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Running Title: First NTM-PD survey of clinical practice in the UK

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Management of Nontuberculous Mycobacteria-Pulmonary Disease: results from the first UK survey of clinical practice

Running Title: First NTM-PD survey of clinical practice in the UK

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Highlights

1. NTM-PD isolates are now more common than TB in many parts of the UK.
2. Considerable variation exists in NTM-PD workload, practice and infrastructure across the UK.
3. 33% centres cannot access allied healthcare support for NTM-PD patients.
4. 56% do not provide any NTM-PD related patient resources.
5. Opportunities to improve support include multi-disciplinary teams; regional networks; a national NTM-PD Advice Service.

Key messages

1. The number of NTM isolates is increasing globally; and in many low-TB incidence settings including parts of the UK, NTM-PD is now more common than TB.
2. We sought, to better understand the current NTM-PD related workload and the infrastructure in place to support this in the UK.
3. Our survey results demonstrate considerable variation in practice and infrastructure for NTM diagnosis and treatment, with a lack of standardised NTM care pathways.
4. In particular, 33% of respondents cannot access allied healthcare professional support for their NTM-PD patients, and 56% do not provide any NTM-PD related patient resources.
5. Significant opportunities exist to improve support to patients and clinicians including helping centres set-up NTM-PD multi-disciplinary teams, establishing regional networks and a national NTM-PD Clinical Advice Service, as well as enabling NTM patients to access relevant NTM information and support.

Dear Editor,

We were interested to see the recent article by Dahl et al discussing species distribution of nontuberculous mycobacteria pulmonary disease (NTM-PD) in Europe [1]. As highlighted, the rise in pulmonary isolates of NTM is not just of epidemiological interest but also of clinical significance to patients, healthcare providers and health systems. Current estimates suggest an incidence of 7.6 per 100,000 in the UK – which is similar, and in some regions higher, than that of *Mycobacterium tuberculosis* [2]. NTM-PD often affects populations with significant co-morbidities including structural lung damage (bronchiectasis, COPD, and cystic fibrosis) or immune dysfunction. This combined with its clinical complexity, challenges related to treatment (poor tolerability, high toxicity and prolonged duration)

and considerable risk of recurrence post-treatment, places considerable demands on healthcare services and patients [3].

National and international guidelines aimed at standardising care and supporting clinical decision-making are available [3,4,5]. However, information on their use by UK clinicians and guidance on how to develop and implement NTM-PD services within the National Health Service (NHS) are lacking. This prompted the NTM Network UK to conduct the first national survey of clinical practice in the UK.

Knowledge of current practice and guidelines were used to develop an online survey. This was disseminated to clinicians currently managing patients with NTM-PD via three national networks (British Infection Association, British Thoracic Society, and NTM Network UK) between November 2020 and March 2021. The survey included questions about current NTM-PD related workload, clinical practice, and local infrastructure in place to support patients and clinicians. The majority of questions required a single best response from a selection of multiple choices, whilst also allowing respondents the opportunity to submit free-text responses. To limit bias, questions were constructed to avoid phrasing that would influence respondent choice. Respondent characteristics were also collected. Responses were stored securely and analysed in Microsoft Excel.

Responses were received from 89 hospitals providing NTM-PD services in Northern Ireland, Scotland, Wales and all English regions (Appendix). Sixty-six /89 (74%) hospitals manage six or more new NTM-PD patients annually (Figure 1) and 29/89 (33%) hospitals initiate treatment in 41-60% of patients with a new diagnosis of NTM-PD. Sixty-two percent of hospitals review patients established on treatment every two to four months, with 12% seeing them more frequently. For patients where a decision was taken to “watch and wait” rather than start treatment, over half (53%) of clinicians review patients every one to three months. Thirty-eight percent of hospitals have 10-20 patients, and 36% over 20 patients under review each year.

The speciality clinic providing NTM-PD care influences the support available from clinical nurse specialists (CNS) and allied healthcare professionals (AHP) (Figure 2). Sixty-nine percent receive support from TB CNS whilst 14% had no nursing support. Thirty-three percent of respondents cannot access AHPs for their NTM-PD patients. Over half (52%) are not supported by physiotherapy services and 60% have no pharmacy expert input. Dedicated NTM clinics are rare (4%).

Access to NTM-PD specific patient information or support is limited. Fifty-six percent of services do not provide or signpost their patients to any NTM-PD related patient resources.

Formal NTM networks are underdeveloped and underutilised. Twenty-two sites (25%) identify themselves as a NTM regional referral centre. From the remaining 67 sites, 42 (63%) report no support from a regional centre. Seventy percent are aware they can present complex cases at the BTS TB Clinical Advice Service and of those who have, 91% found it useful.

Our survey identifies a considerable NTM-PD-related workload for UK clinicians. As patient follow-up is usually long-term, the demands on patients and hospital services will increase [6,7]. The current supporting infrastructure is underdeveloped and inadequate. These results highlight significant variation in NTM-PD management across the UK. The majority of NTM care occurs within TB and general respiratory clinics where there is limited CNS or AHP support, leading to regional variations in the quality of patient care. Although regional referral centres exist, systems are not in place to facilitate regular advice and guidance, and so clinicians often work through informal channels. Consideration should therefore be given to establishing regional networks with a national NTM clinical advice service supporting the most complex cases. When asked, 99% of respondents agreed with this model.

To our knowledge, this is the first survey evaluating UK practice for NTM-PD. It was designed by NTM clinicians and developed using available guidelines. Although we had good geographical coverage, it is possible that some areas and types of service are under-represented. A relatively large number of respondents were from referral centres, and this may have increased the proportion who could access certain resources and facilities. The survey asked about several aspects of NTM care and took 10-15 minutes to complete. As a result, we had several incomplete surveys which may have further biased results. Reliable survey completion depends on recall alongside strong knowledge of local caseload, and we were unable to independently verify clinician responses.

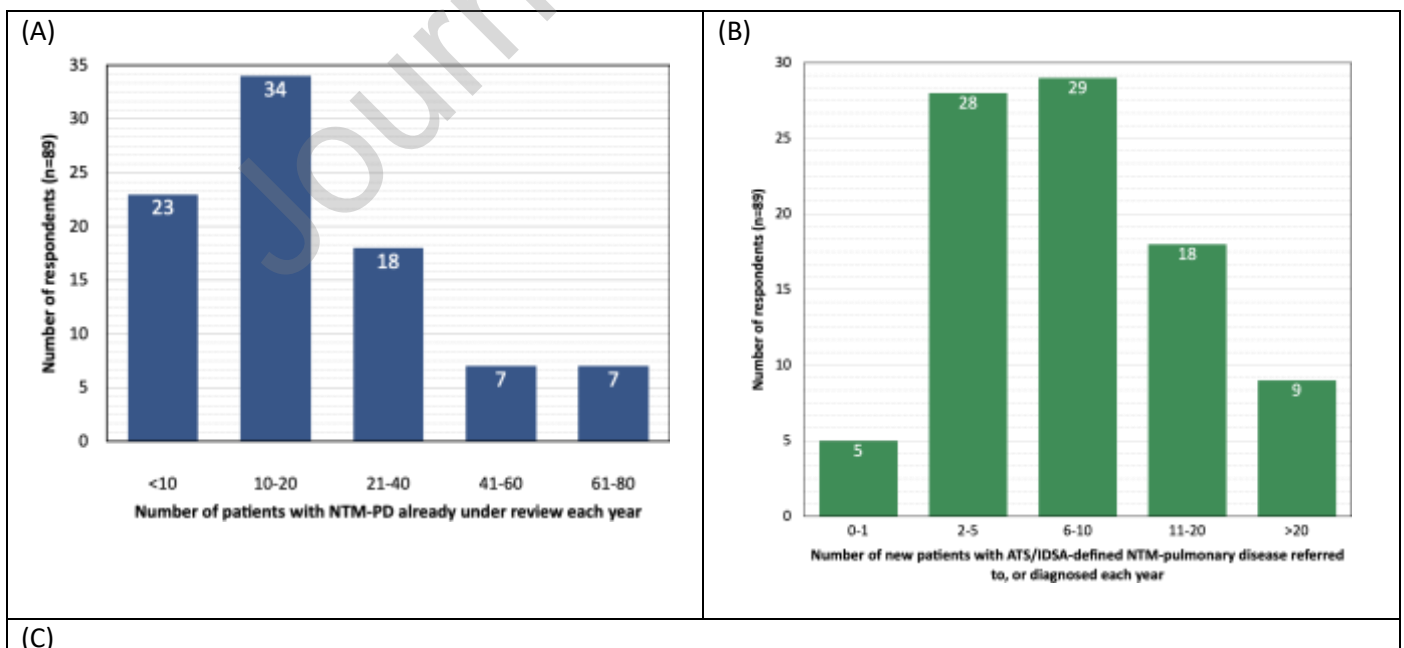
The need for robust clinical services and a new structure to deliver NTM-PD care in the UK is evident. Box 1 depicts how this might look from the perspective of service users, service providers and the healthcare system.

Box 1: What could a new structure to deliver NTM-PD care focus on?

NTM service users	<ul style="list-style-type: none"> - Access to regional specialist NTM-PD services through primary and secondary care. - Development of individualised patient care pathways. - Access to NTM-PD specific patient information. - Opportunity to engage with patient support networks (e.g. <i>NTM Patient Care UK</i> [8]). - Access to NTM-PD research studies.
NTM service providers	<ul style="list-style-type: none"> - Enhanced multi-disciplinary team (MDT) care including access to physiotherapists, clinical nurse specialists, specialised pharmacists, dieticians, psychologists and primary care. - Development of regional NTM treatment centres with regular open-access MDT meetings. - Access to NTM-PD management guidelines. - Networks to promote patient and healthcare provider (primary and secondary care) education. - Networks to promote NTM-PD related research.
National Healthcare system	<ul style="list-style-type: none"> - Development of standards of care for patients with NTM-PD - Audit of NTM-PD services to further inform service developments. - Development of national NTM-PD advisory service.

Novel approaches to NHS healthcare delivery, plus robust evidence from randomised controlled treatment trials, are needed if we are to develop clinically- and cost-effective high-quality and sustainable services for people with NTM-PD. The evidence from this survey combined with learning from colleagues in other specialist disciplines (e.g. Multi-Drug Resistant-TB, cystic fibrosis, HIV) involved in multidisciplinary delivery of care is an important first step.

Figure 1 – Workload was ascertained from the number of patients with ATS/IDSA-defined NTM-PD [5] under review each year (A), the number of new patients seen each year (B) and the frequency of review (C).



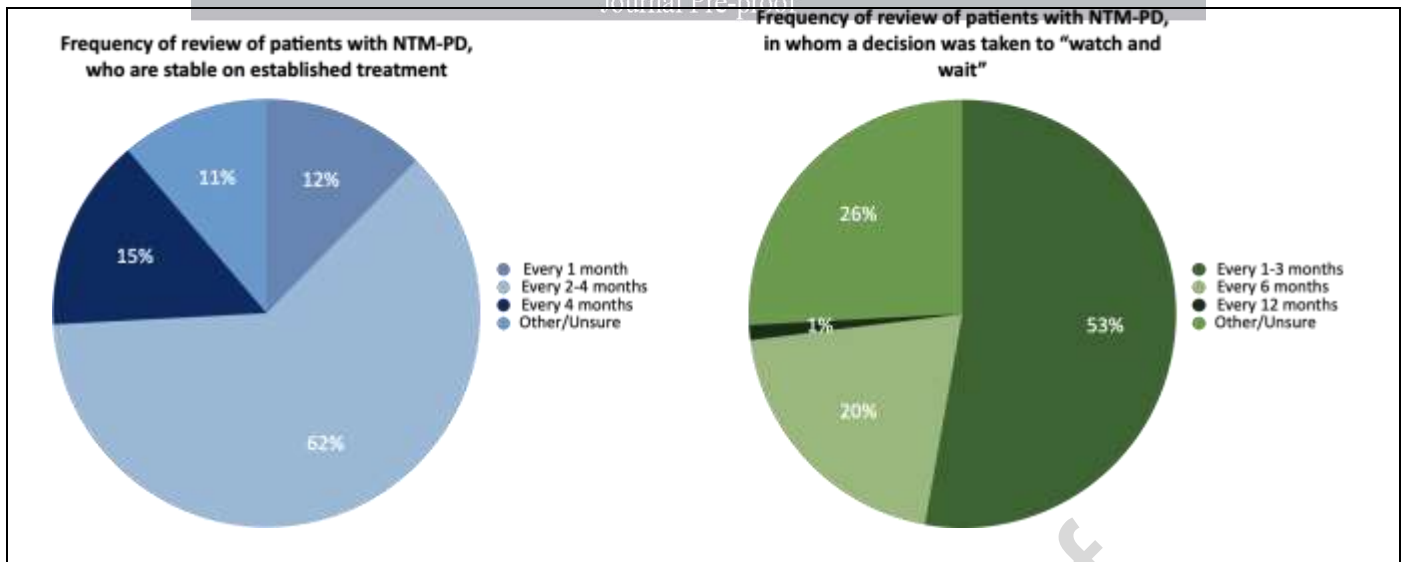
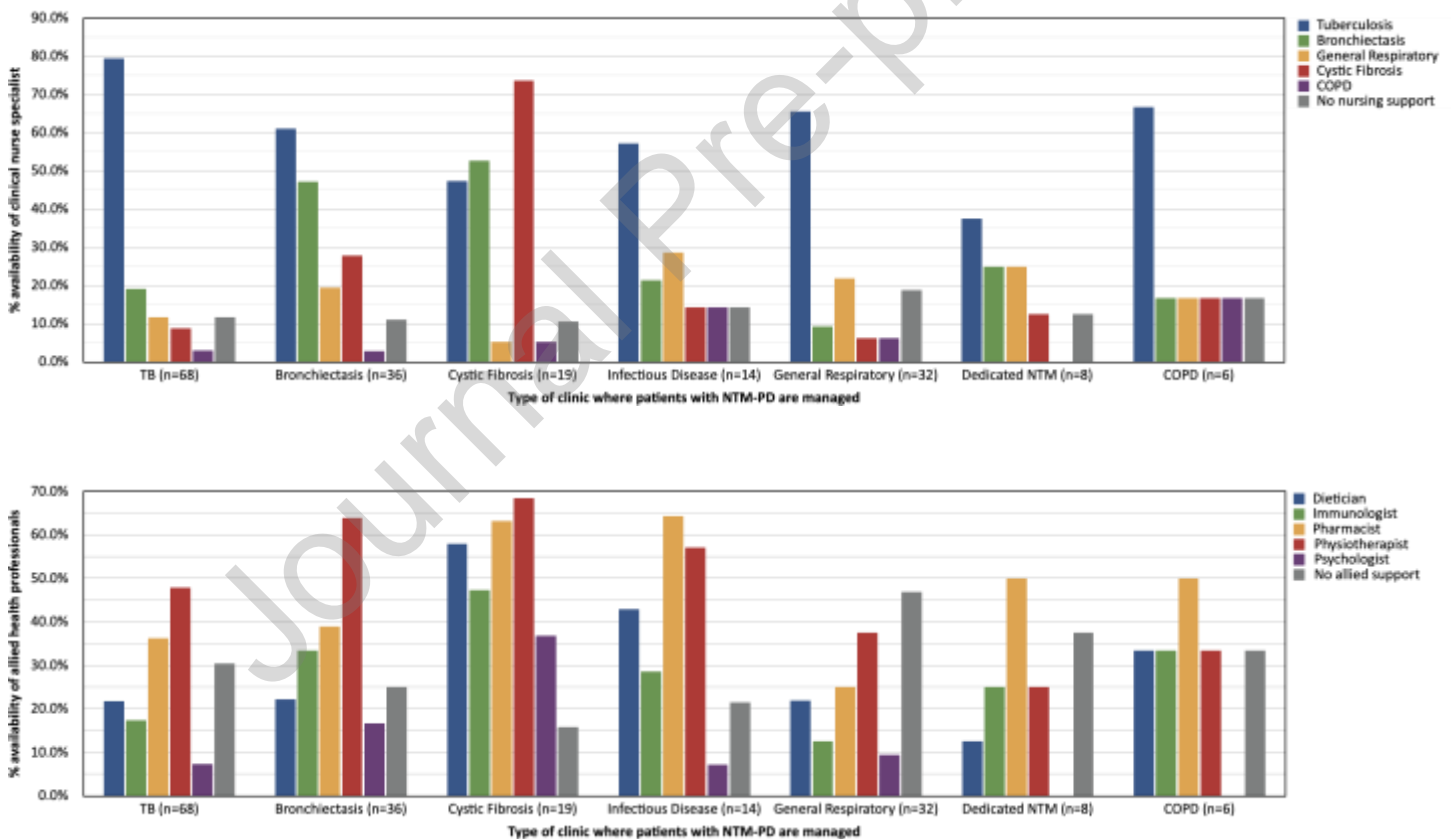


Figure 2 – Support available from clinical nurse specialists (above), and allied health professionals (below) by clinic type.



Key words: Non-tuberculous mycobacteria, atypical mycobacterial infection, respiratory infection, tuberculosis, bronchiectasis, cystic fibrosis.

Contributorship statement: The survey was designed by ML and HK with input from AMM, SB and CH. Data were analysed by AMM. The first draft was written by AMM. All authors reviewed and revised drafts of the manuscript and approved the final version for submission. AMM is the guarantor for this manuscript.

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Patient and public involvement: Professor Michael King (a NTM patient and an academic Doctor at UCL) provided invaluable input into the design of this study. Updates regarding the results and analysis of this research were shared with members of the NTM Network UK which includes patient representatives.

Ethics: Ethics approval was not needed for this survey.

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Competing interests: AMM and HK have declared no competing interests. CH has previously received consulting fees from 30 Technology and Insmmed, as well as support for attending meetings from Zambon. ML holds an honorary role as trustee of NTM Patient Care UK, and has received payment from Insmmed for previous speaking engagements. SB is Project Manager for NTM Network UK and is paid on a project-by-project basis via a contract with the Royal Free NHS Foundation Trust. Administrative support for NTM Network UK is currently funded by an unrestricted grant from Insmmed Limited, who have no input into Network activities including the study reported here.

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Appendix – Respondent information.

	Total
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Location of hospital	England	Wales	Scotland	Northern Ireland		
total number (n)=	78	2	8	1		89
Percentage (%) of total number	88	2	9	1		100
Adult or Paediatric centre	Adult	Paediatric				
n=	85	4				89
% of total	96	5				100
Manage patients with Cystic Fibrosis?	Yes	No				
	12	77				89
	14	87				100
Current position	CNS	Physiotherapist	Medical Consultant	Respiratory Registrar		
n=	9	1	78	1		89
% of total	10	1	88	1		100
Respondent speciality	Adult Respiratory	Paediatric Respiratory	Adult ID, HIV, Sexual Health	Paediatric ID	Microbiology	
n=	60	2	21	2	4	89
% of total	67	2	24	2	5	100
Sub-speciality (respondents able to select more than one option)	MTB	NTM	Bronchiectasis	Cystic Fibrosis		
n=	65	46	32	12		155
% of total	73	52	36	14		
Setting (respondents able to select more than one option)	University Hospital	District General	Regional NTM centre	Community site		
n=	55	36	13	5		109
% of total	50	33	12	5		

Values given to the nearest percentage. Key: *Mycobacterium Tuberculosis* (MTB); ID (Infectious Disease); HIV ((human immunodeficiency virus); NTM(non-tuberculous mycobacteria)