	-0.077*	0.017	0.080*
Type 2 diabetes (with insulin)	0.037	-0.020	-0.054	0.006	-0.049	0.097*
No. of complications	0.190*	-0.151*	-0.020	0.028	-0.097*	0.082*
Health care						
Provider access	-0.143*	0.096*	0.008	-0.026	0.126*	-0.052*
Relationship with provider	-0.184*	0.118*	0.084*	0.066*	0.144*	-0.044*
Team same location	-0.016	0.010	0.009	0.035*	0.036	-0.044
Team communication	0.003	0.013	0.056*	0.031	0.018	0.010
Nurse on premises	0.059*	0.023	0.080*	0.057*	-0.004	0.020
Country r^2	0.055	0.090	0.252	0.511	0.059	0.058
Respondent (change in) r^2	0.060	0.033	0.005	0.012	0.027	0.043
Health care (change in) r^2	0.067	0.030	0.018	0.010	0.048	0.008
Total r^2	0.182	0.153	0.275	0.533	0.134	0.109

U.S. is the reference category for country; type 1 diabetes is the reference category for diabetes. * $P \leq 0.001$.

ing easier access to their providers reported positive outcomes on measures of well-being and diabetes control but not on measures of self-care. In contrast, each measure of team care was positively associated with at least one measure of self-care, but not with any measure of well-being or diabetes control except for one unexpected association: having a nurse at the primary care practitioner's office was associated with higher levels of diabetes-related distress.

Interaction of country and health care factors with patient-reported outcomes

When interactions were included in the models, they contributed significantly to the variance accounted for, and at least one interaction was significant for each outcome. The interaction terms for sev-

eral outcomes accounted for more variance than the combined main effects of country and health care factors.

When relationships between health care factors and each outcome were analyzed separately by country, the average amount of variance accounted for by health care factors in each country was approximately twice the variance accounted for by health care factors in the analyses presented in Table 2.

Association of patient demographic and disease characteristics with patient-reported outcomes

Men in the study reported less diabetes-related distress and greater well-being than women did. Those with more education also reported less diabetes-related distress, and those with more complications reported worse well-being on both

measures and worse diabetes control on both measures than respondents with fewer complications.

CONCLUSIONS — We found that in this large survey of patients from 13 countries in Asia, Australia, Europe, and North America, health care factors, country of residence, and patient demographic and disease characteristics were all associated with reports of well-being, self-management, and diabetes control. In addition, in the regression analysis each set of factors contributed independently to patient-reported outcomes.

Association of health care factors and patient-reported outcomes

Each of the five health care factors (access to provider, relationship with provider, and the three measures of team care) was

associated with at least one patient-reported outcome. Provider access and relationship with the provider were each strongly associated with both measures of well-being and with perceived diabetes control. Each measure of team care was moderately associated with one or both measures of regimen adherence (nurse presence was associated with both) but not with either measure of diabetes control.

The finding that access to the provider and relationship with the provider were each strongly associated with both measures of well-being suggests that patients who could see their providers when they needed support and who felt the provider was easy to talk to and spent enough time with them were able to resolve their diabetes-related distress and improve their general well-being. Notably, patient-provider collaboration was associated with better regimen adherence whereas provider access was not. This finding is consistent with the notion that spending time with patients, presumably in part to more fully inform them of treatment options, and trying to involve patients in making treatment decisions are essential for improving regimen adherence; simple access to providers appears to be insufficient to improve these outcomes. Others have found that both more fully informing patients regarding treatment options and encouraging patients to be more involved in decision making contribute to more active self-management (10,41) and to improved glycemic control (9,42).

Our finding that measures of team care were not associated with better diabetes control contrasts with reports of improvements in blood glucose control attributed to intensive nurse-directed diabetes interventions in recent controlled trials (43–45). On the other hand, our findings are consistent with those of a health care system-wide randomized trial of team diabetes care (2) that showed an increase in the utilization of preventive services (and less use of emergency room and specialty care services) but no greater change in HbA_{1c} (A1C) level in team care patients compared with those receiving usual care. Patients in that study had baseline average A1C levels that were quite low (7.5%). Earlier studies in patients with higher A1C found that team care improved both self-management and glycemic control (1). Although team care might not improve glycemic control in patients whose control is already quite good, the increased utilization of preven-

tive services associated with team care could lead to improvements in longer-term outcomes, as has been shown for patients with recurrent foot ulcers (3). Others have demonstrated that team care can reduce health care costs (1–2).

We doubt that the counterintuitive association between having a nurse available and greater diabetes-related distress means that contact with a nurse increased distress. Perhaps physicians were more likely to refer distressed patients to a nurse, so these patients might have been more aware of the nurse's presence at the office, or perhaps having a nurse available to talk to might have made it more likely that patients would recognize and acknowledge their distress.

Country differences in patient-reported outcomes

Country differences in patient-reported outcomes were substantial, especially for regimen adherence. This may reflect differences among the countries in the treatment recommendations patients receive. For example, Scandinavian patients, who reported lower levels of both lifestyle and medical regimen adherence than U.S. patients, but better diabetes control and less hyperglycemic symptoms, might receive more intensive therapy recommendations. This could make adherence more difficult for Scandinavian patients but make good control more likely even if adherence was not as high as in the U.S.

Reported outcomes for patients in Germany, Spain, and the Netherlands were generally significantly better than outcomes for U.S. patients except for medical regimen adherence. Patients in these European countries, most strikingly Germany, reported a consistent pattern of less diabetes distress, better general well-being, closer adherence to their lifestyle regimen, better diabetes control, and fewer symptoms of hyperglycemia than U.S. patients. National differences in health care organization could account for part of the difference between the reports of U.S. patients and those in Germany, Spain, and the Netherlands. National differences in economic productivity or inequality could also be a factor in some outcomes: Indian patients were the only ones (other than those from Scandinavia) who reported significantly worse general well-being than U.S. patients, and Polish patients also reported less general well-being than those in the U.S., although this difference was not significant.

Association of patient demographic and disease characteristics with patient-reported outcomes

Patients who reported fewer complications also reported worse well-being on both measures and worse diabetes control on both measures but not worse regimen adherence. In fact, no patient characteristic was associated with all outcomes. We found sex differences only for well-being, for which men reported less diabetes distress and greater well-being, and for education, for which those with more education reported less diabetes distress.

Based on our earlier reports, we hypothesized that individual patient characteristics or health care factors would mediate country differences in outcomes, but our findings did not support this hypothesis; substantial country differences remained after we controlled for individual and health care factors. However, ancillary analyses we conducted suggested that health care factors were more important than our initial analyses indicated, but their relationships to the outcomes were country-specific; the average amount of variance accounted for by these factors approximately doubled across countries when associations were analyzed separately for each country.

Future researchers should investigate factors, such as economic productivity and inequality and health system organization, that might account for country-specific relationships between health care factors and patient outcomes. Such studies should include a range of predictive factors and would require the inclusion of more countries than those involved in DAWN.

Study strengths and limitations

Strengths of the study include the large size and international character of the sample and the broad range of variables assessed. We chose to report only associations that were highly statistically significant (i.e., $P < 0.001$), but associations as small as 0.05 were statistically significant even using this conservative criterion. The importance of associations of this magnitude is open to question.

Limitations of the study include the fact that all key measures are self-reported. Patient perceptions have been shown to correlate with clinical markers (46), but the validity of this study's findings should be confirmed and extended using objective measures of glycemic control.

We cannot draw conclusions about causal relationships, because this study is cross-sectional and correlational in design. Patient reports of well-being, self-management, and diabetes control were outcomes in this study because we modeled them as such, not because they represent the results of an intervention. We found, for example, that patients who reported better collaboration with their providers also reported better well-being, but we cannot say whether well-being affected perceptions of patient-provider collaboration or collaboration affected well-being. Finally, because interpretations of the associations observed in this study are largely speculative, these interpretations should be considered hypotheses to be supported or refuted by future research.

Implications

The finding that those with more complications had poorer well-being and diabetes control reinforces the importance of paying close attention to the medical and psychosocial needs of this vulnerable population. Limited mobility and functional capacity combined with the emotional burden complications impose can take a terrible toll.

The finding that patient-provider collaboration was associated with all outcomes highlights the key role that effective collaboration plays in improving diabetes outcomes. Improving collaboration is likely to facilitate effective approaches to resolving key clinical concerns. Finding effective and expedient ways to address patient psychosocial needs is especially important (47).

Patients in this study who had a nurse available at their provider's office reported better regimen adherence. Diabetes care teams incorporating nurses, dietitians, and other nonphysician specialists should play a key role in diabetes care and education. This could help protect the health and well-being of the growing population of patients with diabetes.

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APPENDIX

International DAWN Advisory Panel members

Ib Brorly, Denmark; Ruth Colagiuri, Australia; P. Geelhoed-Duijvestijn, the Neth-

erlands; Hitoshi Ishii, Japan; Line Kleinebreil, France; Rüdiger Landgraf, Germany; Torsten Lauritzen, Denmark; David Matthews, U.K.; A. Ramachandran, India; Richard Rubin, U.S.; Frank Snoek, the Netherlands.

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